

**Pearl River Delta**  
**Regional Air Quality Monitoring Network**

**A Report of Monitoring Results in 2007**

**Report Number** : **PRDAIR-2007-2**

**Report Prepared by** : **Guangdong Provincial  
Environmental Protection  
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 2007 monitoring results from the Pearl River Delta Regional Air Quality Monitoring Network 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 Protection 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 Protection 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<sub>10</sub> or RSP), sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>) and ozone (O<sub>3</sub>).

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.

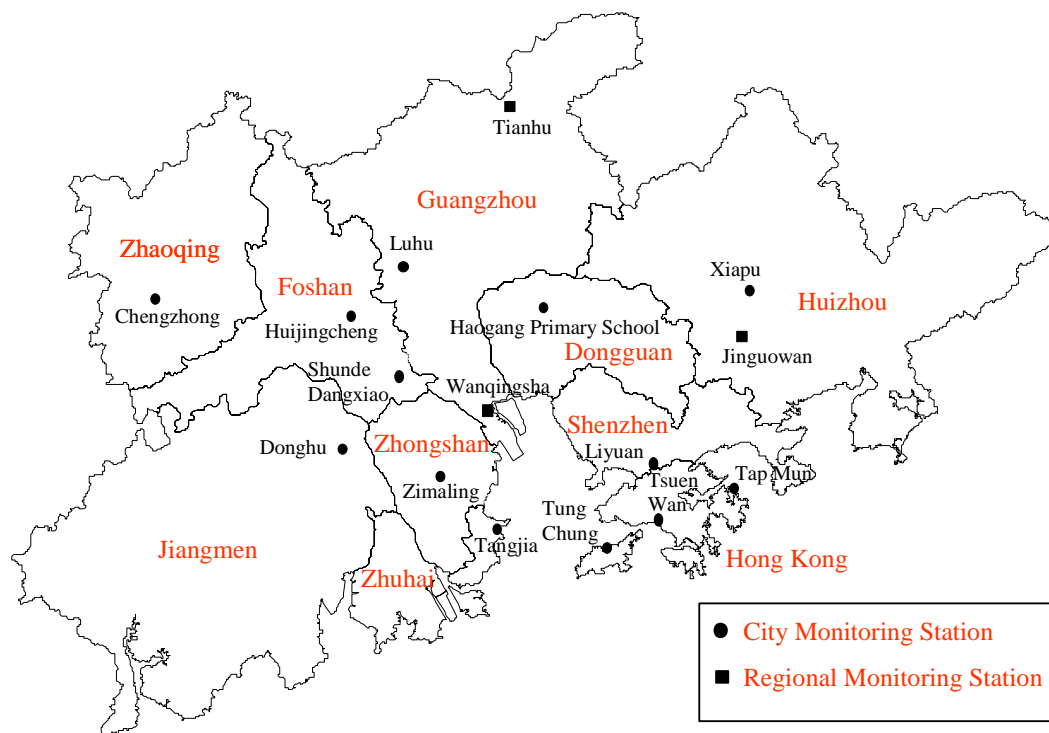


Figure 1 : Spatial distribution of the PRD Regional Air Quality Monitoring Stations

## 2. Operation of the Network

The Network was generally in smooth operation in 2007. The data capture rates of all monitoring stations in the Network 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.

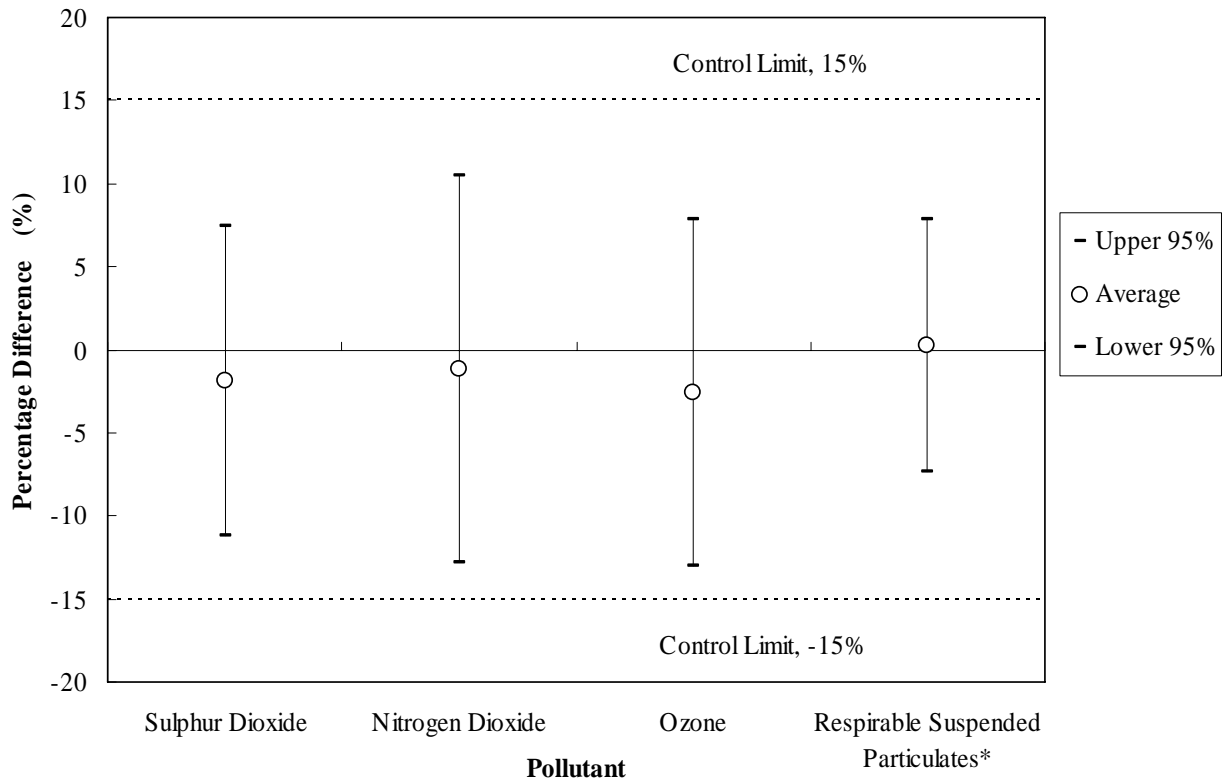
### 2.1 Quality Control (QC) and Quality Assurance (QA) Activities

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 highly 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.

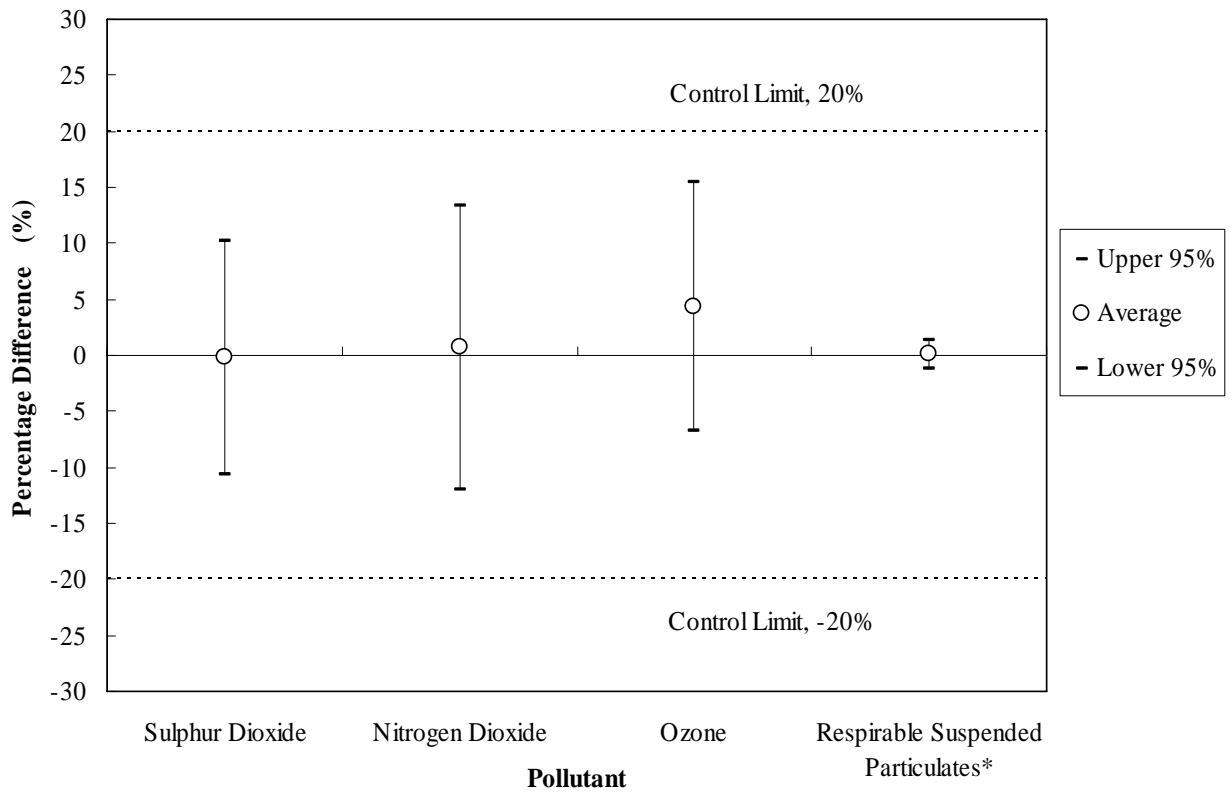
### 2.2 Accuracy and Precision

The accuracy of the Network is assessed by means of performance audits. The control limits set for the gaseous pollutants and respirable suspended particulates ( $PM_{10}$ ) are  $\pm 15\%$  and  $\pm 10\%$  respectively, these limits are similar to those of the United States Environmental Protection Agency and other international standards. In 2007, the GDEMC and HKEPD jointly carried out 365 audit checks on the analysers and samplers at the monitoring stations of the Network. The results showed that, based on the 95% probability limits, the accuracy of the Network varied between -13% to 10% and was within the specified control limits (see Figure 2).

Precision is a measure of repeatability and is calculated in accordance with the QA/QC Operating Procedures. The control limits adopted for the gaseous pollutants and respirable suspended particulates ( $PM_{10}$ ) are  $\pm 20\%$  and  $\pm 10\%$  respectively. In 2007, the GDEMC and HKEPD jointly carried out 1264 precision checks on the analysers and samplers at the monitoring stations of the Network. The results showed that, based on the 95% probability limits, the precision of the Network varied between -12% and 15% (see Figure 3). The QC performance of the Network had improved significantly after the implementation of preventive maintenance measures in the second half of 2006. The QA/QC performance of the Network in 2007 was good, meeting all the requirements specified in the QA/QC Operating Procedures.



**Figure 2 : Accuracy of the PRD Regional Air Quality Monitoring Network in 2007**



**Figure 3 : Precision of the PRD Regional Air Quality Monitoring Network in 2007**

\* Both the accuracy and precision of the respirable suspended particulates (PM<sub>10</sub>) adopt a control limit of ±10%.



### 3. Statistical Analysis of Pollutant Concentrations

#### 3.1 Sulphur Dioxide (SO<sub>2</sub>)

SO<sub>2</sub> 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<sub>2</sub> 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<sub>10</sub>) and visibility in the region.

The annual averages of SO<sub>2</sub> at various monitoring stations in the Network ranged from 0.018 mg/m<sup>3</sup> to 0.120 mg/m<sup>3</sup> in 2007, with values exceeding the national annual air quality standard<sup>#</sup> (0.06 mg/m<sup>3</sup>) at 5 stations. Figure 4 shows that the annual averages of SO<sub>2</sub> 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 previous year. The annual averages of SO<sub>2</sub> at various monitoring stations are shown in Table 3.1c.

During the year, 10 monitoring stations in the Network had recorded exceedance of the national daily air quality standard (0.15 mg/m<sup>3</sup>) of SO<sub>2</sub> while the corresponding national hourly standard (0.50 mg/m<sup>3</sup>) was exceeded at 6 monitoring stations. Details are shown in Tables 3.1a and 3.1b.

Distribution of average SO<sub>2</sub>  
from Jan 2007 to Dec 2007

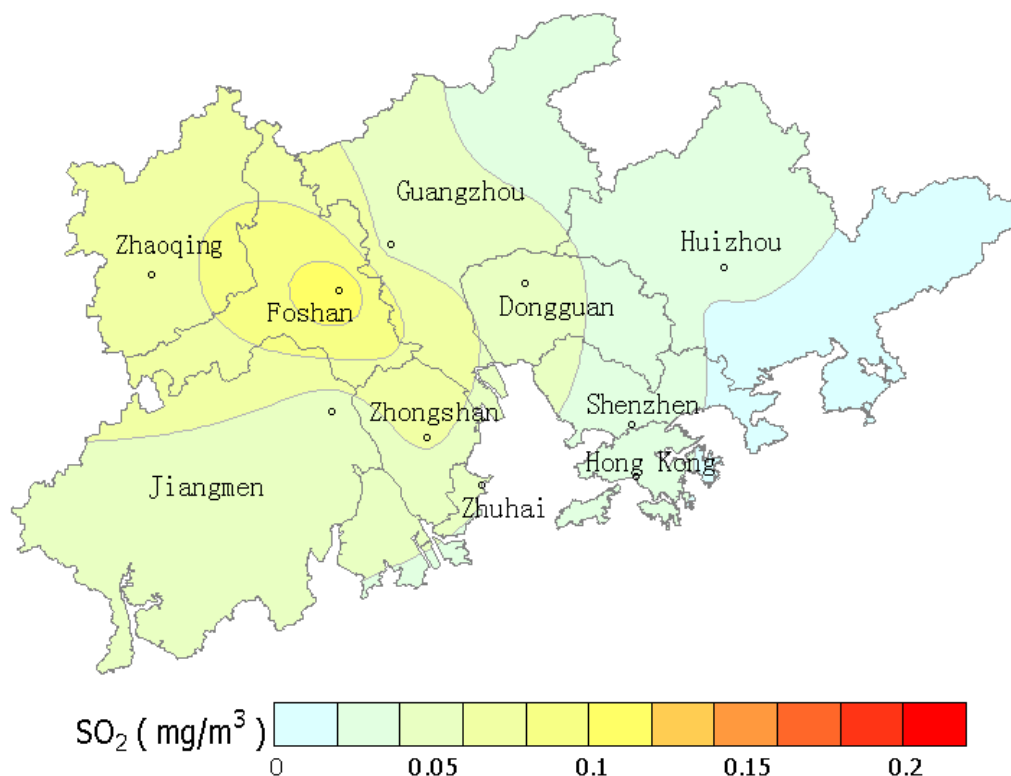


Figure 4 : Spatial distribution of average concentrations of Sulphur Dioxide (SO<sub>2</sub>) in the Network

# 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<sup>3</sup>]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed- ance Hours	Exceed- ance Rate
Luhu Park (Guangzhou)	Max	0.368	0.449	0.510	0.206	0.306	0.356	0.483	0.179	0.488	0.341	0.297	0.508	2	0.02%
	Min	0.008	0.003	0.002	0.004	0.003	0.003	0.004	0.000	0.001	0.002	0.005	0.002		
Wanqingsha (Guangzhou)	Max	0.340	0.466	0.297	0.222	0.346	0.473	0.180	0.410	0.447	0.425	0.350	0.310	0	0.00%
	Min	0.022	0.009	0.009	0.009	0.008	0.009	0.000	0.002	0.003	0.005	0.007	0.010		
Tianhu (Guangzhou)	Max	0.083	0.258	0.190	0.374	0.370	0.260	0.254	0.311	0.145	0.154	0.091	0.163	0	0.00%
	Min	0.006	0.006	0.006	0.007	0.008	0.008	0.007	0.004	0.004	0.005	0.008	0.006		
Liyuan (Shenzhen)	Max	0.197	0.148	0.108	0.180	0.188	0.198	0.106	--	0.113	0.153	0.100	0.200	0	0.00%
	Min	0.014	0.011	0.002	0.000	0.001	0.001	0.000	--	0.000	0.002	0.000	0.003		
Tangjia (Zhuhai)	Max	0.331	0.319	0.349	0.278	0.568	0.199	0.266	0.129	0.232	0.221	0.316	0.442	1	0.01%
	Min	0.020	0.012	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.004		
Shunde Dangxiao (Foshan)	Max	0.514	0.604	0.370	0.338	0.581	0.232	0.285	0.411	0.378	0.515	0.506	0.474	8	0.11%
	Min	0.023	0.001	0.014	0.004	0.003	0.006	0.000	0.000	0.008	0.005	0.015	0.026		
Huijingcheng (Foshan)	Max	0.891	0.593	0.547	0.456	0.675	0.627	0.223	0.688	0.493	0.575	0.755	0.604	58	0.71%
	Min	0.047	0.009	0.027	0.019	0.016	0.012	0.008	0.012	0.020	0.019	0.029	0.024		
Donghu (Jiangmen)	Max	0.279	0.338	0.240	0.209	0.117	0.095	0.116	0.055	0.167	0.292	0.347	0.424	0	0.00%
	Min	0.022	0.003	0.005	0.001	0.000	0.000	0.000	0.004	0.001	0.011	0.002	0.017		
Chengzhong (Zhaoqing)	Max	0.380	0.324	0.405	0.245	0.297	0.260	0.171	0.176	0.245	0.347	0.488	0.396	0	0.00%
	Min	0.013	0.007	0.006	0.005	0.008	0.005	0.007	0.006	0.008	0.016	0.018	0.014		
Xiapu (Huizhou)	Max	0.142	0.075	0.078	0.181	0.083	0.069	0.089	0.120	0.108	0.160	0.079	0.092	0	0.00%
	Min	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.010	0.011		
Jinguowan (Huizhou)	Max	0.074	0.067	0.118	0.126	0.099	0.075	0.120	0.247	0.115	0.185	0.191	0.156	0	0.00%
	Min	0.006	0.005	0.005	0.005	0.006	0.006	0.000	0.000	0.008	0.008	0.010	0.010		
Haogang (Dongguan)	Max	0.495	0.326	0.414	0.439	0.362	0.231	0.204	0.549	0.377	0.405	0.138	0.259	1	0.01%
	Min	0.017	0.005	0.004	0.003	0.004	0.007	0.003	0.000	0.004	0.004	0.005	0.014		
Zimaling Park (Zhongshan)	Max	0.539	0.356	0.409	0.251	0.256	0.153	0.101	0.237	0.244	0.377	0.282	0.349	2	0.01%
	Min	0.015	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.008	0.009	0.016	0.013		
Tsuen Wan (HKSAR)	Max	0.167	0.126	0.225	0.200	0.259	0.149	0.144	0.207	0.268	0.230	0.094	0.181	0	0.00%
	Min	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.005	0.006	0.006	0.008	0.009		
Tap Mun (HKSAR)	Max	0.257	0.069	0.223	0.106	0.132	0.175	0.046	0.171	0.093	0.148	0.091	0.064	0	0.00%
	Min	0.009	0.004	0.004	0.005	0.005	0.003	0.003	0.005	0.006	0.006	0.010	0.011		
Tung Chung (HKSAR)	Max	0.177	0.115	0.186	0.198	0.227	0.114	0.071	0.278	0.283	0.208	0.102	0.174	0	0.00%
	Min	0.008	0.000	0.000	0.002	0.001	0.010	0.010	0.010	0.010	0.011	0.005	0.003		

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

[Class 2 NAAQS (Daily) : 0.15 mg/m<sup>3</sup>]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed- ance Days	Exceed- ance Rate
Luhu Park (Guangzhou)	Max	0.150	0.147	0.154	0.112	0.110	0.151	0.078	0.081	0.106	0.100	0.107	0.146	3	0.89%
	Min	0.017	0.006	0.006	0.010	0.008	0.040	0.019	0.002	0.010	0.005	0.013	0.003		
Wanqingsha (Guangzhou)	Max	0.212	0.135	0.163	0.120	0.118	0.096	0.039	0.147	0.155	0.138	0.127	0.169	8	2.53%
	Min	0.040	0.011	0.012	0.012	0.016	0.012	0.002	0.007	0.014	0.024	0.047	0.040		
Tianhu (Guangzhou)	Max	0.039	0.098	0.108	0.204	0.176	0.139	0.121	0.106	0.073	0.073	0.046	0.071	2	0.58%
	Min	0.006	0.006	0.007	0.007	0.008	0.011	0.011	0.005	0.005	0.006	0.015	0.007		
Liyuan (Shenzhen)	Max	0.078	0.093	0.070	0.063	0.069	0.042	0.024	--	0.054	0.064	0.045	0.050	0	0.00%
	Min	0.023	0.024	0.005	0.004	0.007	0.004	0.002	--	0.008	0.006	0.012	0.011		
Tangjia (Zhuhai)	Max	0.201	0.140	0.184	0.155	0.137	0.060	0.028	0.047	0.108	0.062	0.131	0.179	12	4.03%
	Min	0.098	0.019	0.014	0.003	0.003	0.002	0.002	0.000	0.003	0.015	0.018	0.014		
Shunde Dangxiao (Foshan)	Max	0.285	0.232	0.187	0.177	0.255	0.109	0.091	0.127	0.127	0.182	0.182	0.190	24	7.45%
	Min	0.043	0.007	0.036	0.027	0.028	0.036	0.025	0.010	0.017	0.020	0.030	0.042		
Huijingcheng (Foshan)	Max	0.436	0.319	0.362	0.227	0.267	0.281	0.092	0.289	0.194	0.326	0.308	0.245	78	22.87%
	Min	0.077	0.021	0.043	0.043	0.049	0.034	0.032	0.056	0.042	0.045	0.060	0.037		
Donghu (Jiangmen)	Max	0.127	0.133	0.109	0.090	0.045	0.029	0.030	0.019	0.080	0.119	0.214	0.195	6	1.71%
	Min	0.039	0.005	0.013	0.006	0.004	0.002	0.001	0.004	0.007	0.029	0.036	0.037		
Chengzhong (Zhaoqing)	Max	0.212	0.175	0.230	0.139	0.165	0.105	0.088	0.084	0.150	0.166	0.239	0.247	31	8.83%
	Min	0.051	0.014	0.016	0.021	0.018	0.012	0.011	0.014	0.013	0.027	0.052	0.031		
Xiapu (Huizhou)	Max	0.052	0.048	0.048	0.077	0.039	0.030	0.027	0.057	0.041	0.051	0.051	0.059	0	0.00%
	Min	0.002	0.005	0.005	0.009	0.001	0.005	0.014	0.007	0.006	0.010	0.017	0.020		
Jinguowan (Huizhou)	Max	0.033	0.045	0.039	0.065	0.033	0.032	0.041	0.073	0.038	0.053	0.043	0.041	0	0.00%
	Min	0.009	0.006	0.007	0.007	0.007	0.006	0.000	0.000	0.009	0.010	0.014	0.016		
Haogang (Dongguan)	Max	0.173	0.132	0.115	0.175	0.135	0.068	0.083	0.218	0.113	0.147	0.065	0.111	5	1.53%
	Min	0.038	0.008	0.017	0.010	0.011	0.021	0.015	0.008	0.008	0.008	0.011	0.026		
Zimaling Park (Zhongshan)	Max	0.219	0.170	0.137	0.146	0.095	0.028	0.032	0.101	0.127	0.124	0.135	0.194	15	5.12%
	Min	0.037	0.007	0.006	0.007	0.004	0.008	0.006	0.006	0.015	0.014	0.045	0.027		
Tsuen Wan (HKSAR)	Max	0.065	0.054	0.069	0.073	0.080	0.064	0.049	0.078	0.092	0.096	0.046	0.052	0	0.00%
	Min	0.012	0.007	0.008	0.008	0.010	0.011	0.008	0.007	0.008	0.008	0.010	0.016		
Tap Mun (HKSAR)	Max	0.056	0.043	0.029	0.035	0.036	0.021	0.019	0.058	0.042	0.062	0.046	0.043	0	0.00%
	Min	0.016	0.006	0.007	0.007	0.007	0.003	0.005	0.006	0.007	0.008	0.014	0.017		
Tung Chung (HKSAR)	Max	0.092	0.070	0.067	0.073	0.065	0.036	0.024	0.078	0.089	0.104	0.049	0.092	0	0.00%
	Min	0.020	0.003	0.000	0.003	0.003	0.011	0.011	0.011	0.012	0.014	0.011	0.012		

**Table 3.1 c : The monthly and annual averages of Sulphur Dioxide****[Class 2 NAAQS (Annual) : 0.06 mg/m<sup>3</sup>]**

Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Luhu Park (Guangzhou)	0.049	0.075	0.059	0.049	0.050	0.076	0.047	0.039	0.038	0.030	0.034	0.054	0.050
Wanqingsha (Guangzhou)	0.107	0.039	0.055	0.065	0.055	0.031	0.018	0.053	0.070	0.068	0.085	0.094	0.061
Tianhu (Guangzhou)	0.024	0.039	0.027	0.040	0.039	0.049	0.065	0.030	0.016	0.025	0.026	0.031	0.034
Liyuan (Shenzhen)	0.049	0.054	0.041	0.021	0.021	0.013	0.009*	--	0.021	0.024*	0.025	0.027	0.029
Tangjia (Zhuhai)	0.154*	0.047	0.060	0.059	0.033	0.011	0.010	0.009	0.041*	0.030*	0.063	0.065	0.043
Shunde Dangxiao (Foshan)	0.147*	0.091	0.094	0.094	0.090	0.068	0.058	0.051	0.073	0.084	0.079	0.105	0.084
Huijingcheng (Foshan)	0.179	0.104	0.137	0.128	0.115	0.108	0.063	0.122	0.102	0.120	0.124	0.152	0.120
Donghu (Jiangmen)	0.074	0.037	0.044	0.036	0.021	0.012	0.010	0.008	0.037	0.068	0.084	0.108	0.044
Chengzhong (Zhaoqing)	0.113	0.070	0.089	0.060	0.065	0.036	0.028	0.039	0.055	0.094	0.111	0.130	0.073
Xiapu (Huizhou)	0.025	0.020	0.024	0.027	0.019	0.019*	0.020*	0.026*	0.019	0.027	0.034	0.039	0.025
Jinguowan (Huizhou)	0.020*	0.016	0.014	0.018	0.015	0.013	0.015	0.018	0.018	0.022	0.025	0.026*	0.018
Haogang (Dongguan)	0.074	0.054	0.043	0.052	0.052	0.042	0.040	0.056	0.045	0.051	0.046	0.063*	0.051
Zimaling Park (Zhongshan)	0.131	0.049*	0.048	0.063	0.028*	0.016*	0.014	0.026	0.057	0.074	0.098	0.098	0.064
Tsuen Wan (HKSAR)	0.031	0.023	0.022	0.023	0.033	0.026	0.021	0.026	0.024	0.027	0.024	0.030	0.026
Tap Mun (HKSAR)	0.030	0.014	0.013	0.017	0.015	0.010	0.009	0.016	0.017	0.026	0.026	0.026	0.018
Tung Chung (HKSAR)	0.045	0.019	0.014	0.020	0.022	0.018	0.015	0.026	0.030	0.035	0.025	0.029	0.025

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

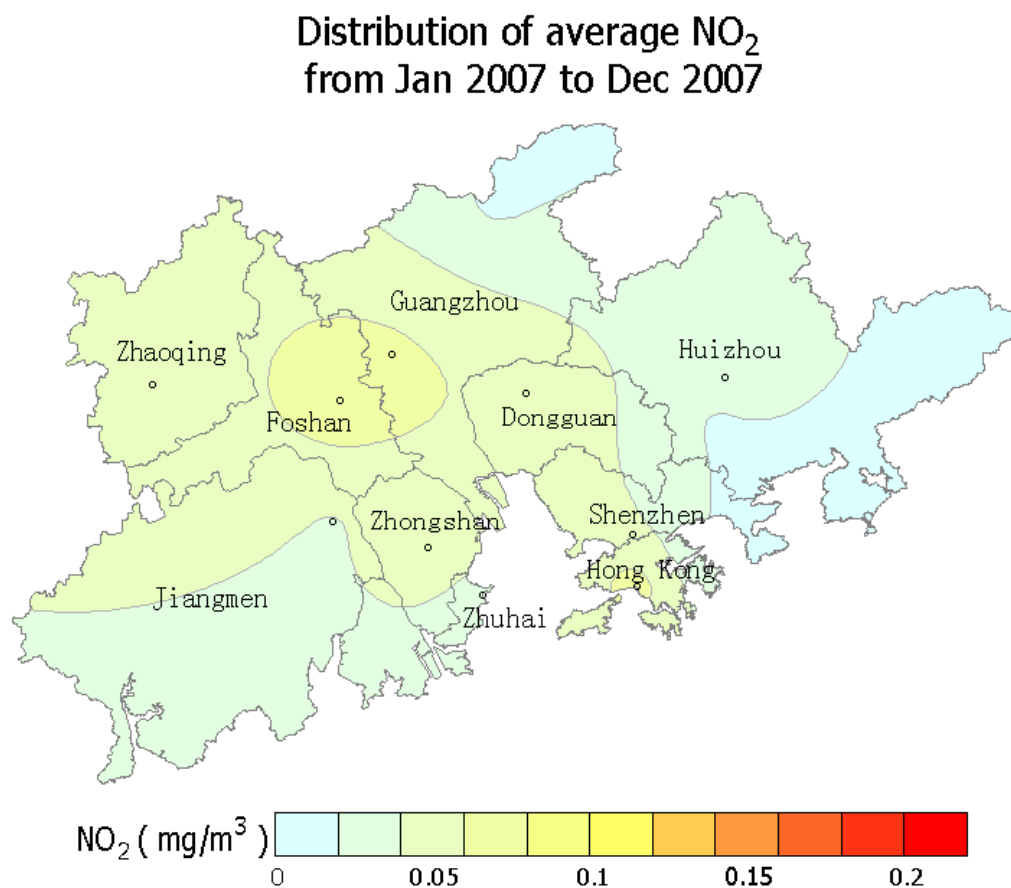
2. "--" denotes lack of data due to equipment maintenance/upgrading works.

3. "\*" denotes that the data is for reference only since the data capture rate does not meet the minimum requirements for determining a representative value.

### 3.2 Nitrogen Dioxide (NO<sub>2</sub>)

Nitrogen Dioxide (NO<sub>2</sub>) 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 annual averages of NO<sub>2</sub> at various monitoring stations in the Network ranged from 0.016 mg/m<sup>3</sup> to 0.074 mg/m<sup>3</sup> in 2007; all are in compliance with the national annual air quality standard (0.08 mg/m<sup>3</sup>). During the period, 11 monitoring stations in the Network had recorded exceedance of the national daily air quality standard (0.12 mg/m<sup>3</sup>) of NO<sub>2</sub>. The corresponding national hourly standard (0.24 mg/m<sup>3</sup>) was also exceeded at 11 monitoring stations. Details are shown in Figures 5 and Tables 3.2a - 3.2c.



**Figure 5 : Spatial distribution of average concentrations of Nitrogen Dioxide (NO<sub>2</sub>) 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/m3]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed-ance Hours	Exceed-ance Rate
Luhu Park (Guangzhou)	Max	0.271	0.267	0.245	0.335	0.276	0.167	0.099	0.150	0.261	0.181	0.279	0.269	31	0.39%
	Min	0.016	0.015	0.024	0.000	0.014	0.011	0.003	0.003	0.014	0.010	0.022	0.006		
Wanqingsha (Guangzhou)	Max	0.192	0.182	0.159	0.152	0.207	0.129	0.066	0.213	0.119	0.134	0.122	0.182	0	0.00%
	Min	0.030	0.003	0.005	0.003	0.000	0.000	0.000	0.000	0.008	0.010	0.022	0.021		
Tianhu (Guangzhou)	Max	0.061	0.150	0.114	0.125	0.116	0.118	0.090	0.106	0.079	0.067	0.072	0.100	0	0.00%
	Min	0.004	0.003	0.002	0.002	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000		
Liyuan (Shenzhen)	Max	0.299	0.158	0.220	0.210	0.225	0.144	0.084	--	0.193	0.201	0.204	0.234	1	0.01%
	Min	0.005	0.003	0.003	0.000	0.008	0.010	0.000	--	0.000	0.004	0.010	0.013		
Tangjia (Zhuhai)	Max	0.144	0.190	0.184	0.122	0.225	0.157	0.095	0.135	0.109	0.100	0.141	0.194	0	0.00%
	Min	0.005	0.000	0.000	0.001	0.004	0.002	0.000	0.004	0.004	0.000	0.018	0.016		
Shunde Dangxiao (Foshan)	Max	0.228	0.187	0.283	0.150	0.242	0.111	0.075	0.113	0.145	0.179	0.243	0.256	7	0.09%
	Min	0.017	0.012	0.016	0.009	0.014	0.006	0.000	0.000	0.008	0.000	0.001	0.029		
Huijingcheng (Foshan)	Max	0.323	0.306	0.217	0.212	0.184	0.209	0.115	0.181	0.289	0.298	0.358	0.296	68	0.85%
	Min	0.026	0.000	0.016	0.016	0.023	0.016	0.012	0.018	0.020	0.011	0.028	0.020		
Donghu (Jiangmen)	Max	0.183	0.202	0.147	0.279	0.182	0.101	0.048	0.053	0.095	0.155	0.158	0.230	7	0.09%
	Min	0.016	0.007	0.002	0.001	0.004	0.001	0.004	0.007	0.007	0.002	0.001	0.016		
Chengzhong (Zhaoqing)	Max	0.230	0.174	0.157	0.133	0.098	0.094	0.077	0.106	0.180	0.201	0.287	0.247	3	0.04%
	Min	0.016	0.005	0.012	0.008	0.020	0.009	0.008	0.000	0.000	0.015	0.019	0.017		
Xiapu (Huizhou)	Max	0.168	0.197	0.152	0.171	0.287	0.072	0.069	0.089	0.095	0.150	0.174	0.150	4	0.06%
	Min	0.002	0.000	0.001	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.001		
Jinguowan (Huizhou)	Max	0.122	0.106	0.096	0.089	0.113	0.075	0.098	0.102	0.076	0.091	0.048	0.079	0	0.00%
	Min	0.005	0.004	0.004	0.005	0.004	0.002	0.000	0.000	0.000	0.000	0.002	0.001		
Haogang (Dongguan)	Max	0.148	0.166	0.199	0.228	0.178	0.165	0.160	0.153	0.189	0.228	0.210	0.251	3	0.04%
	Min	0.009	0.008	0.011	0.009	0.015	0.014	0.014	0.011	0.013	0.011	0.013	0.011		
Zimaling Park (Zhongshan)	Max	0.331	0.172	0.186	0.160	0.166	0.111	0.060	0.098	0.113	0.162	0.208	0.292	6	0.08%
	Min	0.028	0.010	0.006	0.005	0.005	0.013	0.004	0.004	0.006	0.013	0.020	0.017		
Tsuen Wan (HKSAR)	Max	0.241	0.185	0.186	0.211	0.214	0.189	0.076	0.241	0.215	0.241	0.199	0.229	3	0.03%
	Min	0.016	0.020	0.017	0.015	0.015	0.015	0.016	0.011	0.009	0.009	0.016	0.017		
Tap Mun (HKSAR)	Max	0.117	0.077	0.067	0.090	0.116	0.049	0.058	0.106	0.076	0.109	0.069	0.080	0	0.00%
	Min	0.006	0.005	0.003	0.004	0.002	0.002	0.003	0.003	0.002	0.002	0.005	0.006		
Tung Chung (HKSAR)	Max	0.271	0.180	0.205	0.157	0.174	0.154	0.069	0.164	0.171	0.181	0.192	0.202	2	0.02%
	Min	0.013	0.006	0.004	0.003	0.006	0.001	0.001	0.002	0.007	0.006	0.011	0.012		

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

[Class 2 NAAQS (Daily) : 0.12 mg/m3]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed-ance Days	Exceed-ance Rate
Luhu Park (Guangzhou)	Max	0.178	0.179	0.138	0.199	0.157	0.116	0.044	0.070	0.102	0.105	0.139	0.152	24	7.21%
	Min	0.031	0.028	0.036	0.039	0.039	0.030	0.020	0.013	0.034	0.019	0.038	0.028		
Wanqingsha (Guangzhou)	Max	0.125	0.094	0.098	0.098	0.084	0.057	0.039	0.098	0.064	0.076	0.081	0.133	3	0.99%
	Min	0.049	0.016	0.014	0.012	0.011	0.003	0.008	0.013	0.017	0.024	0.040	0.044		
Tianhu (Guangzhou)	Max	0.024	0.070	0.057	0.067	0.058	0.050	0.045	0.050	0.036	0.041	0.026	0.035	0	0.00%
	Min	0.006	0.006	0.004	0.003	0.003	0.004	0.003	0.001	0.001	0.001	0.000	0.004		
Liyuan (Shenzhen)	Max	0.109	0.070	0.053	0.124	0.090	0.093	0.047	--	0.092	0.094	0.092	0.117	1	0.35%
	Min	0.022	0.006	0.007	0.031	0.029	0.027	0.023	--	0.027	0.019	0.043	0.035		
Tangjia (Zhuhai)	Max	0.096	0.068	0.097	0.072	0.074	0.066	0.026	0.066	0.060	0.073	0.083	0.117	0	0.00%
	Min	0.052	0.013	0.010	0.006	0.009	0.007	0.003	0.011	0.009	0.021	0.032	0.031		
Shunde Dangxiao (Foshan)	Max	0.156	0.131	0.116	0.101	0.123	0.061	0.039	0.062	0.075	0.099	0.143	0.133	10	3.11%
	Min	0.028	0.022	0.028	0.026	0.026	0.021	0.007	0.012	0.025	0.003	0.035	0.045		
Huijingcheng (Foshan)	Max	0.234	0.170	0.104	0.120	0.109	0.095	0.061	0.117	0.126	0.180	0.225	0.172	33	9.79%
	Min	0.048	0.019	0.031	0.027	0.048	0.029	0.029	0.038	0.037	0.037	0.052	0.038		
Donghu (Jiangmen)	Max	0.108	0.130	0.063	0.171	0.091	0.049	0.019	0.034	0.051	0.070	0.091	0.119	4	1.18%
	Min	0.029	0.013	0.009	0.008	0.008	0.007	0.009	0.012	0.011	0.021	0.020	0.033		
Chengzhong (Zhaoqing)	Max	0.114	0.104	0.112	0.068	0.058	0.050	0.049	0.041	0.081	0.099	0.143	0.153	6	1.76%
	Min	0.029	0.010	0.022	0.017	0.027	0.019	0.015	0.018	0.022	0.028	0.031	0.033		
Xiapu (Huizhou)	Max	0.073	0.078	0.073	0.074	0.055	0.041	0.032	0.041	0.037	0.054	0.059	0.071	0	0.00%
	Min	0.014	0.016	0.017	0.019	0.005	0.010	0.021	0.007	0.013	0.010	0.008	0.008		
Jinguowan (Huizhou)	Max	0.032	0.042	0.038	0.053	0.031	0.032	0.050	0.048	0.029	0.034	0.020	0.032	0	0.00%
	Min	0.007	0.007	0.010	0.009	0.009	0.006	0.005	0.000	0.004	0.001	0.007	0.007		
Haogang (Dongguan)	Max	0.094	0.101	0.099	0.142	0.089	0.092	0.073	0.098	0.108	0.113	0.104	0.119	1	0.31%
	Min	0.027	0.021	0.025	0.023	0.039	0.036	0.029	0.027	0.028	0.022	0.031	0.022		
Zimaling Park (Zhongshan)	Max	0.140	0.114	0.086	0.082	0.072	0.040	0.026	0.059	0.059	0.084	0.107	0.151	7	2.33%
	Min	0.042	0.022	0.014	0.011	0.011	0.025	0.007	0.010	0.022	0.019	0.035	0.044		
Tsuen Wan (HKSAR)	Max	0.147	0.118	0.099	0.131	0.128	0.100	0.051	0.113	0.120	0.125	0.117	0.138	10	2.78%
	Min	0.052	0.052	0.044	0.046	0.049	0.030	0.032	0.032	0.040	0.027	0.048	0.057		
Tap Mun (HKSAR)	Max	0.043	0.035	0.027	0.043	0.042	0.028	0.029	0.045	0.041	0.048	0.029	0.036	0	0.00%
	Min	0.011	0.006	0.007	0.006	0.004	0.006	0.005	0.006	0.004	0.004	0.008	0.010		
Tung Chung (HKSAR)	Max	0.139	0.102	0.122	0.110	0.108	0.075	0.032	0.082	0.110	0.093	0.092	0.123	4	1.11%
	Min	0.043	0.025	0.011	0.008	0.015	0.010	0.006	0.014	0.021	0.014	0.037	0.038		

**Table 3.2 c : The monthly and annual averages of Nitrogen Dioxide**

[Class 2 NAAQS (Annual) : 0.08 mg/m<sup>3</sup>]

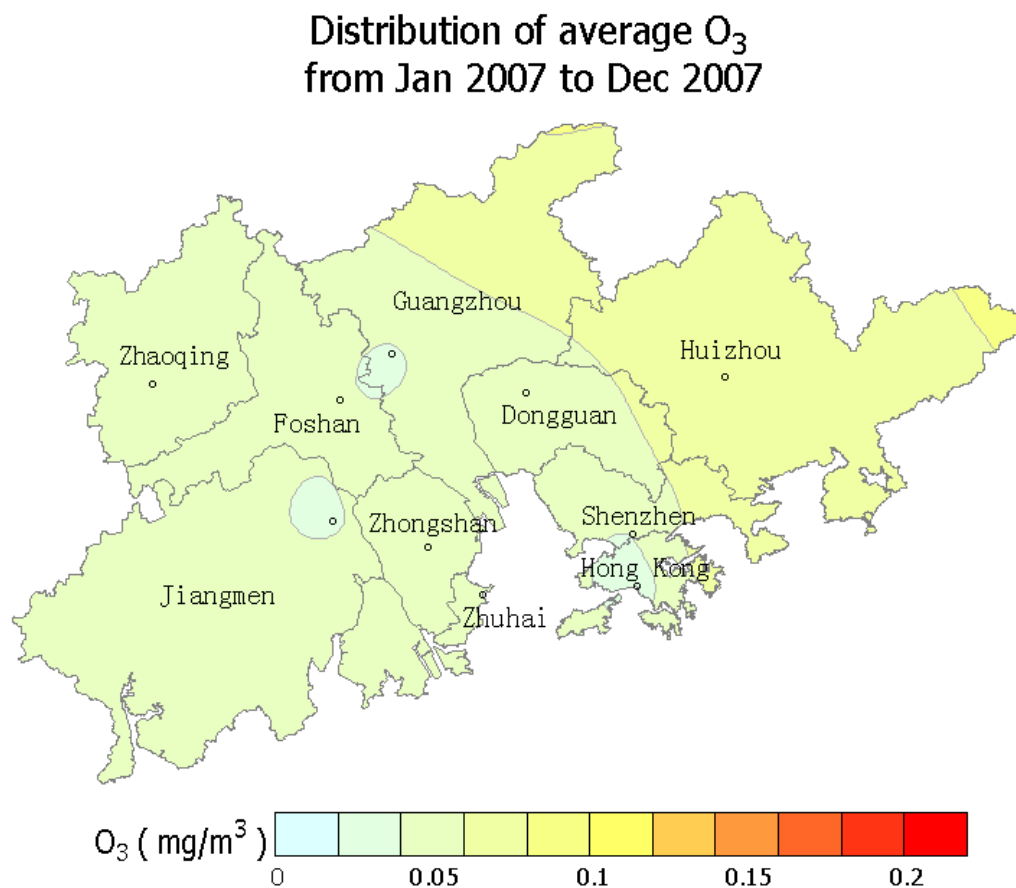
Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Luhu Park (Guangzhou)	0.071	0.087	0.066	0.091	0.072	0.060	0.031	0.040	0.058	0.049	0.067	0.089	0.065
Wanqingsha (Guangzhou)	0.079	0.044	0.046	0.050	0.044	0.021	0.018	0.046	0.043	0.052	0.058	0.076	0.049
Tianhu (Guangzhou)	0.011	0.026	0.019	0.021	0.019	0.025	0.027	0.016	0.008	0.011	0.005	0.015	0.017
Liyuan (Shenzhen)	0.042	0.023	0.021	0.059	0.055	0.043	0.032*	--	0.045	0.052*	0.060	0.070	0.046
Tangjia (Zhuhai)	0.070*	0.033	0.040	0.037	0.033	0.015	0.008	0.024	0.028*	0.036*	0.055	0.065	0.034
Shunde Dangxiao (Foshan)	0.080*	0.064	0.061	0.061	0.063	0.037	0.025	0.035	0.051	0.054	0.073	0.088	0.056
Huijingcheng (Foshan)	0.096	0.075	0.058	0.071	0.073	0.059	0.041	0.062	0.070	0.080	0.097	0.108	0.074
Donghu (Jiangmen)	0.057	0.036	0.026	0.051	0.041	0.024	0.014	0.018	0.035	0.042	0.058	0.070	0.038
Chengzhong (Zhaoqing)	0.060	0.051	0.047	0.036	0.038	0.030	0.023	0.030	0.047	0.055	0.068	0.082	0.047
Xiapu (Huizhou)	0.033	0.041	0.037	0.040	0.025	0.023*	0.027*	0.022*	0.024*	0.028	0.029	0.040	0.032
Jinguowan (Huizhou)	0.016*	0.019	0.020	0.022*	0.018	0.019	0.021	0.017	0.011	0.012	0.011	0.019*	0.017
Haogang (Dongguan)	0.055	0.056	0.055	0.065	0.060	0.059	0.046	0.058	0.058	0.057	0.064	0.068*	0.058
Zimaling Park (Zhongshan)	0.085	0.051*	0.042	0.046	0.036	0.034*	0.016	0.028	0.042	0.054	0.071	0.087	0.051
Tsuen Wan (HKSAR)	0.086	0.078	0.069	0.077	0.073	0.050	0.041	0.055	0.068	0.074	0.077	0.087	0.070
Tap Mun (HKSAR)	0.023	0.014	0.015	0.018	0.015	0.013	0.012	0.019	0.013	0.016	0.018	0.021	0.016
Tung Chung (HKSAR)	0.079	0.055	0.047	0.056	0.045	0.023	0.016	0.033	0.055	0.055	0.063	0.076	0.050

- Remark :
1. All concentration units are in milligrams per cubic metre.
  2. "--" denotes lack of data due to equipment maintenance/upgrading works.
  3. "\*" denotes that the data is for reference only since the data capture rate does not meet the minimum requirements for determining a representative value.

### 3.3 Ozone (O<sub>3</sub>)

Ozone (O<sub>3</sub>) is not directly emitted from emission sources. It is formed by the photochemical reaction of oxygen, nitrogen oxides (NO<sub>x</sub>) 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<sub>3</sub> can increase a person's susceptibility to respiratory diseases and aggravate pre-existing respiratory diseases such as asthma.

The precursors (NO<sub>x</sub> and VOCs) of O<sub>3</sub> mainly originate from pollution sources in urban areas. However, as it usually takes several hours for O<sub>3</sub> to be formed and rise to its peak level, and O<sub>3</sub> and its precursors can be transported to rural areas downwind of their sources during this period, the concentrations of O<sub>3</sub> in rural areas are therefore often higher than in the urban areas. The annual averages of O<sub>3</sub> recorded by the Network ranged from 0.032 mg/m<sup>3</sup> to 0.079 mg/m<sup>3</sup> in 2007, with higher average values measured in rural areas such as Tianhu of Guangzhou, Tap Mun of Hong Kong and Jinguowan of Huizhou. During the year, all 16 monitoring stations in the Network had recorded exceedance of the national hourly standard (0.20 mg/m<sup>3</sup>) of ozone, same as last year. Details are shown in Figures 6 and Tables 3.3a - 3.3c.



**Figure 6 : Spatial distribution of average concentrations of Ozone (O<sub>3</sub>) in the Network**

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

[Class 2 NAAQS (Hourly) : 0.20mg/m3]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed- ance Hours	Exceed- ance Rate
Luhu Park (Guangzhou)	Max	0.126	0.120	0.123	0.239	0.312	0.239	0.271	0.248	0.264	0.250	0.222	0.221	112	1.43%
	Min	0.000	0.000	0.000	0.000	0.002	0.004	0.001	0.001	0.002	0.001	0.000	0.000		
Wanqingsha (Guangzhou)	Max	0.205	0.142	0.196	0.374	0.402	0.367	0.157	0.431	0.435	0.357	0.364	0.282	270	3.70%
	Min	0.000	0.002	0.000	0.001	0.001	0.005	0.003	0.000	0.004	0.004	0.002	0.002		
Tianhu (Guangzhou)	Max	0.165	0.232	0.202	0.364	0.303	0.276	0.328	0.339	0.240	0.211	0.284	0.176	165	2.04%
	Min	0.017	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.002	0.007	0.011	0.007		
Liyuan (Shenzhen)	Max	0.203	0.222	0.164	0.088	0.142	0.067	0.091	--	0.232	0.207	0.172	0.187	9	0.13%
	Min	0.015	0.004	0.005	0.000	0.000	0.000	0.000	--	0.000	0.000	0.000	0.000		
Tangjia (Zhuhai)	Max	0.177	0.187	0.143	0.204	0.382	0.183	0.099	0.271	0.358	0.394	0.335	0.236	145	2.18%
	Min	0.008	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Shunde Dangxiao (Foshan)	Max	0.199	0.161	0.111	0.289	0.385	0.238	0.239	0.299	0.357	0.301	0.305	0.200	220	2.84%
	Min	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.002	0.000	0.000		
Huijingcheng (Foshan)	Max	0.132	0.198	0.108	0.370	0.285	0.226	0.221	0.261	0.314	0.317	0.211	0.204	109	1.37%
	Min	0.002	0.000	0.001	0.000	0.001	0.002	0.004	0.003	0.002	0.003	0.001	0.001		
Donghu (Jiangmen)	Max	0.219	0.267	0.145	0.261	0.330	0.257	0.095	0.212	0.347	0.266	0.168	0.176	121	1.47%
	Min	0.002	0.003	0.001	0.003	0.001	0.002	0.002	0.001	0.003	0.002	0.001	0.001		
Chengzhong (Zhaoqing)	Max	0.164	0.164	0.092	0.213	0.293	0.179	0.154	0.203	0.305	0.259	0.277	0.221	80	0.97%
	Min	0.003	0.002	0.002	0.002	0.003	0.002	0.004	0.005	0.004	0.002	0.003	0.003		
Xiapu (Huizhou)	Max	0.183	0.169	0.119	0.303	0.253	0.264	0.186	0.277	0.275	0.206	0.199	0.237	42	0.60%
	Min	0.001	0.000	0.000	0.003	0.010	0.009	0.015	0.019	0.029	0.028	0.021	0.012		
Jinguowan (Huizhou)	Max	0.172	0.198	0.143	0.358	0.267	0.244	0.307	0.318	0.336	0.211	0.194	0.202	114	1.44%
	Min	0.011	0.003	0.003	0.003	0.004	0.003	0.003	0.005	0.004	0.003	0.008	0.001		
Haogang (Dongguan)	Max	0.175	0.218	0.226	0.352	0.342	0.350	0.288	0.288	0.261	0.228	0.295	0.189	140	1.77%
	Min	0.002	0.001	0.003	0.001	0.002	0.003	0.003	0.002	0.000	0.002	0.002	0.002		
Zimaling Park (Zhongshan)	Max	0.228	0.181	0.116	0.255	0.290	0.245	0.146	0.381	0.402	0.409	0.339	0.252	243	3.54%
	Min	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Tsuen Wan (HKSAR)	Max	0.103	0.112	0.093	0.134	0.175	0.074	0.040	0.226	0.217	0.219	0.149	0.161	10	0.12%
	Min	0.002	0.003	0.004	0.005	0.004	0.004	0.004	0.003	0.005	0.007	0.008	0.007		
Tap Mun (HKSAR)	Max	0.191	0.171	0.183	0.226	0.303	0.160	0.127	0.323	0.309	0.271	0.184	0.207	59	0.71%
	Min	0.006	0.005	0.002	0.002	0.002	0.000	0.000	0.001	0.004	0.009	0.009	0.005		
Tung Chung (HKSAR)	Max	0.208	0.132	0.093	0.152	0.289	0.100	0.126	0.337	0.325	0.318	0.265	0.209	73	0.86%
	Min	0.000	0.001	0.000	0.000	0.001	0.007	0.009	0.006	0.005	0.005	0.006	0.003		

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

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Luhu Park (Guangzhou)	Max	0.047	0.056	0.051	0.070	0.094	0.081	0.096	0.086	0.102	0.087	0.082	0.063
	Min	0.004	0.003	0.001	0.001	0.007	0.014	0.013	0.008	0.011	0.010	0.019	0.004
Wanqingsha (Guangzhou)	Max	0.064	0.094	0.055	0.137	0.138	0.124	0.051	0.130	0.157	0.164	0.120	0.093
	Min	0.008	0.006	0.002	0.004	0.029	0.021	0.019	0.014	0.026	0.026	0.032	0.007
Tianhu (Guangzhou)	Max	0.132	0.134	0.115	0.154	0.152	0.099	0.154	0.131	0.145	0.154	0.125	0.135
	Min	0.033	0.019	0.010	0.017	0.053	0.025	0.034	0.027	0.045	0.041	0.053	0.041
Liyuan (Shenzhen)	Max	0.105	0.101	0.084	0.051	0.053	0.017	0.024	--	0.083	0.077	0.080	0.074
	Min	0.039	0.023	0.020	0.005	0.002	0.000	0.001	--	0.008	0.008	0.023	0.007
Tangjia (Zhuhai)	Max	0.078	0.116	0.100	0.111	0.154	0.085	0.039	0.102	0.137	0.136	0.131	0.090
	Min	0.010	0.014	0.006	0.004	0.034	0.024	0.005	0.014	0.013	0.018	0.030	0.003
Shunde Dangxiao (Foshan)	Max	0.055	0.061	0.052	0.114	0.125	0.081	0.075	0.083	0.129	0.105	0.113	0.065
	Min	0.000	0.004	0.001	0.001	0.010	0.000	0.011	0.012	0.023	0.023	0.030	0.002
Huijingcheng (Foshan)	Max	0.053	0.058	0.055	0.148	0.081	0.091	0.074	0.094	0.106	0.099	0.087	0.072
	Min	0.003	0.003	0.006	0.006	0.005	0.010	0.016	0.016	0.015	0.016	0.015	0.004
Donghu (Jiangmen)	Max	0.058	0.100	0.060	0.114	0.178	0.081	0.040	0.083	0.128	0.107	0.070	0.056
	Min	0.003	0.011	0.004	0.005	0.013	0.011	0.008	0.007	0.007	0.008	0.012	0.003
Chengzhong (Zhaoqing)	Max	0.057	0.057	0.063	0.121	0.128	0.094	0.066	0.084	0.129	0.117	0.098	0.087
	Min	0.011	0.005	0.004	0.012	0.007	0.017	0.014	0.031	0.022	0.015	0.032	0.012
Xiapu (Huizhou)	Max	0.096	0.102	0.069	0.137	0.110	0.076	0.063	0.097	0.143	0.131	0.133	0.124
	Min	0.015	0.023	0.011	0.023	0.041	0.024	0.045	0.036	0.053	0.041	0.064	0.037
Jinguowan (Huizhou)	Max	0.120	0.132	0.096	0.185	0.146	0.078	0.112	0.115	0.169	0.173	0.143	0.139
	Min	0.029	0.033	0.013	0.036	0.042	0.021	0.005	0.027	0.037	0.029	0.066	0.060
Haogang (Dongguan)	Max	0.085	0.077	0.070	0.113	0.127	0.115	0.088	0.101	0.103	0.093	0.081	0.065
	Min	0.018	0.016	0.009	0.010	0.016	0.013	0.015	0.010	0.013	0.017	0.030	0.007
Zimaling Park (Zhongshan)	Max	0.055	0.071	0.072	0.103	0.078	0.076	0.056	0.118	0.149	0.157	0.121	0.076
	Min	0.002	0.008	0.001	0.000	0.015	0.019	0.020	0.015	0.009	0.014	0.023	0.004
Tsuen Wan (HKSAR)	Max	0.059	0.058	0.054	0.080	0.073	0.020	0.017	0.043	0.097	0.100	0.079	0.069
	Min	0.006	0.006	0.005	0.009	0.007	0.006	0.008	0.006	0.010	0.023	0.026	0.010
Tap Mun (HKSAR)	Max	0.105	0.135	0.102	0.168	0.146	0.058	0.047	0.101	0.143	0.166	0.137	0.135
	Min	0.020	0.027	0.017	0.032	0.027	0.017	0.020	0.013	0.018	0.040	0.059	0.032
Tung Chung (HKSAR)	Max	0.081	0.096	0.075	0.096	0.107	0.059	0.048	0.072	0.110	0.128	0.115	0.083
	Min	0.002	0.005	0.002	0.003	0.014	0.016	0.021	0.017	0.013	0.018	0.022	0.007



**Table 3.3 c : The monthly and annual averages of Ozone**

Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Luhu Park (Guangzhou)	0.023	0.017	0.013	0.027	0.051	0.045	0.050	0.033	0.051	0.055	0.055	0.031	0.038
Wanqingsha (Guangzhou)	0.027	0.025	0.019	0.061	0.080	0.047	0.034*	0.057	0.080	0.086	0.073	0.052	0.053
Tianhu (Guangzhou)	0.082	0.081	0.059	0.078	0.091	0.058	0.078	0.060	0.080	0.101	0.096	0.084	0.079
Liyuan (Shenzhen)	0.066	0.056	0.045	0.026	0.027	0.004	0.016*	--	0.057	0.047*	0.049	0.041	0.040
Tangjia (Zhuhai)	0.036*	0.059	0.032	0.055	0.075	0.045	0.025	0.036*	0.076*	0.105*	0.077	0.055	0.055
Shunde Dangxiao (Foshan)	0.021*	0.026	0.015	0.037	0.053	0.018	0.032	0.040	0.084	0.078	0.070	0.035*	0.043
Huijingcheng (Foshan)	0.024*	0.028	0.017	0.045	0.035	0.033	0.043	0.038	0.060	0.067	0.060	0.033	0.041
Donghu (Jiangmen)	0.029	0.046	0.023	0.047	0.053	0.024	0.021	0.025	0.062	0.063	0.043	0.031	0.039
Chengzhong (Zhaoqing)	0.033	0.031	0.020	0.048	0.062	0.039	0.044	0.049	0.080	0.074	0.068	0.044	0.049
Xiapu (Huizhou)	0.051	0.050	0.034	0.060	0.070	0.048*	0.052*	0.066*	0.096	0.095	0.097	0.074	0.068
Jinguowan (Huizhou)	0.071*	0.080	0.054	0.081	0.082	0.044	0.043	0.057	0.100	0.100	0.108	0.095*	0.076
Haogang (Dongguan)	0.056	0.043	0.030	0.051	0.065	0.042	0.047	0.040	0.060	0.059	0.053	0.039*	0.049
Zimaling Park (Zhongshan)	0.025	0.039*	0.028	0.046*	0.036*	0.040*	0.039	0.041	0.073	0.087	0.069	0.041	0.049
Tsuen Wan (HKSAR)	0.027	0.030	0.025	0.036	0.031	0.011	0.012	0.016	0.048	0.056	0.052	0.035	0.032
Tap Mun (HKSAR)	0.072	0.084	0.065	0.075	0.078	0.031	0.033	0.045	0.087	0.109	0.100	0.087	0.072
Tung Chung (HKSAR)	0.030	0.042	0.032	0.039	0.051	0.030	0.033	0.032	0.062	0.072	0.066	0.039	0.044

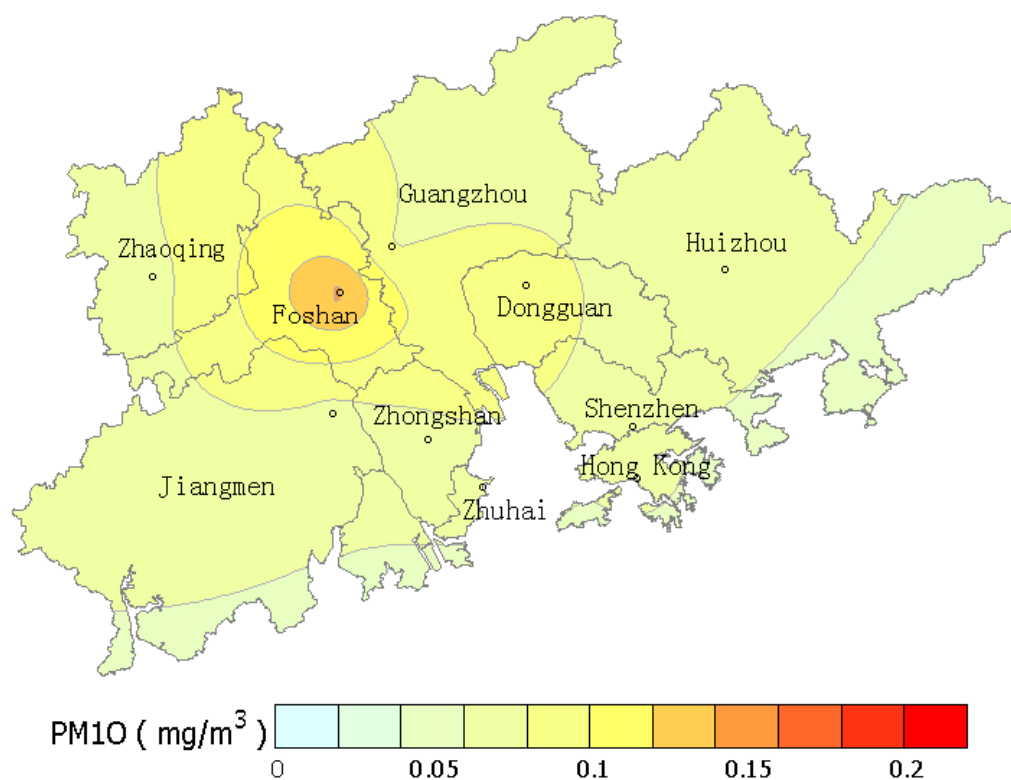
- Remark :
1. All concentration units are in milligrams per cubic metre.
  2. "--" denotes lack of data due to equipment maintenance/upgrading works.
  3. "\*" denotes that the data is for reference only since the data capture rate does not meet the minimum requirements for determining a representative value.

### 3.4 Respirable Suspended Particulates (PM<sub>10</sub>)

The respirable suspended particulates (PM<sub>10</sub> 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<sub>2</sub>) or from photochemical reactions. PM<sub>10</sub> can penetrate deeply into human lungs and cause impact on human respiratory system. Furthermore, finer particles in PM<sub>10</sub> have significant effect on visibility.

The annual averages of PM<sub>10</sub> at various monitoring stations in the Network ranged from 0.058 mg/m<sup>3</sup> to 0.146 mg/m<sup>3</sup> in 2007, with value exceeding the national annual air quality standard (0.10 mg/m<sup>3</sup>) at 1 station. As shown in Figure 7, the average levels of PM<sub>10</sub> in the central and northern parts of PRD were generally higher than those in the coastal areas in the south. All monitoring stations except Tangjia had recorded exceedance of the national daily standard (0.15mg/m<sup>3</sup>) of PM<sub>10</sub>, same as last year. Details are shown in Tables 3.4a - 3.4c.

**Distribution of average PM10  
from Jan 2007 to Dec 2007**



**Figure 7 : Spatial distribution of average concentrations of Respirable Suspended Particulates (PM<sub>10</sub>) in the Network**

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

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Luhu Park (Guangzhou)	Max	0.385	0.307	0.273	0.294	0.187	0.249	0.185	0.189	0.378	0.257	0.377	0.365
	Min	0.007	0.000	0.000	0.008	0.002	0.001	0.001	0.000	0.009	0.000	0.019	0.012
Wanqingsha (Guangzhou)	Max	0.376	0.311	0.459	0.243	0.331	0.214	0.143	0.202	0.331	0.472	0.333	0.563
	Min	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.019	0.008
Tianhu (Guangzhou)	Max	0.235	0.225	0.150	0.228	0.298	0.204	0.246	0.208	0.213	0.304	0.278	0.293
	Min	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Liyuan (Shenzhen)	Max	0.426	0.311	0.330	0.176	0.269	0.160	0.115	--	0.344	0.194	0.283	0.325
	Min	0.003	0.000	0.000	0.000	0.000	0.002	0.000	--	0.000	0.000	0.015	0.004
Tangjia (Zhuhai)	Max	0.116	0.180	0.100	0.223	0.312	0.122	0.073	0.108	0.169	0.126	0.260	0.247
	Min	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Shunde Dangxiao (Foshan)	Max	0.536	0.480	0.546	0.291	0.559	0.248	0.158	0.332	0.280	0.444	0.404	0.442
	Min	0.021	0.005	0.006	0.015	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000
Huijingcheng (Foshan)	Max	0.862	0.626	0.916	0.516	0.607	0.872	0.302	0.469	0.533	0.629	0.805	0.705
	Min	0.016	0.011	0.007	0.024	0.007	0.007	0.004	0.007	0.036	0.040	0.038	0.008
Donghu (Jiangmen)	Max	0.312	0.423	0.224	0.302	0.283	0.245	0.170	0.282	0.280	0.264	0.381	0.352
	Min	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.017	0.011
Chengzhong (Zhaoqing)	Max	0.304	0.250	0.252	0.221	0.192	0.173	0.096	0.134	0.186	0.255	0.322	0.418
	Min	0.006	0.001	0.001	0.001	0.004	0.000	0.000	0.000	0.000	0.010	0.012	0.007
Xiapu (Huizhou)	Max	0.382	0.379	0.423	0.381	0.479	--	--	0.295	0.394	0.562	0.369	0.479
	Min	0.051	0.041	0.004	0.000	0.007	--	--	0.018	0.002	0.002	0.002	0.035
Jinguowan (Huizhou)	Max	0.192	0.163	0.239	0.223	0.216	0.120	0.160	0.254	0.265	0.230	0.267	0.289
	Min	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017
Haogang (Dongguan)	Max	0.533	0.412	0.347	0.321	0.274	0.240	0.203	0.333	0.251	0.327	0.357	0.422
	Min	0.018	0.006	0.003	0.010	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000
Zimaling Park (Zhongshan)	Max	0.234	0.181	0.202	0.161	0.175	0.201	0.133	0.202	0.283	0.283	0.287	0.577
	Min	0.011	0.004	0.003	0.002	0.003	0.002	0.000	0.000	0.001	0.004	0.000	0.000
Tsuen Wan (HKSAR)	Max	0.218	0.179	0.330	0.173	0.217	0.098	0.097	0.212	0.261	0.238	0.260	0.286
	Min	0.025	0.016	0.008	0.013	0.010	0.009	0.011	0.009	0.008	0.011	0.015	0.007
Tap Mun (HKSAR)	Max	0.167	0.176	0.143	0.122	0.168	0.075	0.055	0.187	0.193	0.181	0.234	0.232
	Min	0.021	0.015	0.006	0.010	0.007	0.004	0.005	0.006	0.010	0.022	0.020	0.006
Tung Chung (HKSAR)	Max	0.257	0.195	0.343	0.172	0.213	0.082	0.050	0.064	0.171	0.243	0.257	0.299
	Min	0.025	0.012	0.006	0.006	0.006	0.003	0.005	0.006	0.005	0.025	0.025	0.006

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

[Class 2 NAAQS (Daily) : 0.15 mg/m3]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed-ance Days	Exceed-ance Rate
Luhu Park (Guangzhou)	Max	0.269	0.228	0.179	0.255	0.121	0.129	0.095	0.113	0.177	0.183	0.155	0.218	26	7.69%
	Min	0.035	0.027	0.011	0.021	0.021	0.021	0.031	0.014	0.027	0.014	0.047	0.020		
Wanqingsha (Guangzhou)	Max	0.236	0.165	0.311	0.133	0.170	0.071	0.056	0.119	0.232	0.246	0.206	0.336	47	17.74%
	Min	0.053	0.038	0.024	0.025	0.030	0.011	0.021	0.022	0.046	0.036	0.102	0.056		
Tianhu (Guangzhou)	Max	0.133	0.134	0.087	0.173	0.186	0.103	0.143	0.098	0.101	0.243	0.157	0.153	9	2.59%
	Min	0.006	0.018	0.009	0.015	0.011	0.019	0.027	0.017	0.014	0.025	0.021	0.006		
Liyuan (Shenzhen)	Max	0.183	0.136	0.092	0.112	0.157	0.069	0.039	--	0.148	0.133	0.148	0.191	6	2.09%
	Min	0.047	0.023	0.021	0.024	0.020	0.018	0.018	--	0.020	0.018	0.039	0.038		
Tangjia (Zhuhai)	Max	0.058	0.056	0.049	0.105	0.105	0.045	0.025	0.056	0.113	0.072	0.100	0.134	0	0.00%
	Min	0.027	0.024	0.022	0.021	0.019	0.010	0.012	0.010	0.011	0.015	0.037	0.026		
Shunde Dangxiao (Foshan)	Max	0.355	0.265	0.267	0.204	0.256	0.124	0.070	0.136	0.175	0.194	0.203	0.317	52	16.05%
	Min	0.055	0.053	0.039	0.047	0.034	0.022	0.018	0.031	0.033	0.024	0.048	0.037		
Huijingcheng (Foshan)	Max	0.512	0.368	0.552	0.293	0.291	0.276	0.129	0.245	0.258	0.321	0.444	0.362	128	38.32%
	Min	0.057	0.074	0.051	0.031	0.026	0.023	0.079	0.069	0.082	0.073	0.100	0.038		
Donghu (Jiangmen)	Max	0.156	0.102	0.115	0.143	0.154	0.089	0.048	0.133	0.159	0.152	0.260	0.253	17	4.89%
	Min	0.033	0.028	0.023	0.022	0.022	0.013	0.015	0.021	0.038	0.027	0.064	0.044		
Chengzhong (Zhaoqing)	Max	0.186	0.170	0.174	0.135	0.105	0.071	0.053	0.105	0.137	0.192	0.235	0.269	29	8.43%
	Min	0.016	0.034	0.014	0.026	0.025	0.016	0.020	0.009	0.022	0.040	0.048	0.017		
Xiapu (Huizhou)	Max	0.242	0.220	0.213	0.204	0.157	--	--	0.084	0.197	0.241	0.231	0.287	87	38.33%
	Min	0.079	0.065	0.043	0.023	0.017	--	--	0.084	0.039	0.035	0.028	0.068		
Jinguowan (Huizhou)	Max	0.114	0.119	0.083	0.124	0.115	0.068	0.077	0.108	0.152	0.166	0.187	0.191	8	2.46%
	Min	0.028	0.022	0.017	0.024	0.019	0.010	0.016	0.003	0.025	0.018	0.061	0.040		
Haogang (Dongguan)	Max	0.266	0.207	0.152	0.183	0.131	0.106	0.079	0.152	0.161	0.213	0.167	0.260	37	11.11%
	Min	0.058	0.039	0.019	0.034	0.024	0.028	0.034	0.025	0.040	0.037	0.044	0.040		
Zimaling Park (Zhongshan)	Max	0.121	0.108	0.097	0.078	0.065	0.036	0.045	0.116	0.180	0.163	0.192	0.284	27	8.74%
	Min	0.028	0.019	0.014	0.013	0.013	0.012	0.017	0.020	0.030	0.024	0.066	0.045		
Tsuen Wan (HKSAR)	Max	0.141	0.130	0.121	0.102	0.119	0.060	0.052	0.088	0.172	0.148	0.173	0.180	7	1.97%
	Min	0.039	0.028	0.028	0.038	0.021	0.024	0.022	0.020	0.020	0.024	0.043	0.034		
Tap Mun (HKSAR)	Max	0.119	0.126	0.088	0.092	0.103	0.046	0.035	0.082	0.142	0.128	0.125	0.174	3	0.86%
	Min	0.039	0.026	0.023	0.020	0.019	0.012	0.012	0.011	0.015	0.039	0.050	0.022		
Tung Chung (HKSAR)	Max	0.155	0.144	0.192	0.096	0.116	0.042	0.034	0.024	0.094	0.137	0.173	0.217	9	2.67%
	Min	0.038	0.027	0.024	0.023	0.015	0.013	0.011	0.010	0.010	0.050	0.044	0.042		

**Table 3.4 c : The monthly and annual averages of Respirable Suspended Particulates****[Class 2 NAAQS (Annual) : 0.10 mg/m<sup>3</sup>]**

Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Luhu Park (Guangzhou)	0.101	0.093	0.063	0.091	0.059	0.065	0.049	0.054	0.079	0.085	0.090	0.112	0.079
Wanqingsha (Guangzhou)	0.131	0.083	0.078	0.077	0.073*	0.036*	0.039	0.057*	0.125*	0.153*	0.141	0.165*	0.094
Tianhu (Guangzhou)	0.071	0.073	0.047	0.068	0.066	0.057	0.073	0.056	0.062	0.093	0.081	0.095	0.070
Liyuan (Shenzhen)	0.087	0.068	0.047	0.056	0.066	0.032	0.029*	--	0.073	0.074*	0.088	0.100	0.067
Tangjia (Zhuhai)	0.042*	0.035	0.035	0.038	0.055*	0.024	0.018	0.023	0.048*	0.055*	0.072*	0.076*	#
Shunde Dangxiao (Foshan)	0.161*	0.120	0.100	0.106	0.098	0.062	0.051	0.068	0.100	0.108	0.103	0.134	0.098
Huijingcheng (Foshan)	0.207	0.147	0.159	0.143	0.074	0.116	0.100	0.126	0.152	0.172	0.201	0.162	0.146
Donghu (Jiangmen)	0.087	0.058	0.054	0.065	0.061	0.037	0.036	0.058	0.084	0.094	0.114	0.125	0.073
Chengzhong (Zhaoqing)	0.091	0.082	0.066	0.065	0.062	0.037	0.031	0.044	0.065	0.102	0.109	0.135	0.074
Xiapu (Huizhou)	0.153	0.145	0.110	0.083	0.063*	--	--	0.084*	0.114	0.137	0.130	0.191	#
Jinguowan (Huizhou)	0.074*	0.059	0.048	0.063	0.059	0.033	0.043	0.043	0.073	0.093	0.093	0.111*	0.065
Haogang (Dongguan)	0.125	0.097	0.066	0.079	0.074	0.054	0.048	0.065	0.089	0.111	0.115	0.148	0.088
Zimaling Park (Zhongshan)	0.068	0.041*	0.031	0.035	0.038	0.027*	0.033	0.044	0.088	0.114	0.123	0.138	0.070
Tsuen Wan (HKSAR)	0.088	0.066	0.055	0.061	0.061	0.034	0.035	0.042	0.072	0.087	0.083	0.093	0.065
Tap Mun (HKSAR)	0.077	0.060	0.046	0.054	0.056	0.022	0.023	0.034	0.065	0.089	0.082	0.090	0.058
Tung Chung (HKSAR)	0.098	0.063	0.051	0.057	0.052	0.022	0.022	0.016	0.034*	0.091	0.086	0.099	0.059

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

2. "--" denotes lack of data due to equipment maintenance/upgrading works.

3. "\*" denotes that the data is for reference only since the data capture rate does not meet the minimum requirements for determining a representative value.

4. "#" denotes that there were insufficient data to calculate the annual average due to equipment maintenance and upgrading works.

### 3.5 Monthly Variations of Pollutant Concentrations

Figure 8 shows the monthly variations of the major pollutants ( $\text{SO}_2$ ,  $\text{NO}_2$ ,  $\text{O}_3$ , and  $\text{PM}_{10}$ ) recorded by the Network in 2007. The overall concentrations of  $\text{SO}_2$ ,  $\text{NO}_2$  and  $\text{PM}_{10}$  were generally higher in January and from October to December. Levels of these pollutants were lower in June and July due to the heavier rainfall and higher mixing layer height in these 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. As for ozone, the highest monthly averages occurred in October because it was relatively sunny and calm that favoured the formation and accumulation of ozone in 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.

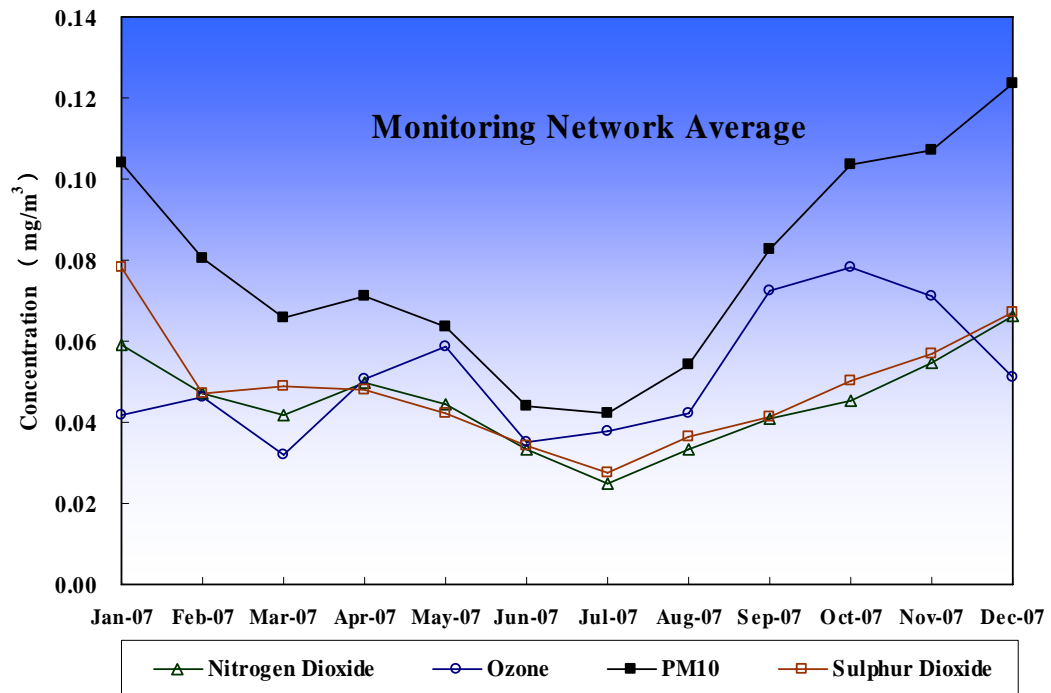


Figure 8 : Monthly variations of average pollutant concentrations measured by the Network

## 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<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>) and respirable suspended particulates (PM<sub>10</sub>). 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 <sup>#</sup>	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<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub> and O<sub>3</sub>. For SO<sub>2</sub>, NO<sub>2</sub> and PM<sub>10</sub>,  $C_i$  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<sub>3</sub>,  $C_i$  is the highest hourly average of a day while  $R_i$  represents the hourly average concentration limit in Class 2 NAAQS (refer to Class 2 NAAQS (GB 3095 – 1996) revised version).

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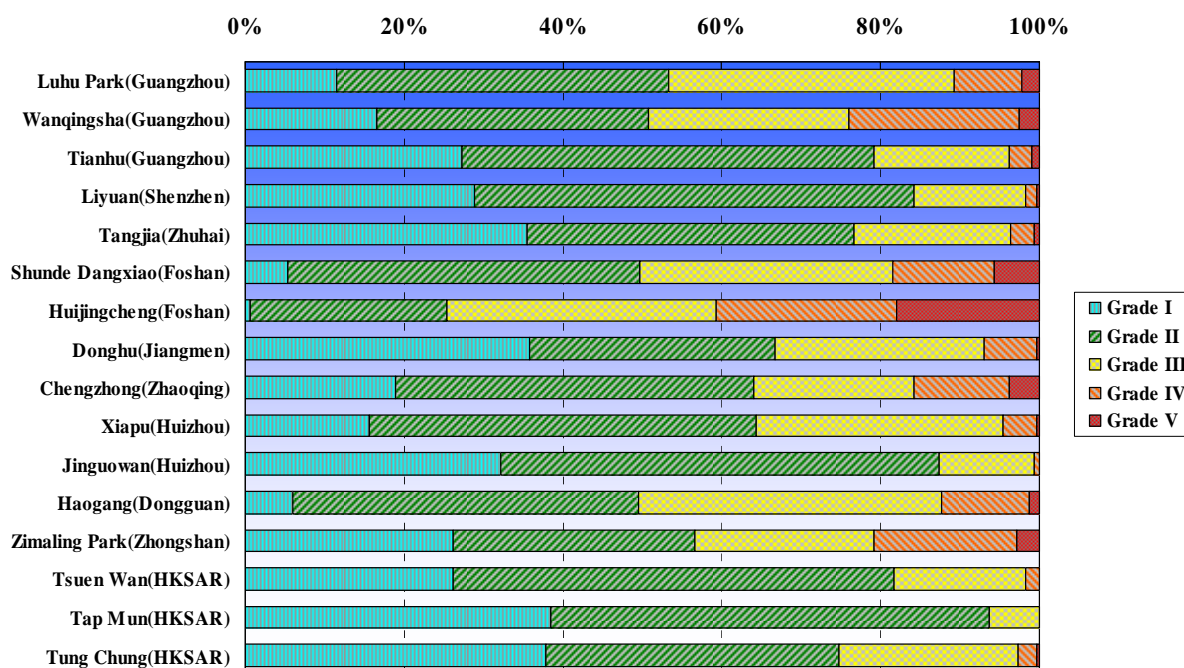
<sup>#</sup> The upper limits of the range of Grades I, II, III and IV of the RAQI are inclusive.

## 4.1 Statistics on RAQI Grades

Table 4.1a and Figure 9 summarise the statistics on the RAQI grades of all monitoring stations in the Network from January to December 2007. As shown in the table, the percentages of days with valid RAQI at various monitoring stations averaged 87%.

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

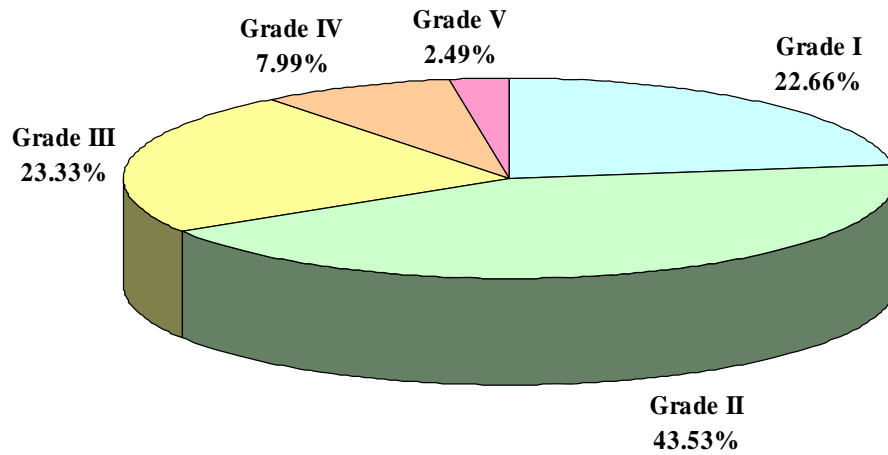
Monitoring Stations	District	Days with valid RAQI	Distribution of RAQI grades in 2007 (%)				
			Grade I	Grade II	Grade III	Grade IV	Grade V
Luhu Park	Guangzhou	328	11.59	41.77	35.98	8.54	2.13
Wanqingsha	Guangzhou	325	16.62	34.15	25.23	21.54	2.46
Tianhu	Guangzhou	345	27.25	51.88	17.10	2.90	0.87
Liyuan	Shenzhen	291	28.87	55.33	14.09	1.37	0.34
Tangjia	Zhuhai	299	35.45	41.14	19.73	3.01	0.67
Shunde Dangxiao	Foshan	314	5.41	44.27	31.85	12.74	5.73
Huijingcheng	Foshan	339	0.59	24.78	33.92	22.71	17.99
Donghu	Jiangmen	333	35.74	30.93	26.43	6.61	0.30
Chengzhong	Zhaoqing	337	18.99	45.10	20.18	11.87	3.86
Xiapu	Huizhou	289	15.57	48.79	31.14	4.15	0.35
Jinguowan	Huizhou	317	32.18	55.21	11.99	0.63	0.00
Haogang	Dongguan	319	5.96	43.57	38.24	10.97	1.25
Zimaling Park	Zhongshan	249	26.10	30.52	22.49	18.07	2.81
Tsuen Wan	HKSAR	344	26.16	55.52	16.57	1.74	0.00
Tap Mun	HKSAR	335	38.51	55.22	6.27	0.00	0.00
Tung Chung	HKSAR	341	37.83	36.95	22.58	2.35	0.29



**Figure 9 : Stacked column chart of RAQI grades of individual monitoring stations**

Figure 10 shows the overall distribution of different RAQI grades recorded by the Network in 2007. On the whole, 66.19% of the RAQI values are in Grade I or II, meaning the pollutant concentrations are within Class 2 NAAQS, followed by 23.33% in Grade III, 7.99% in Grade IV and 2.49% in Grade V; the grade distribution is similar to the previous year.

**Distribution of RAQI Grades  
(Jan - Dec 2007)**

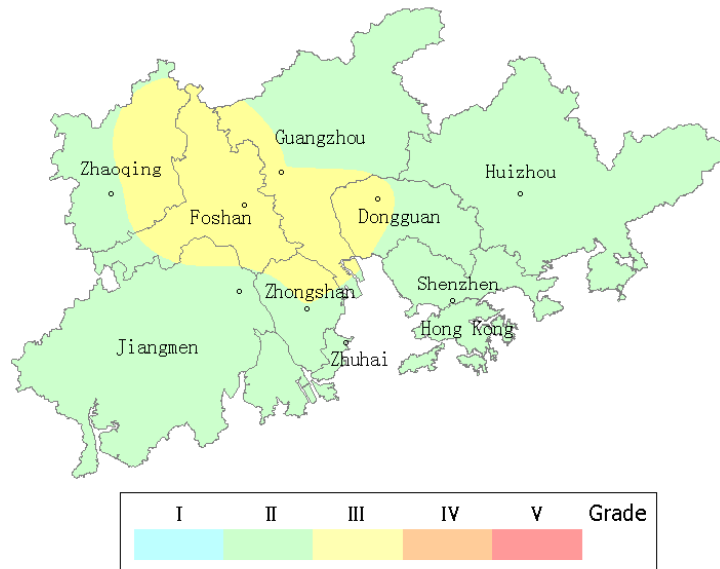


**Figure 10 : Distribution of RAQI grades in the Network**

**4.2 Spatial Distribution of Average RAQI Grades**

Figure 11 shows the spatial distribution of RAQI annual average grades in 2007. 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 previous year. Average RAQI values measured at individual monitoring stations in the Network are shown in Figure 12

**Distribution of average RAQI  
from Jan 2007 to Dec 2007**



**Figure 11 : Spatial distribution of average RAQI grades in the Network**



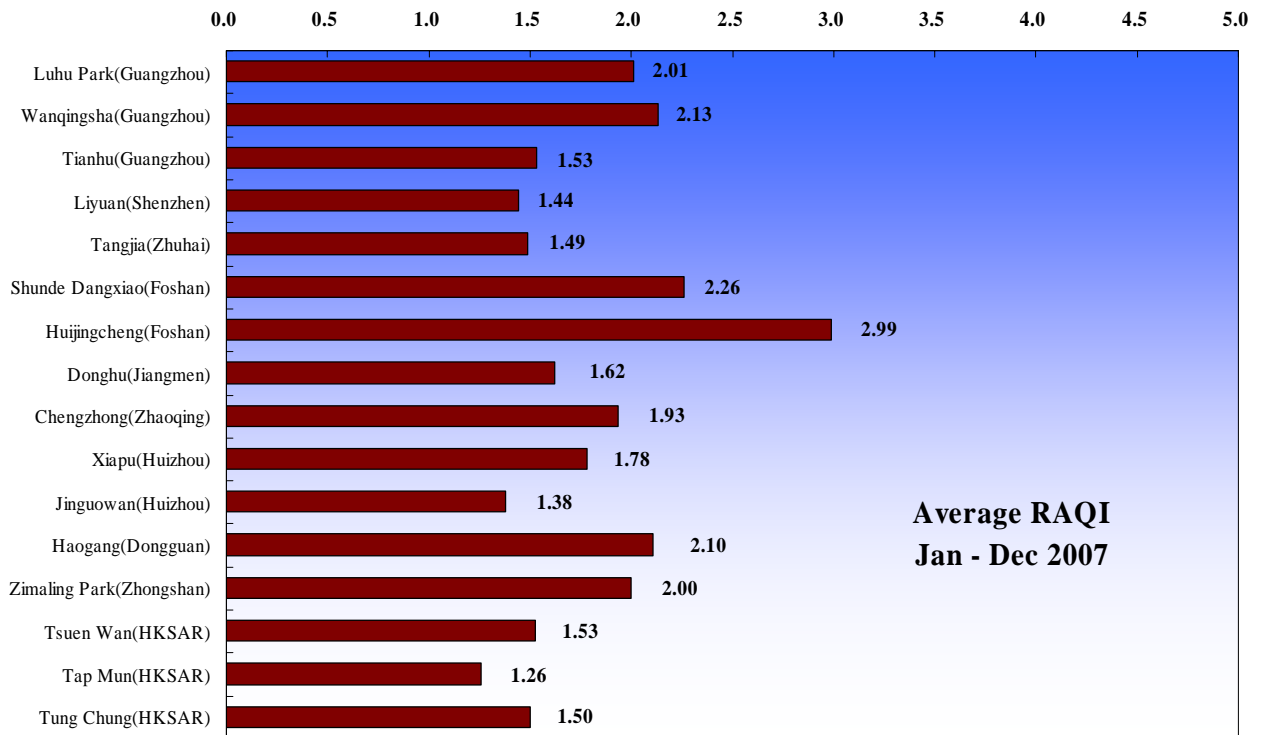


Figure 12 : The average RAQI of individual monitoring stations

### 4.3 Monthly Variations of Average RAQI

Figure 13 shows the monthly variations in the average RAQI values of the Network from January to December 2007. Except for January, October, November and December where average RAQI values reached the Grade III level, the values in other months were within the Grade II category. The maximum and minimum RAQI values were recorded in December and July respectively.

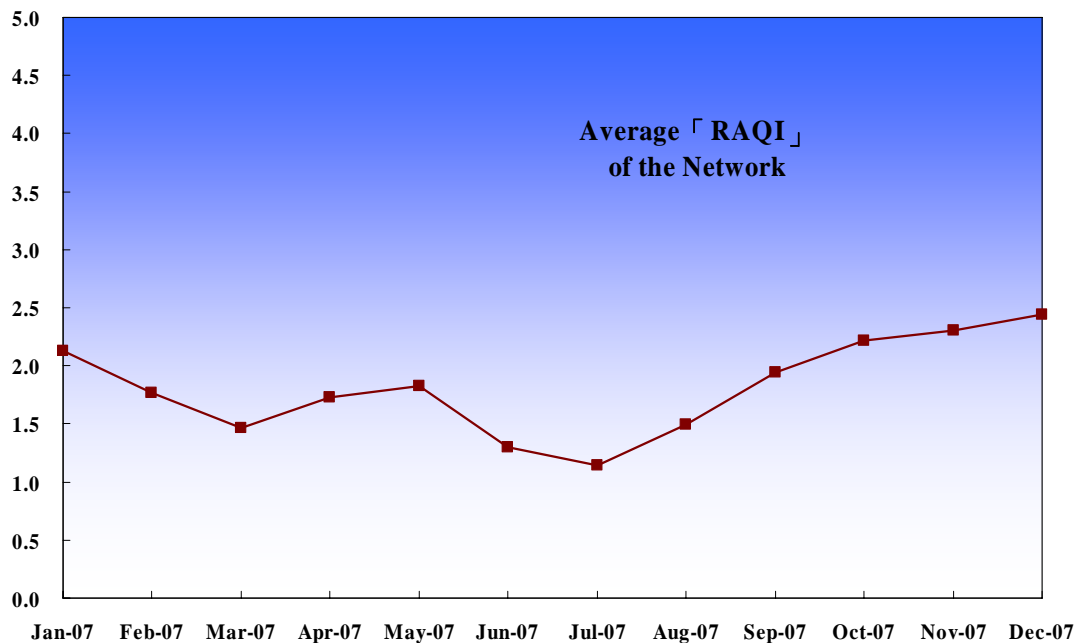


Figure 13 : Monthly variations in average RAQI

## 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

<b>Pollutants</b>	<b>Measuring Principles</b>
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