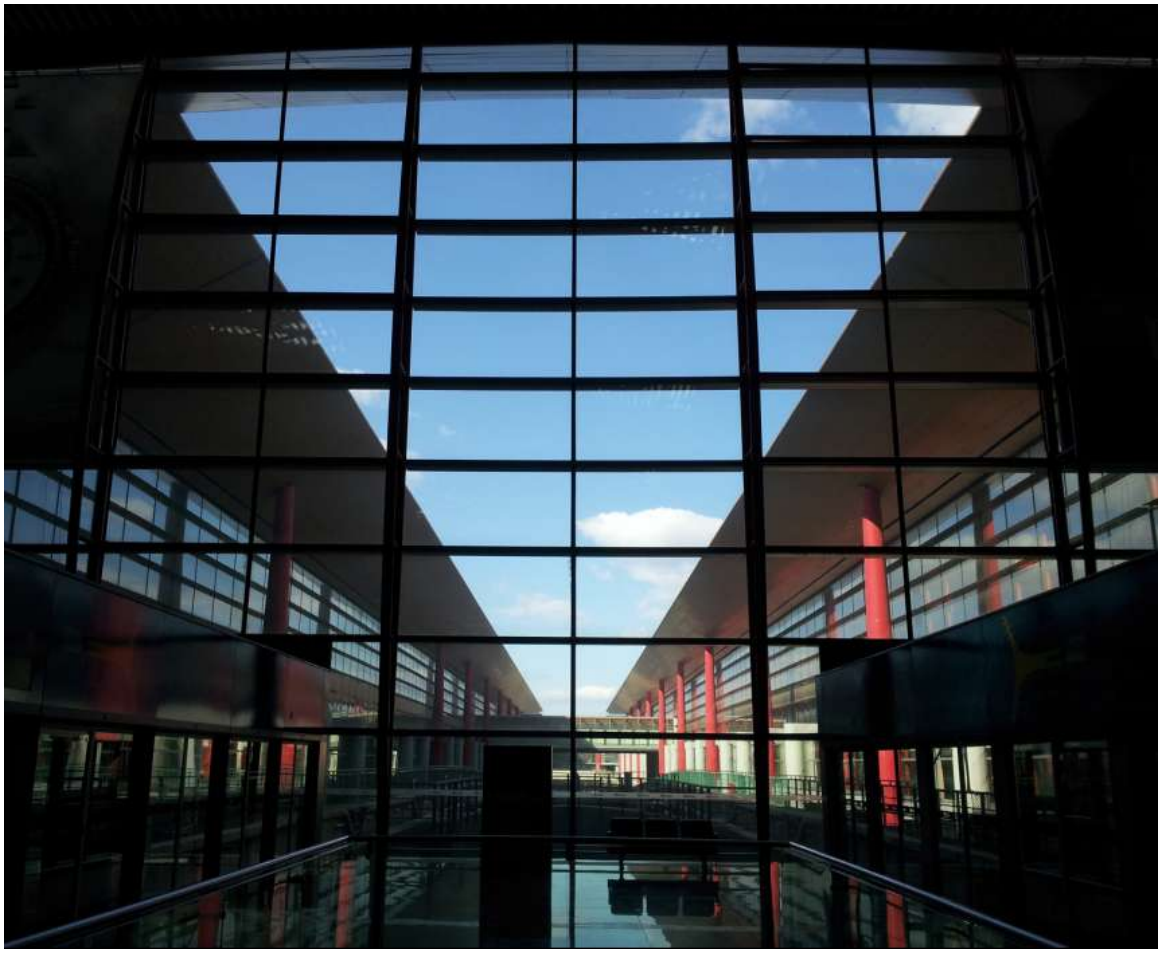
IPE 公众环境研究中心
Institute of Public & Environmental Affairs

# Small Particles, Big Breakthrough

## 2012 Urban Air Quality Information Transparency Index



**Beijing - October, 2012**

**About the Institute of Public & Environmental Affairs:**

The Institute of Public & Environmental Affairs (IPE) is a registered non-profit organization based in Beijing. Since its establishment in May 2006, IPE has developed two pollution databases (water & air—see: http://www.ipe.org.cn) to monitor corporate environmental performance and to facilitate public participation in environmental affairs. Its aim is to expand environmental information disclosure to allow communities to fully understand the hazards and risks in the surrounding environment, thus promoting widespread public participation in environmental governance.

**Report Authors:**
IPE: He Jing, Ma Jun, Shen Sunan,Qi Yu, Li Jie, Zhang Yi, Wang Jingjing, Sabrina Orlins
Beijing Technology and Business University Department of Environmental Technology and Engineering: Yao Zhiliang, Ye Yu, Wang Linna

**Translation:** Matthew Collins, Sabrina Orlins

**Data Processing:** Yang Cheng

The IPE would like to thank the following experts for their suggestions, evaluation and guidance: Zhang Shiqiu, Zhao Lijian, Wang Wuyi, Wang Xianliang, Zhu Xiao, Wu Qi

# Contents

# Summary

In order to encourage improvements in the control of urban air pollution, Renmin University of China Law School and the Insititute of Public & Environmental Affairs jointly developed the Urban Air Quality Information Transparency Index (AQTI). The first phase report was published in January 2011 and the evaluation results from the report showed that Chinese cities had started to publish air quality information, but the level of disclosure was much lower than in developed countries and regions.

In 2011, several regions of China suffered from long-spells of hazy days which aroused strong public concerns. In response to public demand for higher levels of transparency, in early 2012, the Chinese government revised the Ambient Air Quality Standards, and in doing so they initiated historic improvements to urban air quality information disclosure.

In order to help the public accurately understand the extent and nature of these changes, and in order to promote a higher level of air quality information disclosure, the Institute of Public & Environmental Affairs decided to once again carry out an AQTI evaluation, this time expanding the scope of the evaluation to 113 cities.[1] The Institute of Public & Environmental Affairs worked together with the Beijing Technology and Business University's Department of Environmental Technology and Engineering to analyze hourly monitoring data from monitoring sites in 120 cities released by the China National Environmental Monitoring Center.

The AQTI evaluation revealed the ten cities in China with the highest level of air quality information disclosure; their ranking from first to last was as follows: Guangzhou, Shenzhen, Dongguan, Zhongshan, Beijing, Foshan, Zhuhai, Nanjing, Suzhou, and Ningbo. Their scores all exceeded 54 points; in the last AQTI evaluation, the highest number of points was 38, showing that within a relatively short time, some cities have made significant progress in air quality monitoring and disclosure.

The major breakthroughs confirmed in this report were due to the substantial strengthening of requirements in information disclosure laws and regulations, and the rapid improvements in the monitoring and disclosure by a number of cities of $PM_{2.5}$ and other pollutants. However, information disclosure is just the first step, and to get improvements in air quality there is still a great need for all stakeholders to push for pollutant emissions reduction.

The increase in AQTI score results came from progress made in more systematic, timely, comprehensive, and user friendly information disclosure by some Chinese cities, as seen in the following ways: a) Important pollutants like $PM_{2.5}$ and ozone have been incorporated into the scope of disclosure for the first time. b) High frequency publishing of site-specific monitoring data is becoming the norm. c) Detailed pollutant information and detailed concentration values are being published in addition to the pollution index. d) Many cities have adopted more user friendly methods of publication such as digital maps and Weibo.

During the evaluation, the Institute of Public & Environmental Affairs looked in detail at how air quality information disclosure laws, through pressure from many sources, have been improved. These included adding parameters like $PM_{2.5}$ and ozone; tightening concentration limits for pollutants like $PM_{10}$ and lead; changing the API to Air Qualtiy Index (AQI) in line with international norms and removing the lower standard that was set for industrial zones.

By comparing the MEP's time table for implementing new standards, we saw that provinces and municipalities like Beijing, Guangdong, Jiangsu, Shanghai and Zhejiang have made rapid progress. As of August 31, 2012, there were 192 stations in 55 cities publishing $PM_{2.5}$ data. Amongst these cities, Beijing took the initiative

[1] Most of them are Key Environmental Protection Cities.

and in January 2012 began to publish data for one monitoring site. By October 6th they had expanded disclosure to 35 monitoring sites, meaning that Beijing now publishes data for more monitoring sites than any other city in China.

The evaluation also revealed that problems with air quality information disclosure still exist. The level of a lot of urban data disclosure is limited; the average score for the 113 cities' that were evaluated was still only 21.5. There were 89 cities that did not reach 30 points and 80 cities that had a total of less than 20 points. Out of these, 64 cities (more than half the total number evaluated) scored between 10-20 points and the six cities of Benxi, Weifang, Jining, Rizhao, Qujing, and Jinchang scored zero points.

As of August 31, 2012, 29 cities in the First Phase Air Quality Implementation Plan, including Chongqing, Hohhot, Zhengzhou, Shenyang, Jinan, Hefei, Changsha and Urumqi had still not started to publish any information on $PM_{2.5}$, a pollutant that has attracted a lot of public attention. Wuhan, Chengdu and a number of cities in Hebei, Jiangsu, and Zhejiang had data published but only for one monitoring site, which could not represent the state of air quality conditions across the whole of the city. In Shanxi province, real time $PM_{2.5}$ data was not being published on time and in Xi'an, Xiamen, Zhejiang there was only daily publication of data. Tianjin only published their "monthly" daily average concentration data after one month had passed.

The Beijing Technology and Business University Environmental Technology and Engineering Department and the Institute of Public & Environmental Affairs, carried out analysis of hourly monitoring data released by the China National Environmental Monitoring Center for each monitoring site in 120 cities. The analysis showed that there were areas with very serious air pollution levels. It also revealed that amongst the 19 cities whose $SO_2$ levels were in breach of the standard, seven were located in Shandong Province. It was initially reckoned that such heavy pollution was related to the intensive energy consumption in the province in recent years.

Analysis of average monthly values from State Controlled Monitoring Sites in Beijing, Tianjin and Hubei province and the Yangtze River Delta Area and the Pearl River Delta Area showed that three types of pollutants followed the same monthly changes. This shows that air pollution is a regional problem and so therefore, to effectively control the problem, cities and areas need to work closely together to form effective measures to improve air quality.

Through analysis of the data from different monitoring sites in key cities, we saw fairly big variations in pollution concentration levels in different sites in the same city. This shows that the scientific distribution of multiple monitoring sites is vital in order to accurately reflect a city's true air quality level. It also means that although a city's average air quality data can meet the required standards, the air quality in some areas may still not reach the required standards and may affect public health.

The report also looked into seasonal changes and hourly variations of atmospheric air quality in different regions.

On the basis of this research and analysis, the 2012 AQTI evaluation report makes the following recommendations for air quality information disclosure: 1) Further raise the level of atmospheric air pollution disclosure; 2) Immediately formulate and implement emergency response plans for smoggy days; 3) Encourage all stakeholders to use publically disclosed data to conduct more research.

# Part 1. AQTI Evaluation Results and Analysis

## Section 1. AQTI Evaluation Results

The 2012 AQTI is an evaluation of air quality information disclosure in cities across China, covering a total of 113 cities.

Figure 1.1 Distribution of cities evaluated in the AQTI


The maximum possible AQTI score was 100 points; Guangzhou came first in the rankings with 76 points and the average score for all the cities that were evaluated was 21.5 points.

Table 1.1 2012 AQTI score and rankings for the 113 cities that were evaluated

| Rank | City | AQTI Score | Rank | City | AQTI Score | Rank | City | AQTI Score |
|---|---|---|---|---|---|---|---|---|
| 1 | Guangzhou | 76 | 37 | Shijiazhuang | 19.2 | 75 | Zhengzhou | 13.8 |
| 2 | Shenzhen | 75 | 40 | Yichang | 18.6 | 75 | Changsha | 13.8 |
| 3 | Dongguan | 69 | 40 | Baoding | 18.6 | 75 | Xiangtan | 13.8 |
| 4 | Zhongshan | 67.6 | 40 | Yancheng | 18.6 | 75 | Yueyang | 13.8 |
| 5 | Beijing | 64.8 | 40 | Nanchang | 18.6 | 75 | Guilin | 13.8 |
| 5 | Foshan | 64.8 | 40 | Yantai | 18.6 | 75 | Xianyang | 13.8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7 | Zhuhai | 56.4 | 45 | Linfen | 18.2 | 83 | Handan | 11.4 |
| 8 | Nanjing | 56 | 46 | Huzhou | 18 | 83 | Chifeng | 11.4 |
| 9 | Suzhou | 55.2 | 46 | Anyang | 18 | 83 | Shenyang | 11.4 |
| 10 | Ningbo | 54.8 | 48 | Yangquan | 17.6 | 83 | Anshan | 11.4 |
| 11 | Shanghai | 50.2 | 49 | Datong | 17.4 | 83 | Changchun | 11.4 |
| 12 | Wuhan | 47.4 | 50 | Zhuzhou | 16.8 | 83 | Jilin | 11.4 |
| 13 | Nantong | 44.2 | 50 | Kunming | 16.8 | 83 | Qiqihar | 11.4 |
| 14 | Xiamen | 43 | 50 | Baoji | 16.8 | 83 | Daqing | 11.4 |
| 15 | Chengdu | 42.6 | 53 | Jiujiang | 16.2 | 83 | Ma'anshan | 11.4 |
| 16 | Changzhou | 39.6 | 53 | Qingdao | 16.2 | 83 | Zibo | 11.4 |
| 17 | XI'an | 38.6 | 53 | Shantou | 16.2 | 83 | Zhangjiajie | 11.4 |
| 17 | Nanning | 38.6 | 53 | Beihai | 16.2 | 83 | Panzhihua | 11.4 |
| 19 | Shaoxing | 37.8 | 57 | Changzhi | 15.8 | 83 | Luzhou | 11.4 |
| 20 | Tianjin | 33.6 | 58 | Quanzhou | 15.6 | 83 | Zunyi | 11.4 |
| 21 | Wuxi | 31.8 | 58 | Yibin | 15.6 | 83 | Karamay | 11.4 |
| 22 | Yangzhou | 31.2 | 58 | Shizuishan | 15.6 | 98 | Yan'an | 9.6 |
| 23 | Hefei | 30.6 | 61 | Fuzhou | 15 | 99 | Dalian | 9 |
| 23 | Chongqing | 30.6 | 61 | Yinchuan | 15 | 99 | Mudanjiang | 9 |
| 25 | Lianyungang | 28.8 | 63 | Jinzhou | 14.4 | 99 | Mianyang | 9 |
| 26 | Jiaxing | 28.6 | 63 | Wuhu | 14.4 | 102 | Hohhot | 8.4 |
| 27 | Harbin | 27 | 63 | Kaifeng | 14.4 | 103 | Baotou | 8.4 |
| 28 | Taiyuan | 25.4 | 63 | Luoyang | 14.4 | 104 | Weihai | 7.2 |
| 29 | Wenzhou | 24 | 63 | Pingdingshan | 14.4 | 105 | Qinhuangdao | 5.4 |
| 30 | Fushun | 22.8 | 63 | Changde | 14.4 | 106 | Ordos | 4.2 |
| 31 | Xuzhou | 22.2 | 63 | Shaoguan | 14.4 | 106 | Jiaozuo | 4.2 |
| 32 | Taizhou | 22 | 63 | Zhanjiang | 14.4 | 108 | Benxi | 0 |
| 33 | Hangzhou | 20.4 | 63 | Liuzhou | 14.4 | 108 | Weifang | 0 |
| 34 | Tangshan | 19.8 | 63 | Lanzhou | 14.4 | 108 | Jining | 0 |
| 34 | Guiyang | 19.8 | 63 | Xining | 14.4 | 108 | Rizhao | 0 |
| 34 | Tongchuan | 19.8 | 63 | Urumqi | 14.4 | 108 | Qujing | 0 |
| 37 | Tai'an | 19.2 | 75 | Jinan | 13.8 | 108 | Jinchang | 0 |
| 37 | Jingzhou | 19.2 | 75 | Zaozhuang | 13.8 | | | |

In 2010 Renmin University of China Law School and the Institute of Public & Environmental Affairs jointly developed the Urban Air Quality Information Transparency Index (AQTI) Evaluation Standards:[2]

The evaluation index was set according to the following four aspects:

- The potential health impact of each atmospheric pollutant.
- The status, characteristics, and developmental trends of air pollution in China.
- The standard procedures for urban air quality information disclosure by international organizations and cities in developed countries (or regions).
- The status of and development trends for urban atmospheric pollutant monitoring in China.

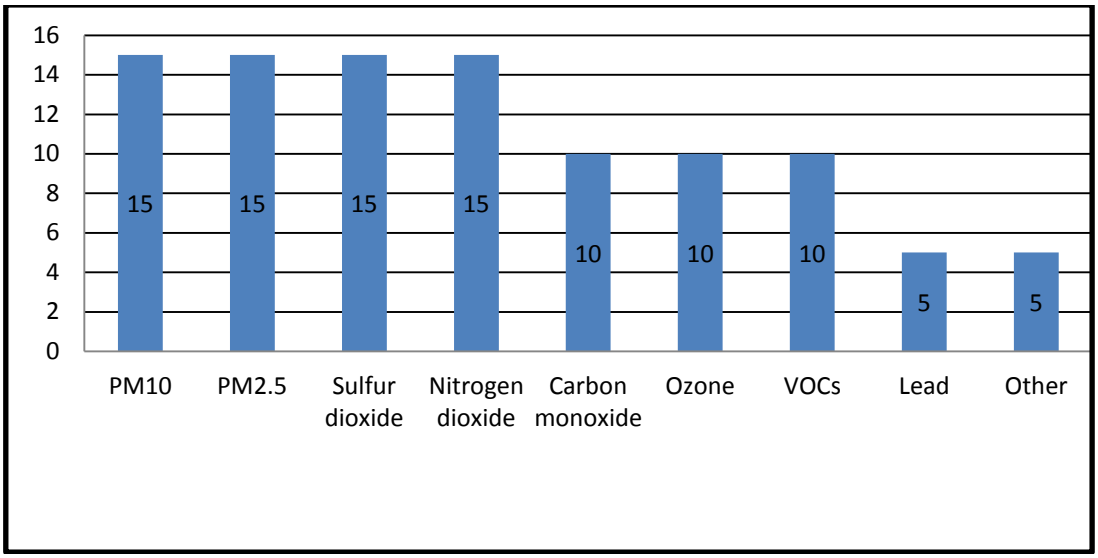
[2] For "Urban Air Quality Information Transparency Index (AQTI) Evaluation Standards" please see: http://www.ipe.org.cn/about/notice_de.aspx?id=9683. We carried out an evaluation and comparison of air quality information disclosure in 20 Chinese cities and 10 international cities and then released a report titled "A Threat to Public Health: China's Urban Air Quality Disclosure needs Urgent Improvement." For details please see: http://www.ipe.org.cn/Upload/Report-AQTI-EN.pdf.

The weighting of the index was based primarily on the following four factors:

- The degree of health hazard
- The environmental capacity for pollutants
- The current situation and trends in management in developed countries
- The status of management in China

The weightings for each pollutant in the AQTI were as follows:

Figure 1.2 Weightings for each pollutant in the AQTI




The AQTI evaluation system was based on the Institute of Public & Environmental Affairs and the Natural Resources Defense Council's Pollution Information Transparency Index (PITI) evaluation method. The evaluation of each individual index was completed based on four categories: systematic disclosure, timeliness, comprehensiveness and user friendliness.

### Systematic Disclosure:

How systematically the information was disclosed, based primarily on two factors: scope and continuity (or regularity).
Scope: Determined by evaluating how broad an area was covered by the air pollution information that was published.
Continuity: Determined by evaluating whether or not the published air pollution information covered the entire year.

### Timeliness

Timeliness was primarily evaluated by how promptly local air quality information was released—whether in hourly, daily, monthly or annual reports.

### Comprehensiveness

Comprehensiveness was primarily evaluated by whether or not local air quality information covered all of the basic elements.

### User Friendliness

User-friendliness was primarily evaluated by whether the air quality information was presented to the public in a clear way and whether it was easy for users to obtain air quality information.

Table 1.2 Total AQTI evaluation scores and scores for each index

| Rank | City | Total AQTI Score (Max. 100 pts.) | Respirable Particulate Matter $PM_{10}$ (15 pts.) | Fine Particles $PM_{2.5}$ (15 pts.) | Sulfur Oxide $SO_2$ (15 pts.) | Nitrogen Dioxide $NO_2$ (15 pts.) | Carbon Monoxide CO (10 pts.) | Ozone $O_3$ (10 pts.) | VOCs (10 pts.) | Lead Pb (5 pts.) | Others (Mercury, Benzo[a] Pyrene, Dioxins) (5 pts.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Guangzhou | 76 | 15 | 12.8 | 15 | 15 | 9.6 | 8.6 | 0 | 0 | 0 |
| 2 | Shenzhen | 75 | 15 | 12.8 | 15 | 15 | 8.6 | 8.6 | 0 | 0 | 0 |
| 3 | Dongguan | 69 | 13.4 | 12.8 | 13.4 | 13.4 | 8 | 8 | 0 | 0 | 0 |
| 4 | Zhongshan | 67.6 | 13 | 12.2 | 13 | 13 | 8.2 | 8.2 | 0 | 0 | 0 |
| 5 | Beijing | 64.8 | 15 | 6.2 | 15 | 15 | 3.6 | 3.6 | 0 | 2.8 | 3.6 |
| 5 | Foshan | 64.8 | 12.8 | 11.2 | 12.8 | 12.8 | 7.6 | 7.6 | 0 | 0 | 0 |
| 7 | Zhuhai | 56.4 | 10 | 11.2 | 10 | 10 | 7.6 | 7.6 | 0 | 0 | 0 |
| 8 | Nanjing | 56 | 13.8 | 6.2 | 13.8 | 13.8 | 4.2 | 4.2 | 0 | 0 | 0 |
| 9 | Suzhou | 55.2 | 12.8 | 7.6 | 12.8 | 12.8 | 4.8 | 4.4 | 0 | 0 | 0 |
| 10 | Ningbo | 54.8 | 12 | 6.2 | 12 | 12 | 4.2 | 4.2 | 1.6 | 0 | 2.6 |
| 11 | Shanghai | 50.2 | 13.8 | 8.8 | 13.8 | 13.8 | 0 | 0 | 0 | 0 | 0 |
| 12 | Wuhan | 47.4 | 13.8 | 6 | 13.8 | 13.8 | 0 | 0 | 0 | 0 | 0 |
| 13 | Nantong | 44.2 | 10 | 6.2 | 10 | 10 | 4.2 | 3.8 | 0 | 0 | 0 |
| 14 | Xiamen | 43 | 10 | 6.4 | 10 | 10 | 0 | 6.6 | 0 | 0 | 0 |
| 15 | Chengdu | 42.6 | 10 | 5.4 | 10 | 10 | 3.6 | 3.6 | 0 | 0 | 0 |
| 16 | Changzhou | 39.6 | 7.8 | 7 | 7.8 | 7.8 | 4.8 | 4.4 | 0 | 0 | 0 |
| 17 | Xi'an | 38.6 | 11 | 5.6 | 11 | 11 | 0 | 0 | 0 | 0 | 0 |
| 17 | Nanning | 38.6 | 12.2 | 0 | 12.2 | 12.2 | 1 | 1 | 0 | 0 | 0 |
| 19 | Shaoxing | 37.8 | 11 | 4.8 | 11 | 11 | 0 | 0 | 0 | 0 | 0 |
| 20 | Tianjin | 33.6 | 10.2 | 3 | 10.2 | 10.2 | 0 | 0 | 0 | 0 | 0 |
| 21 | Wuxi | 31.8 | 6.2 | 5.6 | 6.2 | 6.2 | 3.8 | 3.8 | 0 | 0 | 0 |
| 22 | Yangzhou | 31.2 | 6.2 | 5.4 | 6.2 | 6.2 | 3.6 | 3.6 | 0 | 0 | 0 |
| 23 | Hefei | 30.6 | 10.2 | 0 | 10.2 | 10.2 | 0 | 0 | 0 | 0 | 0 |
| 23 | Chongqing | 30.6 | 10.2 | 0 | 10.2 | 10.2 | 0 | 0 | 0 | 0 | 0 |
| 25 | Lianyungang | 28.8 | 5.4 | 5.4 | 5.4 | 5.4 | 3.6 | 3.6 | 0 | 0 | 0 |
| 26 | Jiaxing | 28.6 | 6.8 | 7.2 | 6.8 | 6.8 | 0 | 0 | 1 | 0 | 0 |
| 27 | Harbin | 27 | 9 | 0 | 9 | 9 | 0 | 0 | 0 | 0 | 0 |
| 28 | Taiyuan | 25.4 | 6.4 | 6.2 | 6.4 | 6.4 | 0 | 0 | 0 | 0 | 0 |
| 29 | Wenzhou | 24 | 6.4 | 4.8 | 6.4 | 6.4 | 0 | 0 | 0 | 0 | 0 |
| 30 | Fushun | 22.8 | 7.6 | 0 | 7.6 | 7.6 | 0 | 0 | 0 | 0 | 0 |
| 31 | Xuzhou | 22.2 | 3.2 | 5.4 | 3.2 | 3.2 | 3.6 | 3.6 | 0 | 0 | 0 |
| 32 | Taizhou | 22 | 6.8 | 0 | 7.6 | 7.6 | 0 | 0 | 0 | 0 | 0 |
| 33 | Hangzhou | 20.4 | 4.6 | 6.6 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 34 | Tangshan | 19.8 | 4.8 | 5.4 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 34 | Guiyang | 19.8 | 6.6 | 0 | 6.6 | 6.6 | 0 | 0 | 0 | 0 | 0 |
| 34 | Tongchuan | 19.8 | 6.6 | 0 | 6.6 | 6.6 | 0 | 0 | 0 | 0 | 0 |
| 37 | Tai'an | 19.2 | 6.4 | 0 | 6.4 | 6.4 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | Jingzhou | 19.2 | 6.4 | 0 | 6.4 | 6.4 | 0 | 0 | 0 | 0 | 0 |
| 37 | Shijiazhuang | 19.2 | 4.6 | 5.4 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 40 | Yichang | 18.6 | 6.2 | 0 | 6.2 | 6.2 | 0 | 0 | 0 | 0 | 0 |
| 40 | Baoding | 18.6 | 4.4 | 5.4 | 4.4 | 4.4 | 0 | 0 | 0 | 0 | 0 |
| 40 | Yancheng | 18.6 | 2 | 5.4 | 2 | 2 | 3.6 | 3.6 | 0 | 0 | 0 |
| 40 | Nanchang | 18.6 | 6.2 | 0 | 6.2 | 6.2 | 0 | 0 | 0 | 0 | 0 |
| 40 | Yantai | 18.6 | 6.2 | 0 | 6.2 | 6.2 | 0 | 0 | 0 | 0 | 0 |
| 45 | Linfen | 18.2 | 4 | 6.2 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| 46 | Huzhou | 18 | 3.8 | 6.6 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 46 | Anyang | 18 | 6 | 0 | 6 | 6 | 0 | 0 | 0 | 0 | 0 |
| 48 | Yangquan | 17.6 | 3.8 | 6.2 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 49 | Datong | 17.4 | 4 | 5.4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| 50 | Zhuzhou | 16.8 | 5.6 | 0 | 5.6 | 5.6 | 0 | 0 | 0 | 0 | 0 |
| 50 | Kunming | 16.8 | 5.6 | 0 | 5.6 | 5.6 | 0 | 0 | 0 | 0 | 0 |
| 50 | Baoji | 16.8 | 5.6 | 0 | 5.6 | 5.6 | 0 | 0 | 0 | 0 | 0 |
| 53 | Jiujiang | 16.2 | 5.4 | 0 | 5.4 | 5.4 | 0 | 0 | 0 | 0 | 0 |
| 53 | Qingdao | 16.2 | 5.4 | 0 | 5.4 | 5.4 | 0 | 0 | 0 | 0 | 0 |
| 53 | Shantou | 16.2 | 5.4 | 0 | 5.4 | 5.4 | 0 | 0 | 0 | 0 | 0 |
| 53 | Beihai | 16.2 | 5.4 | 0 | 5.4 | 5.4 | 0 | 0 | 0 | 0 | 0 |
| 57 | Changzhi | 15.8 | 3.2 | 6.2 | 3.2 | 3.2 | 0 | 0 | 0 | 0 | 0 |
| 58 | Quanzhou | 15.6 | 5.2 | 0 | 5.2 | 5.2 | 0 | 0 | 0 | 0 | 0 |
| 58 | Yibin | 15.6 | 5.2 | 0 | 5.2 | 5.2 | 0 | 0 | 0 | 0 | 0 |
| 58 | Shizuishan | 15.6 | 5.2 | 0 | 5.2 | 5.2 | 0 | 0 | 0 | 0 | 0 |
| 61 | Fuzhou | 15 | 5 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 0 |
| 61 | Yinchuan | 15 | 5 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 0 |
| 63 | Jinzhou | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Wuhu | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Kaifeng | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Luoyang | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Pingdingshan | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Changde | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Shaoguan | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Zhanjiang | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Liuzhou | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Lanzhou | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Xining | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 63 | Urumqi | 14.4 | 4.8 | 0 | 4.8 | 4.8 | 0 | 0 | 0 | 0 | 0 |
| 75 | Jinan | 13.8 | 4.6 | 0 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 75 | Zaozhuang | 13.8 | 4.6 | 0 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 75 | Zhengzhou | 13.8 | 4.6 | 0 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 75 | Changsha | 13.8 | 4.6 | 0 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 75 | Xiangtan | 13.8 | 4.6 | 0 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 75 | Yueyang | 13.8 | 4.6 | 0 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 75 | Guilin | 13.8 | 4.6 | 0 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |
| 75 | Jinchang | 13.8 | 4.6 | 0 | 4.6 | 4.6 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 83 | Handan | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Chifeng | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Shenyang | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Anshan | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Changchun | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Jilin | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Qiqihar | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Daqing | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Ma'anshan | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Zibo | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Zhangjiajie | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Panzhihua | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Luzhou | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Zunyi | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 83 | Karamay | 11.4 | 3.8 | 0 | 3.8 | 3.8 | 0 | 0 | 0 | 0 | 0 |
| 98 | Yan'an | 9.6 | 3.2 | 0 | 3.2 | 3.2 | 0 | 0 | 0 | 0 | 0 |
| 99 | Dalian | 9 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 99 | Mudanjiang | 9 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 99 | Mianyang | 9 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 102 | Hohhot | 8.4 | 2.8 | 0 | 2.8 | 2.8 | 0 | 0 | 0 | 0 | 0 |
| 103 | Baotou | 8.4 | 2.8 | 0 | 2.8 | 2.8 | 0 | 0 | 0 | 0 | 0 |
| 104 | Weihai | 7.2 | 2.4 | 0 | 2.4 | 2.4 | 0 | 0 | 0 | 0 | 0 |
| 105 | Qinhuangdao | 5.4 | 0 | 5.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 106 | Ordos | 4.2 | 1.4 | 0 | 1.4 | 1.4 | 0 | 0 | 0 | 0 | 0 |
| 106 | Jiaozuo | 4.2 | 1.4 | 0 | 1.4 | 1.4 | 0 | 0 | 0 | 0 | 0 |
| 108 | Benxi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 108 | Weifang | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 108 | Jining | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 108 | Rizhao | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 108 | Qujing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 108 | Jinchang | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Section 2. AQTI Results Explained

***1. Air quality information disclosure for some citie has now reached an intermediate level or higher.***

This AQTI evaluation showed the ten Chinese cities with the highest level of air quality information disclosure to be: Guangdong, Shenzhen, Dongguan, Zhongshan, Foshan, Zhuhai, Nanjing, Suzhou, and Ningbo.

They all scored more than 54 points, which compared with the previous AQTI's highest score of 38, shows that in a relatively short time these cities have made significant progress in air quality monitoring and publishing.

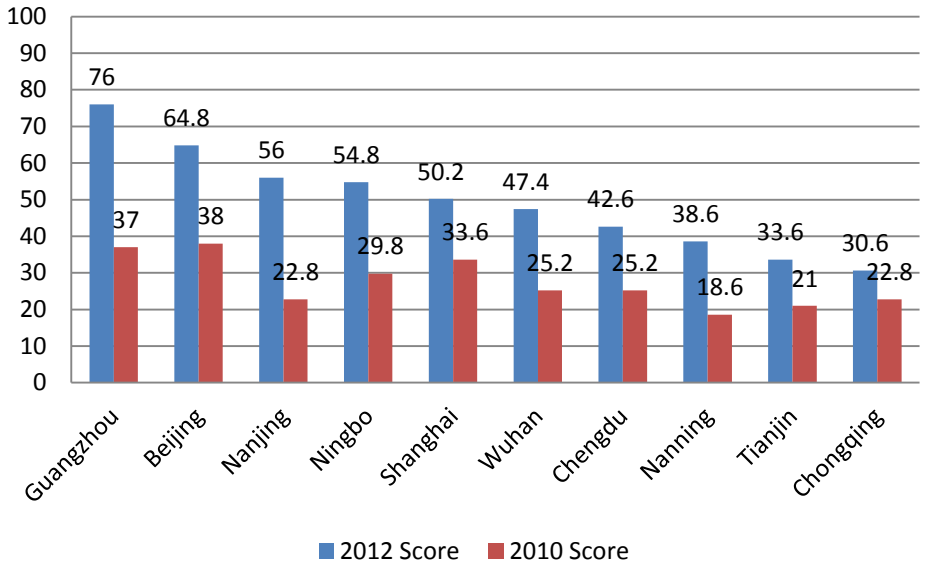
***2. Air quality information disclosure in a number of cities has substantially increased.***

Within a short period of time the average score for the 20 cities that were evaluated in the 2010 evaluation - 23 points - has now increased to 32.9 points. The scores for Guangzhou, Beijing, Nanjing, Ningbo, Shanghai, Wuhan, Chengdu, Nanning, Tianjin and Chongqing have all increased by more than 30% and Guangzhou, Nanjing and Nanning's points have all increased by more than 100%.

Table 1.3 Comparisons of points scores for 2012 and 2010

| City | 2012 AQTI Score | 2010 AQTI Score | Change in Score |
|---|---|---|---|
| Guangzhou | 76 | 37 | 39 |
| Beijing | 64.8 | 38 | 26.8 |
| Nanjing | 56 | 22.8 | 33.2 |
| Ningbo | 54.8 | 29.8 | 25 |
| Shanghai | 50.2 | 33.6 | 16.6 |
| Wuhan | 47.4 | 25.2 | 22.2 |
| Chengdu | 42.6 | 25.2 | 17.4 |
| Nanning | 38.6 | 18.6 | 20 |
| Tianjin | 33.6 | 21 | 12.6 |
| Chongqing | 30.6 | 22.8 | 7.8 |
| Guiyang | 19.8 | 21.6 | -1.8 |
| Nanchang | 18.6 | 18.6 | 0 |
| Kunming | 16.8 | 18.6 | -1.8 |
| Fuzhou | 15 | 18.8 | -3.8 |
| Urumqi | 14.4 | 15 | -0.6 |
| Lanzhou | 14.4 | 16.2 | -1.8 |
| Zhengzhou | 13.8 | 16.2 | -2.4 |
| Changsha | 13.8 | 17.4 | -3.6 |
| Dalian | 9 | 18.6 | -9.6 |
| Hohhot | 8.4 | 18 | -9.6 |

Figure 1.3. Comparison of 2010 and 2012 AQTI points scores




- Reduction in the disparity between Chinese and international levels of disclosure

The situation in cities like Paris, Los Angeles, New York, London, Vienna, Berlin and Moscow has remained more or less stable. For this reason we have not repeated an evaluation and will use their 2011 evaluation scores.

In line with the expansion in pollution monitoring on the Chinese mainland, on March 3, 2012, Hong Kong also started to publish real-time $PM_{2.5}$ data from 14 monitoring stations.

New Delhi has continued to use and continuously publish results from the Air Quality Weather Forecasting and Research System that was developed for the 2010 Commonwealth Games. On the official website the public can see minute by minute AQI data on $NO_2$, $O_3$, CO, $PM_{2.5}$ and $PM_{10}$ from ten monitoring stations in New Delhi.[3] This information can also be seen on 17 outdoor display screens on streets throughout the city. The New Delhi air quality system uses google earth[4] and publishes complete city data every day at 06:00 for the next 48 hours predicitng changes in TRCF, $SO_2$, $PM_{2.5,}$ $PM_{10\text{-bio,}}$ $PM_{10}$, $O_3$, $NO_x$, $NO_2$, and CO. However, New Delhi's publishing of daily air quality data has taken a step back. India's Central Pollution Control Board, (CPCB) website[5] publishes New Delhi's "real time air quality status[6]" but there is a serious time lag. On August 20, 2012 at 7 o'clock local time, four monitoring stations still showed data from August 17, 2012, as well as data from May 26, 2012, January 12, 2012, and July 1, 2011; the majority of the data also said "N/A" (data not available).

Mexico City has made rapid progress. On their air quality monitoring system, Sistema de Monitoreo Atmosférico, (SIMAT) website,[7] they not only have major pollution and IMECA (Índice Metropolitano de la Calidad del Aire/AQI) values for individual monitoring sites, urban areas and the whole of Mexico city, they also have 22 hour $O_{3,}$ $NO_2$, $SO_2$, CO, $PM_{10}$ IMECA values and charts showing changes and trends in $O_3$. They have also added monitoring site data for $O_3$, CO, $SO_{2,}$ $NO_2$, PM10, $PM_{2.5}$ and $PM_{10\text{-}2.5}$ concentrations and a chart showing changes in $PM_{10.}$

[3] http://safar.tropmet.res.in/
[4] http://80.70.33.178/site_02_2010/index.php?Site=Inde
[5] http://www.cpcb.nic.in/air.php
[6] http://164.100.43.188/cpcbnew/movie.html
[7] http://www.calidadaire.df.gob.mx/calidadaire/index.php

Out of the ten international cities that were evaluated in the 2010 AQTI, Paris had the highest score with 89.2 points, New Delhi scored the lowest with 37.6 and the average score was 72.7. Out of the 20 Chinese cities that were evaluated, Beijing had the highest points with 38 and Urumqi the lowest with 15 points. The average score was only 27.4 points, 45.3 points less than the score for the ten international cities. During the 2012 AQTI it was discovered that domestic cities showed a marked improvement. The top ten cities had an average score of 49.5 points. This was 24.6 points less than the international average but did show a reduction in the disparity compared with the previous AQTI evaluation.

Figure 1.4. Comparison of AQTI scores for domestic and international cities


***3. A number of the cities that were evaluated made progress in aspects of systematic disclosure, timeliness, comprehensiveness and user friendliness***

- **A number of important pollutants have been brought into the scope of disclosure**

  - $PM_{2.5}$

During the 2010 AQTI evaluation it was discovered that there was an obvious omission in the atmospheric pollutant monitoring index. At that time, fine particulate matter ($PM_{2.5}$) had not been brought into the scope of monitoring and publication, and on a national level, there were no cities that carried out disclosure of $PM_{2.5}$ information. Moving forward however, according to information published by local Environmental Protection Bureaus and monitoring stations, as of August 31, 2012, 55 prefecture-level cities nationwide had published $PM_{2.5}$ information for 192 different monitoring sites.

Figure 1.5 Cities that have started monitoring and publishing $PM_{2.5}$


- **Ozone**

In the 2010 AQTI evaluation it was discovered that just Guangdong province included ozone in their daily air quality monitoring. More recently however, according to information published by local EPBs and monitoring stations, as of August 31, 2012, 25 prefecture level cities nationwide had published ozone information for 104 monitoring sites.

- **Carbon Monoxide**

In the 2010 AQTI evaluation of cities, it was found that only Beijing published carbon monoxide monitoring results, and moreover, it is only in the annual report that they publish daily and annual average values. More recently however, according to information published by local EPBs and monitoring stations, as of August 31, 2012, 24 prefecture level cities nationwide had published carbon monoxide information for 96 monitoring sites.

- **Volatile Organic Compounds**

VOCs were not included on the list of pollutants required to be monitored and published as stipulated in the new "Ambient Air Quality Standards". Apart from Ningbo, which publishes information on VOCs in their annual environmental report, only Jiaxing has started VOC monitoring and publishing. Jiaxing's economic and technological development zone is situated in the northern part of the region and contains a large concentration of industrial enterprises. For this reason industrial waste gas pollution is a constant problem for local communities and also difficult for the government to manage. As part of control measures for atmospheric pollution, Jiaxing Municipal EPB chose to put monitoring equipment on the east side of Muhu Forestry Park. They placed the equipment in a spot between three large scale manufacturing sites: Hantai Tyres, Hexin Industrial and Xiaoxing Synthetic Fibres and two residential areas: Zixi Garden and Hecheng Century Garden.[8] They carried out monitoring of 48 pollutants according to characteristics of production at the companies in the city's northern area. This included the monitoring of routine indexes, malodorous substances and volatile organic compounds.

[8] First Publication of the Chengbei Atmospheric Pollution Automatic Monitoring Station Report, Nanhu Wanbao, 2012-5-8, http://www.jx3721.cn/jxnews/xinwen/490.html

This was done in order to increase the fundamentals of pollution control. They began to publish data on the Jiaxing EPB's website on April 30, 2012, as a "Northern Municipal Area Atmospheric Pollutant Automatic Monitoring Station Weekly Monitoring Report."[9]

- **Site-specific data disclosure at high frequencies is becoming the new norm**

In addition to findings pointing to pollutants that were omitted from monitoring, the 2010 AQTI evaluation of Chinese cities also showed three other big differences with regards to air quality information disclosure:

- Cities only published air pollution index data, but commonly did not publish detailed pollutant type monitoring data.
- They did not publish detailed air quality data from monitoring sites.
- There was a lack of real time data disclosure.

The 2012 AQTI evaluation confirmed that many cities made large breakthroughs in systematic disclosure, timeliness, comprehensiveness and user friendliness.

- Systematic Disclosure: average values not only published for the whole city. Out of the 113 cities evaluated, 63 published air quality information for each county or district or for one or more monitoring sites.

- Timeliness: 45 cities released hourly $PM_{2.5}$ data reports from one or more monitoring sites (altogether 164 sites) within their jurisdiction. 25 cities released hourly and 8 hour average values for ozone from one or more monitoring sites in their area of jurisdiction (with a total of 96 sites). 24 cities released hourly carbon monoxide data reports from one or more monitoring sites in their area of jurisdiction (with a total of 95 sites). 14 cities also released $PM_{10,}$ $SO_2$ and $NO_2$ hourly data reports from one or more monitoring sites in their area of jurisdiction.

- Comprehensiveness: 14 cities not only published a pollution index but also published detailed concentration values for $PM_{10}$, $SO_2$ and $NO_2$ on the websites of local EPBs and environmental monitoring centers. These cities were Beijing, Shanghai, Guangdong, Shenzhen, Dongguan, Zhongshan, Foshan, Zhuhai, Nanjing, Suzhou, Nantong, Changzhou, Ningbo, and Tai'an. However the four cities of Nanjing, Tianjin, Hefei and Chongqing linked from local EPB homepages to the China National Environmental Monitoring Center's real time monitoring system. Detailed values for the newly added indexes of $PM_{2.5}$, $O_3$ and CO concentration make up the basis of the data in all of the locations.

[9] http://www.jepb.gov.cn/News/9/f4906fbdb29a8f513237c498afa22e4a55bf9556.html

Table 1.4 Table 1.4 Summary of monitoring in each region for newly added pollutants

| Rank | Province or Municipality | City | Time of Publication | $PM_{2.5}$ | | $O_3$ | | CO | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Number of Monitoring Sites | Frequency of Publication | No. of Monitoring Sites | Frequency of Publication | No. of Monitoring Sites | Frequency of Publication |
| 1 | Beijing | Beijing | PM2.5: 2012.1.21 O3/CO: 2012.5.12 | 1[10] | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 2 | Tianjin | Tianjin | 2012.4.28 | 4 | Monthly | None | NA | None | NA |
| 3 | Hebei | Shijiazhuang | 2012.6.1 | 2 | Hourly | None | NA | None | NA |
| 4 | | Tangshan | 2012.6.1 | 1 | Hourly | None | NA | None | NA |
| 5 | | Qinhuangdao | 2012.6.1 | 1 | Hourly | None | NA | None | NA |
| 6 | | Baoding | 2012.6.1 | 1 | Hourly | None | NA | None | NA |
| 7 | | Zhangjiakou | 2012.6.1 | 1 | Hourly | None | NA | None | NA |
| 8 | | Chengde | 2012.6.1 | 1 | Hourly | None | NA | None | NA |
| 9 | | Langfang | 2012.6.1 | 1 | Hourly | None | NA | None | NA |
| 10 | Shanxi | Taiyuan | 2012.6.5 | 8 | Hourly | None | NA | None | NA |
| 11 | | Datong | 2012.6.5 | 2 | Hourly | None | NA | None | NA |
| 12 | | Yangquan | 2012.6.5 | 6 | Hourly | None | NA | None | NA |
| 13 | | Changzhi | 2012.6.5 | 5 | Hourly | None | NA | None | NA |
| 14 | | Linfen | 2012.6.5 | 6 | Hourly | None | NA | None | NA |
| 15 | | Jinzhong | 2012.6.5 | 4 | Hourly | None | NA | None | NA |
| 16 | | Jincheng | 2012.6.5 | 5 | Hourly | None | NA | None | NA |
| 17 | | Luliang | 2012.6.5 | 3 | Hourly | None | NA | None | NA |
| 18 | | Shuozhou | 2012.6.5 | 5 | Hourly | None | NA | None | NA |
| 19 | | Xinzhou | 2012.6.5 | 3 | Hourly | None | NA | None | NA |
| 20 | | Yuncheng | 2012.6.5 | 2 | Hourly | None | NA | None | NA |
| 21 | Shanghai | Shanghai | 2012.3.9 two sites; 2012.6.28 ten sites | 10 | Hourly | None | NA | None | NA |
| 22 | Jiangsu | Nanjing | Provincial: 2012.4.1, Municipal: 2012.7.1 | 3 | Hourly | 3 | Hourly, 8 hourly | 3 | Hourly |
| 23 | | Wuxi | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 24 | | Xuzhou | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |

[10] Since October 6 2012 the number of monitoring sites in Beijing has risen to 35.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 25 | | Changzhou | Provincial: 2012.4.1，Municipal: 2012.6.21 | 3 | Hourly | 3 | Hourly, 8 hourly | 3 | Hourly |
| 26 | | Suzhou | Prvincial: 2012.4.1，Municipal: 2012.3.37 | 3 | Hourly | 3 | Hourly, 8 hourly | 3 | Hourly |
| 27 | | Nantong | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 28 | | Lianyungang | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 29 | | Yangzhou | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 30 | | Yancheng | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 31 | | Huaian | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 32 | | Zhenjiang | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 33 | | Taizhou | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 34 | | Suqian | Provincial: 2012.4.1 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Hourly |
| 35 | Zhejiang | Hangzhou | 2012.3.25, 6.3 increased to 2 sites | 3 | Daily | None | NA | None | NA |
| 36 | | Ningbo | 2012.3.25, 6.3 increased to 2 sites | 5 | Daily | None | NA | None | NA |
| 37 | | Wenzhou | 2012.3.25 | 1 | Daily | None | NA | None | NA |
| 38 | | Jiaxing | 2012.3.25 | 1 | Daily | None | NA | None | NA |
| 39 | | Huzhou | 2012.3.25 | 1 | Daily | None | NA | None | NA |
| 40 | | Shaoxing | 2012.3.25 | 1 | Daily | None | NA | None | NA |
| 41 | | Zhoushan | 2012.3.25 | 1 | Daily | None | NA | None | NA |
| 42 | | Jinhua | 2012.6.3 | 1 | Daily | None | NA | None | NA |
| 43 | Fujian | Xiamen | 2012.3.1 | 3 | Daily | None | Daily | None | NA |
| 44 | Hubei | Wuhan | 2012.5.25 | 1 | Hourly | None | NA | None | NA |
| 45 | Guangdong | Guangzhou | 2012.5.2 | 10 | Hourly | 10 | Hourly, 8 hourly | 10 | Hourly |
| | | | 2012.3.8 | 13 | Hourly | 13 | Hourly, 8 hourly | 13 | Hourly |
| 46 | | Shenzhen | 2012.3.8 | 8 | Hourly | 8 | Hourly, 8 hourly | 8 | Hourly |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2012.3.8 | 19 | Hourly | 19 | Hourly, 8 hourly | 19 | Hourly |
| 47 | | Zhuhai | 2012.3.8 | 4 | Hourly | 4 | Hourly, 8 hourly | 4 | Hourly |
| 48 | | Foshan | 2012.3.8 | 10 | Hourly | 10 | Hourly, 8 hourly | 10 | Hourly |
| 49 | | Zhongshan | 2012.3.8 | 4 | Hourly | 4 | Hourly, 8 hourly | 4 | Hourly |
| 50 | | Dongguan | 2012.3.8 | 5 | Hourly | 5 | Hourly, 8 hourly | 5 | Hourly |
| | | | 2012.3.27 | 7 | Hourly | 7 | Hourly, 8 hourly | 7 | Hourly |
| 51 | | Jiangmen | 2012.3.8 | 7 | Hourly | 7 | Hourly, 8 hourly | 7 | Hourly |
| 52 | | Zhaoqing | 2012.3.8 | 4 | Hourly | 4 | Hourly, 8 hourly | 4 | Hourly |
| 53 | | Huizhou | 2012.3.8 | 7 | Hourly | 7 | Hourly, 8 hourly | 7 | Hourly |
| 54 | Sichuan | Chengdu | 2012.3.30 | 1 | Hourly | 1 | Hourly, 8 hourly | 1 | Daily |
| 55 | Shaanxi | XI'an | 2012.7.1 | 7 | Daily | None | NA | None | NA |

## Case Study: Beijing

Since January 1, 2012, the city of Beijing has published trial $PM_{2.5}$ data on the Environmental Monitoring Center's website from one monitoring site at the Environmental Monitoring Center's observation laboratory, making it the first city to publish $PM_{2.5}$ data.

In September 2012, the Beijing municipal EPB published a plan on Weibo for Beijing's $PM_{2.5}$ monitoring sites. The plan showed that Beijing would be upgrading the 27 current monitoring stations, including three environmental evaluation sites, one citywide comparison site, and three regional background transmition sites so that they had the ability to measure $PM_{2.5}$. They would also add five transportation pollution monitoring and control sites and three area background transmitter sites. In this way, the number of $PM_{2.5}$ monitoring sites in Beijing would increase to 35 and made it the city in China with the greatest number of $PM_{2.5}$ monitoring sites. On September 28, 2012, the new Beijing Environmental Monitoring Center Website started publishing real time $PM_{2.5}$ data from the first set of 20 monitoring sites that had been tested.[11] Since October 6th, real time monitoring data from a further 15 monitoring sites has been released through the Beijing Municipal Environmental Protection Monitoring Center Air Quality Publication Platform: http://www.bjmemc.com.cn/g356.aspx.[12]

[11] These 20 monitoring sites and stations were in: Dongcheng Dongsi, Dongcheng Tiantan, Xicheng Guanyuan, Xicheng Wanshou Xigong, Chaoyang Olympic Center, Chaoyang Agricultural Exhibition Center, HaidianWanliu, Fengtai Huayuan, Shijingshan Gucheng, Fangshan Liangxiang, Daxing Huangcun Zhen, Yizhuang Development Zone, Tongzhou Xincheng, Shunyi Xincheng, Changping Zhen, Mentougou Longquan Zhen, Pinggu Zhen, Huairou Zhen, Miyun Zhen and Yanqing Zhen.

[12] These 15 sites and stations were: City Environmental Evaluation Sites: Haidian Beibu Xinqu, Haidian Beijing Botanical Gardens, Fengtai Yungang; City Comparison Sites: Changping Dingling; Transportation Pollution Control and Monitoring Sites: Qianmen Dongda Jie,Yongdingmen Neidajie, Xizhimen Beidajie, South 3rd Ring Road Xilu, Dongsi Huangbeilu; background monitoring sites: Northwest Beijing Badaling, Northeast Beijing Miyun Reservoir, Eastern Beijing Donggaocun, Southeast Beijing Yongledian, South Beijing Yufa and Southwest Beijing Liuli He.

Figure 1.6 Map showing beijing $PM_{2.5}$ monitoring stations and sites[13]

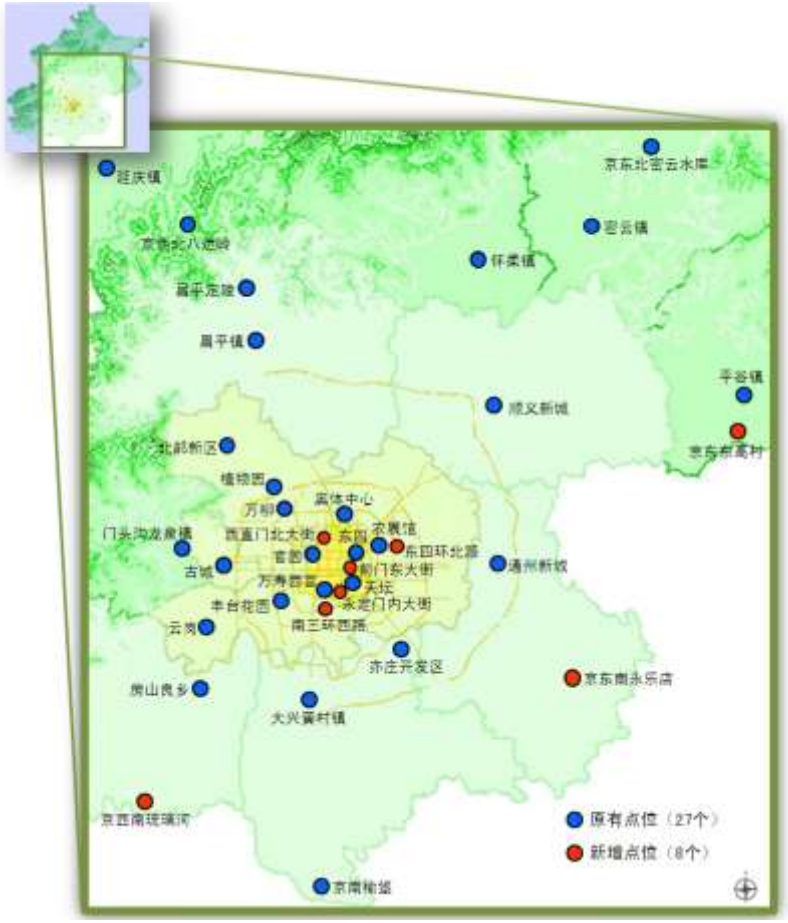



Figure 1.7 Graph showing real time data from beijing's "Shunyi Newtown" monitoring site[14]

[13] Beijing EPB Monitoring Center, http://www.bjmemc.com.cn/g327/s968/t1293.asp. Accessed September 29, 2012.

[14] Beijing EPB monitoring center, http://www.bjmemc.com.cn/g356.aspx, accessed October 12, 2012.

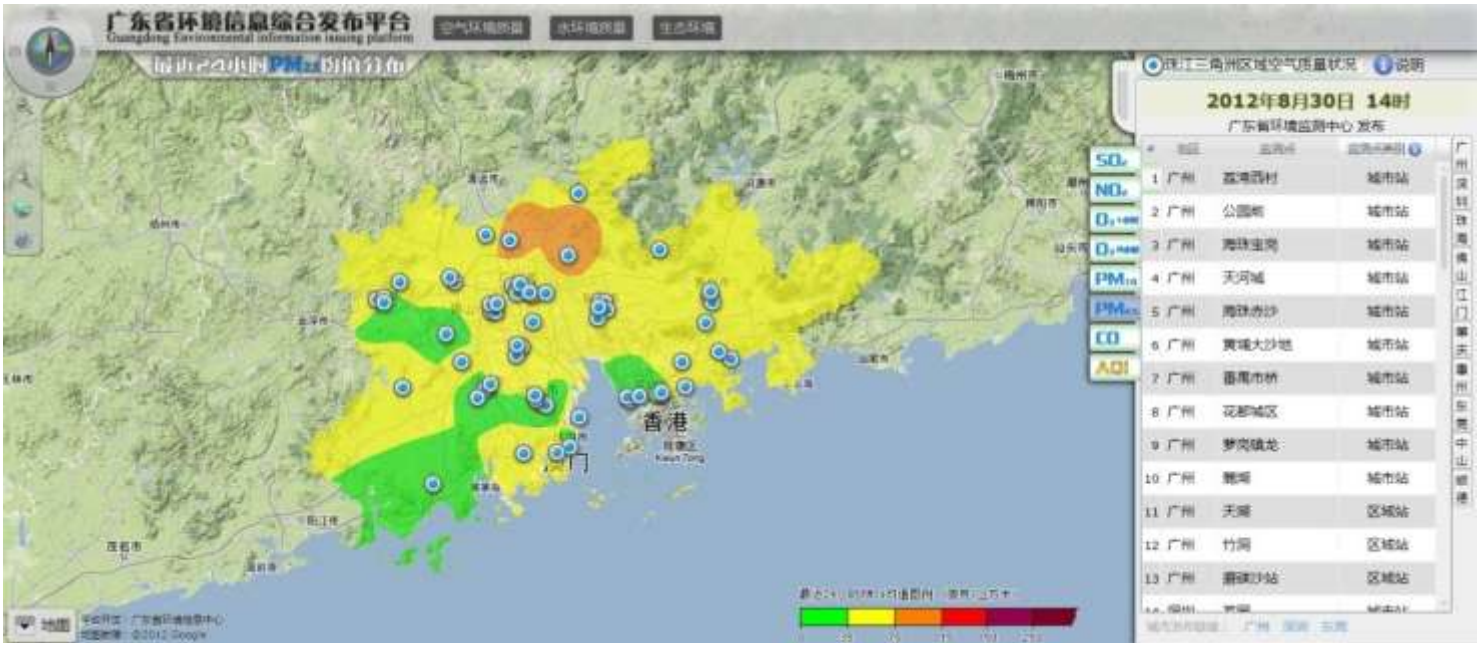
- **Publishing methods are more user friendly**

In the 2010 AQTI evaluation it was discovered that information from the daily air quality reports from the ten international cities were basically all displayed in map format. However, for the 20 domestic cities, apart from Shanghai, Beijing, Guangzhou and Wuhan, which all display air quality information on a map, the others only published data, which does not make for an intuitive or visual user experience.

In this evaluation we saw that many provinces and cities have started to use digital maps to publish air quality information. Of note are the pollution maps used by Guangdong Province, Beijing Municipality, Jiangsu Province, and Shanghai Municipality.

- Integrating Electronic Maps

Figure 1.8 Guangdong Province environmental information comprehensive publishing platform[15]




The Guangdong Province Environmental Information Publishing Platform is comprehensive and has a clear layout. Guangzhou, Dongguan, Zhuhai, Foshan, and Zhongshan all have city evel real time air quality disclosure systems and good visual interfaces where users can select individual indexes, instantly see the most recent hourly average value, the most recent 24 hour average value, and 8 hour average concentration values. Guangzhou, Shenzhen and Zhongshan publish concentration levels and quality index simultaneously. Guangdong has taken the lead in bringing data for $PM_{2.5}$, $O_3$ and CO into the scope of environmental air quality index calculations. They have a comprehensive evaluation of air quality and use different colors to show the air quality status in different areas and clearly indicate the “health impacts status” and “measures to be adopted”.

[15] Guangdong EPB http://www-app.gdepb.gov.cn/EQpubplatform/Default.aspx#AirQualityPM25Widget.AirQualityPM25Page,AirQualityPM25Widget2, Accessed August 30, 2012).

Figure 1.9. Shanghai municipal real time air quality publishing system[16]


Shanghai's real-time air quality publishing system, the "Shanghai City District Air Quality Daily Report," releases daily air quality reports for 17 county areas administered by Shanghai. The "Shanghai Air Quality Monitoring Stations and Site" publishes real-time air quality information for monitoring stations and sites; this includes real-time concentrations for $PM_{10}$, $SO_2$, and $NO_2$ from ten state-controlled sites (updated hourly) and a graph showing concentration values for the previous 24 hours. The "Shanghai Municipal $PM_{2.5}$ Test Site Data" publishes real time $PM_{2.5}$ values (updated every hour) and a graph of concentration values for the previous 24 hours from ten state-controlled sites.

- Publishing on Weibo

Apart from the municipal EPBs, monitoring center websites and specialist air quality information platforms, some cities, including Beijing, Shanghai, Guangdong, Shenzhen, Dongguan, Nanjing, Suzhou, Jiaxing, Fuzhou, Yinchuan, Yichang, Fushun and Wuhan also use Weibo to publish their daily air quality reports. Amongst these, Guangzhou, Shenzhen, Dongguan, Jiaxing, Shanghai, Suzhou, and Wuhan also use Weibo to publish $PM_{2.5}$ information.

[16] Shanghai EPB Monitoring Center, http://202.136.217.188:9090/ssfb/, accessed August 30, 2012.

Figure 1.10 $PM_{2.5}$ monitoring data published through the Wuhan EPB's official Sina Weibo account[17]


### *4. Many cities still have very low AQTI scores*

Air quality information disclosure has made definite progress and some areas have made striking advancements. However the average score for the 113 cities that were evaluated was still only 21.5 points. The reason for this is that air quality information disclosure is still at a very low level in many areas and this reduced the overall average scores. The average score for the top 20 cities was 52.8 points while the average for the bottom 20 cities was only six points, a difference of 46.8 points. Looking at these figures a polarization in the levels of information disclosure in different cities is very obvious.

The cities that performed relatively poorly heavily outnumbered those cities that performed reasonably well. 89 cities out of the 113 cities that were evaluated had scores below 30 points. 80 cities did not even reach a score of 20 points and 64 cities, 56.6% of the total number of cities that were evaluated, had a score of only ten to 20 points. 16 cities had a score of less than ten points, accounting for 14.2% of the total number of cities that were evaluated; however these 16 cities also included Benxi, Weifang, Jining, Rizhao, Qujing, and Jinchang and these cities all scored zero points.[18] On the EPB websites for these six cities, users cannot see current daily air quality grades, pollution index or pollutant concentration information. They also do not promptly publish periodic statistical data such as monthly, quarterly or annual air quality reports.

Ten cities in Shandong had scores below the average. These cities have low scores because there is a large gap in their systematic disclosure, timeliness, comprehensiveness and user friendliness.

[17] Sina Weibo, http://weibo.com/whepb, accessed August 30, 2012.

[18] Rizhao has a forecast.

# Section 3. Legislation on Air Quality Information Disclosure in China is Improving

### *1. History behind China's Air Quality Standard*

- 1982: China's first ambient air quality standard formulated and implemented
  It was mainly aimed at managing atmospheric pollutants from coal smoke. The regulation was for the concentration value for total suspended particles (TSP, namely particles over 100 microns in diameter).
- 1996: first revision of the ambient air quality standard
  The names of pollutants were revised, analysis of monitoring was updated, and respirable particulate matter with a diameter of 10 microns, commonly referred to as $PM_{10}$, was brought into the scope of monitored data.

- 2000: Second revision of the ambient air quality standard - released the "Ambient Air Quality Standard" (GB3095-1196) Revision.

Content revised:

a.) Removed the nitrogen oxide ($NO_x$) standard.

b.) Nitrogen dioxide ($NO_2$) [19]

i. The level II annual concentration limit value of 0.04mg/$m^3$ was changed to 0.08mg/$m^3$;

ii. The level II daily average concentration limit value of 0.08mg/$m^3$ was changed to 0.12mg/$m^3$;

iii. The level II hourly average concentration limit value of 0.12mg/$m^3$ was changed to 0.24mg/$m^3$;

c.) Ozone ($O_3$)

iv. The level I hourly average concentration limit value of 0.12mg/$m^3$ was changed to 0.16mg/$m^3$;

v. The level II hourly average concentration limit value of 0.16mg/$m^3$ was changed to 0.20mg/$m^3$;

On February 29th, 2012: the third revision of the "Ambient Air Quality Standard" (GB3095-1996) was released. Values for fine particles ($PM_{2.5}$ – particles with a diameter of 2.5μm or less) were added as well as 8 hour average concentration values for ozone. The name was also changed from API to AQI.

### *2. The reasons for the most recent revisions to the standard and the process through which the changes came about.*

- The first consultative draft of the regulations did not include $PM_{2.5}$ within the scope of pollutants that were to be monitored and published.

Since the 1980s the main atmospheric particle pollutants that make up $PM_{2.5}$ have come to replace those primary pollutants such as sulfur dioxide, nitrogen dioxide and $PM_{10}$ particulates. This was first seen in economically developed areas such as the Pearl River Delta in the form of hazy days. Following rapid economic expansion and urbanization, hazy days in the Yangtze River Delta, as well as the Beijing, Tianjin and Tangshan

[19] In the year 2000 amendment to the "Ambient Air Quality Standard" the level II standard for nitrogen dioxide was relaxed. In an article titled "Comparison of Air Quality Standards in China and Abroad" from March 2010, Wang Zongshuang from the Chinese Resaerch Academy of Environmental Science compared the concentrations for nitrogen dioxide in standards in China and abroad. Other than the WHO, the one hour International standard concentration values for $NO_2$ were all between 90-850 μg/$m^3$, daily average values were between 60-200 μg/$m^3$ and annual average values were between 30-100μg/$m^3$. The daily average values and yearly average values for China's level I standard were higher than Switzerland and Austria respectively but were stricter than all other countries. Concentration values for level II and level III standards were at middling to strict levels.

areas have become increasingly frequent.[20]

## In 2008 the Ministry of Environmental Protection issued revisions to the Ambient Air Quality Standards (GB3095 - 1996).

> "Currently in China both TSP and $PM_{10}$ levels are relatively high and the pollution problems associated with these two pollutants have yet to be resolved. $PM_{2.5}$ pollution in China is also very serious; in 2008, 113 key cities throughout China had average annual values that were well above WHO guideline levels and only two cities had average annual values that were within the Interim Target -2 standard. If $PM_{2.5}$ Ambient Air Quality Standards were drawn up and implemented then there would be widespread breaches of the standards. China has still not started the work of monitoring $PM_{2.5}$ and lacks monitoring bases. Therefore, it is still relatively early to be formulating and implementing national $PM_{2.5}$ ambient air quality standards."
>
> "These revisions to the standard recommend that the People's Government, on a provincial basis, formulate and implement local $PM_{2.5}$ Ambient Air Quality Standards. Once national TSP and $PM_{10}$ levels have been significantly reduced and the time is right for national $PM_{2.5}$ pollution control measures then $PM_{2.5}$ Ambient Air Quality Standards should be formulated and implemented. However, in order to satisfy the requirements for new forms of ambient air quality management, this revision will consider $PM_{2.5}$ and will include non-legally binding reference values for some areas of the country in order to promote the monitoring of $PM_{2.5}$."[21]

- Many hazy days causes heated debate amongst the general public

Between September and December 2011, China's Eastern regions suffered more than 10 instances when smoggy weather occurred. Continuous smoggy weather, which even had an effect on residents' normal life and work, drew large scale media attention.

Figure 1.11 Reports from different regions that have experienced smoggy days[22]


[20] "PM2.5" The Whole Story, Southern Metropolis Daily, March 5th, 2012.

[21] "Ambient Air Quality Standard" Draft Feedback Explanation, "Air Quality Standard" Working Group, November 2010.

[22] Many Cities in China Suffer Smoggy Days: Thick Fog locksdown Cities, Where is the $PM_{2.5}$ coming from, December 23rd, 2011.

However, the monitoring data released by the Environmental Protection Bureaus were often based on the Air Quality Standards from the year 2000 which meant they used the description "Slightly Polluted". The difference between this description and what the general public was witnessing was very obvious.

At the same time, a number of well known bloggers on Weibo started to re-tweet daily real-time $PM_{2.5}$ information from the Embassy of the United States in Beijing which showed that on October 30th at 12 o'clock, the $PM_{2.5}$ value was monitored to be 387 $\mu g/m^3$ and the air quality was "Hazardous". By 6 o'clock on the morning of October 31st, this value had gone down to 307 but the air quality was still rated as "Hazardous". On smoggy days Zheng Yuanjie's Weibo avatar would often be wearing a mask.[23]

Figure 1.12 Pan Shiyi was invited by the Deputy Head of the Beijing EPB, Du Shaozhong, to see the Beijing Environmental Monitoring Centre[24]

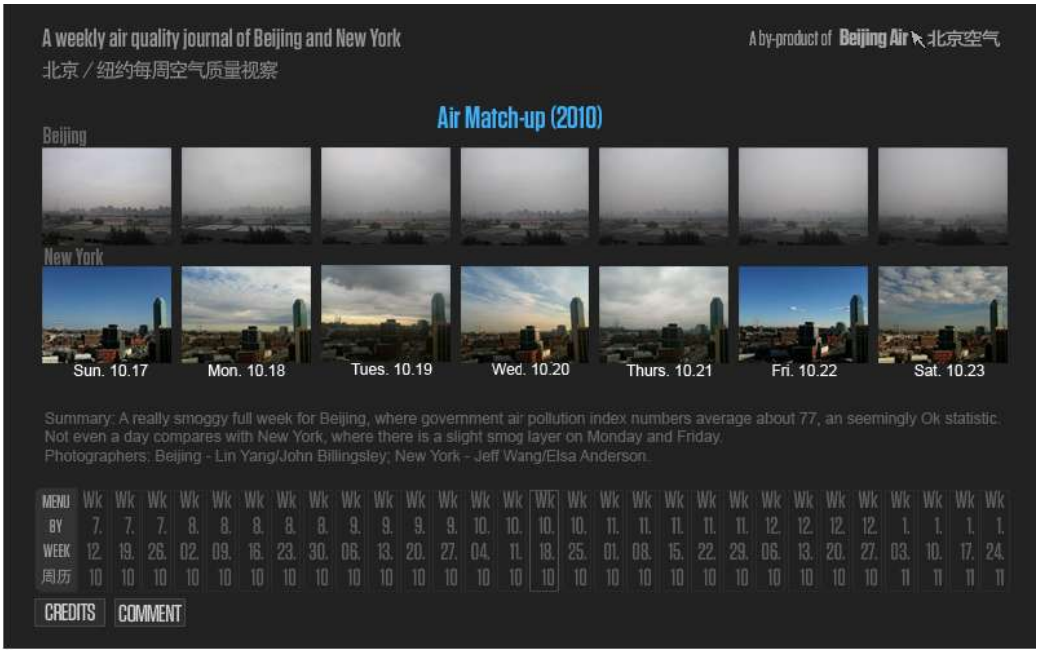

Photographer Wang Yikun started to post pictures of the CBD (taken from a fixed position) online every day. On December 5th, the Respiratory Department of the China Civil Aviation General Hospital saw a 30% increase in their number of patients compared with normal. More and more ordinary people, NGOs and media started to pay greater attention to $PM_{2.5}$ data.[25] Some environmental groups and individuals even took to the streets to monitor $PM_{2.5}$.[26]

Figure 1.13 Series of photographs of Beijing by Wang Yikun - December 2nd 2011- December 5th 2011


[23] Beijing – Smoggy City – Shihua, November 1st, 2012.
[24] Pan Shiyi's Weibo
[25] Fog in the Capital, China Newsweek Magazine, December 16th, 2011.
[26] "PM2.5" The Whole Story, Southern Metropolis Daily, March 5th, 2012.

Since March 2007, China Green has been taking a picture of the sky in Beijing every day. Since July 12th, 2012, they have been posting a comparison of the air quality in New York and Beijing every week and posting the most recent week of comparisons on the front page of China Green.

Figure 1.14 Comparison of air quality in Beijing and New York- 10-17-2010 – 10-23-2010[27]




## Case Study: "Monitoring Air for the Motherland"

Green Beagle started a movement that mobilized a large number of volunteers. When no official data was released for certain air pollutants, NGOs bought simple measuring devices. After monitoring the situation they posted the results on the internet. Green Beagle started doing this in October 2011 but does not regularly do monitoring and publish the results. On March 25th, 2012, they obtained $PM_{2.5}$ data by using an LD-6S monitoring device at five points along Beijing's Kunyu River. They then posted these results on their website.

Environmental groups and individuals from all over China joined in and some groups raised money on the internet in order to buy monitoring equipment and then released results on the internet through Weibo. This movement has had a positive role in promoting government departments to disclose environmental information.

"Wuling Laochao" from the Wuhan branch of Friends of Nature started movements on Weibo called "Finding the Best Air Zone" and "Wuhan Air Diary". They used a Chinaway CW-HAT200 monitoring device to monitor $PM_{2.5}$ and then uploaded the results onto the internet in real time. Wuling Laochao publishes $PM_{2.5}$ data every day, in the morning or the afternoon, at least once a day.

[27] China Green Website, http://sites.asiasociety.org/chinagreen/feature-air-matchup, October 19th, 2012.

Figure 1.15 “Wuling Laochao’s” “Wuhan Air Diary”[28]


These announcements have cought the attention of the government. On March 6th, 2012 the Wuhan Wuchang District Environmental Protection Bureau paid a special visit to the Wuhan branch of Friends of Nature to discuss together how best to involve environmental NGOs in the process of improving Wuhan’s ambient air quality policies. The Wuhan branch of Friends of Nature explained that they had raised some money to buy hand held monitoring devices and had then started the monitoring campaign. The representative from Wucheng Duistrict environmental Protection Bureau stated that they would be willing to provide support with the monitoring technology.

Since April 2012, Friends of nature’s Henan branch has been monitoring $PM_{2.5}$ in Zhengzhou and posting daily results on Weibo.[29]

Figure 1.16 Friends of Nature Wuhan Branch release $PM_{2.5}$ monitoring data through Weibo[30]


[28] http://weibo.com/shanzhongqiao, accessed on October 16, 2012.
[29] Records from Weibo show that it is not continuous daily data.
[30] Sina Weibo, http://weibo.com/thegreenark, accessed October 13th, 2012.

During periods of continuous smoggy days, large amounts of related information were forwarded using social media like Weibo. This caused heated debate amongst netizens and also made the mainstream media pay closer attention. In the space of just a few months, $PM_{2.5}$ had gone from a technical term to a household word.

After a couple of months of heated debate on social media, such as Weibo, and also traditional media, the general public understood that $PM_{2.5}$ well over guideline limits not only produces smoggy weather but also penetrates deep into the lungs and has a serious impact on people's health. At the same time they also understood that the API used in China only takes into consideration $PM_{10}$, sulfur dioxide and nitrogen dioxide and does not include $PM_{2.5}$.

In cities such as Beijing where there have been continuous periods of smoggy days, the general public has shown that there is a strong desire for information disclosure by using Weibo and making requests for official data.

- Listening to public opinion, the MEP decided to include $PM_{2.5}$ as one of the pollutants for which to routinely monitor and publish results for.

In November 2011, the MEP released the "Ambient Air Quality Standard" Draft Version in which they decided to include $PM_{2.5}$ as one of the routinely monitored and published pollutants.

The explanation stated that:

> "Because there is a close relationship between $PM_{2.5}$, people's health and visibility, in developed countries and regions it has already become a pollutant that is routinely controlled. In the long term it should also be one of the main focuses for environmental management in China and should be included as an item in the standard. However, at present in China $PM_{2.5}$ pollution problems are fairly prominent, in cities and areas such as Beijing, Tianjin, and Hebei; the Yangtze River Delta; Pearl River Delta areas; the Shandong Peninsula; Liaoning; the central southern regions; the central plains of China; the middle reaches of the Yangtze River (Wuhan City Circle); the west coast of the Taiwan Strait and Chongqing in Sichuan. Relevant national policies also require that the aforementioned areas strengthen their $PM_{2.5}$ pollution prevention as calls from relevant stakeholders to include $PM_{2.5}$ were very large."[31]

### *3. Main Alterations to the new version of the Ambient air Quality Standard*

The main differences between the old Ambient Air Quality Standard" (GB3095-1996) and the new standard (GB3095-2012) are:

- Included an average value for $PM_{2.5}$ as well as an 8 hour average value for ozone.

The yearly average value for $PM_{2.5}$ in the new standard was 0.035mg/$m^3$ and the 24 hour average value was 0.075mg/$m^3$, the same as the WHO Interim Target-1 value.[32]

The new standard has kept the hourly ozone monitoring but has also added an eight hour value. This has been added to the real time Ambient Air Quality Report so is an even more effective way of allowing the public and environmental management authorities to help prevent the adverse health effects from ozone.

Regarding revisions to particulates (smaller or equal to 2.5μm) and ozone please see table 1.5 for details.

---

[31] "Ambient Air Quality Standard" Second Draft Feedback Explanation, "Air Quality Standard" Working Group, November 2010.

[32] China Draws up $PM_{2.5}$ Quality Standard for the First Time, "Popular Standardization"December 2011.

Table 1.5 Comparisons of revisions to $PM_{2.5}$ and ozone standards

| Pollutant | Average | Unit | Old Ambient Air Quality Standard (GB 3095-1996) Value | Ambient Air Quality Standard (GB 3095-2012) Value |
|---|---|---|---|---|
| Particles (less than 2.5μm) | Yearly Average | μg/m$^3$ | No Requirements | 15 (Level I)<br>35 (Level II) |
| | 24 Hour Average | μg/m$^3$ | No Requirements | 35 (Level I)<br>75 (Level II) |
| Ozone | 1 Hour Average | μg/m$^3$ | 120[33]<br>160 | 160 (Level I)<br>200 (Level II) |
| | Highest Daily 8 Hour Average | μg/m$^3$ | No Requirements | 100 (Level I)<br>160 (Level II) |

- Tightened up $PM_{10}$, lead and benzo[a]pyrene pollutant concentration values.

Table 1.6 Comparison of $PM_{10}$, lead and benzo[a]pyrene pollutant concentration values

| Pollutant | Average | Unit | Old Ambient Air Quality Standard (GB 3095-1996) Value | Ambient Air Quality Standard (GB 3095-2012) Value | Notes |
|---|---|---|---|---|---|
| Particulates (smaller or equal to 10μm) | Yearly Average (Level II Standard) | μg/m$^3$ | 100 | 70 | Basic |
| Lead | Yearly Average | μg/m$^3$ | 1 | 0.5 | Other |
| | Quarterly Average | μg/m$^3$ | 1.5 | 1 | |
| Benzo[a]Pyrene | 24 Hour Average (Daily Average) | μg/m$^3$ | 0.01 | 0.0025 | Other |
| | Yearly Average | μg/m$^3$ | No Requirements | 0.001 | |

At the same time, pollutant concentration values were split into two categories: basic pollutants and other pollutants. The measures for basic pollutants were implemented nationwide and the measures for other pollutants were implemented according to the situation on the ground and based on methods decided upon by either the MEP or provincial level People's Government.[34]

- Revised the Ambient Air Area Classifications from three different classifications to two.

"Special industrial zones" were merged with "residential zones, commercial and residential mixed zones, cultural zones, industrial zones and rural zones". At the same time requirements for ambient air quality areas were changed from a three level standard to a two level standard.

- Made the regulations on validating monitoring data and statistics more strict. The requirements for

[33] "Ambient Air Quality Standard" (GB3095-1996) Revision Chart. The Level I hourly average standard for ozone was changed from 0.12mg/m$^3$ to 0.16mg/m$^3$. The Level II standard value was changed from 0.16mg/m$^3$ to 0.20mg/m$^3$.

[34] "Ambient Air Quality standard" (GB3095-2012), Issued on February 29th, 2012.

valid data increased from the original 50-75% to 75-90%.

This included increasing the requirements for monitoring data and monitoring devices and ruled that data that did not meet the minimum requirements for valid pollutant concentration data should be seen as invalid data. The minimum requirements were revised and also increased for a number of pollutants (basic pollutants). For details please see table 1.7:

Table 1.7 Revisions to the requirements for acceptable monitoring data

| Pollutant | Average | Old Ambient Air Quality Standard (GB 3095-1996) Values | Ambient Air Quality Standard (GB 3095-2012) Values |
|---|---|---|---|
| Particulates (Less than or equal to 10μm) | Yearly Average | Every year must have at least 60 evenly distributed average daily values; Every month must have at least 5 evenly distributed average daily values | Must have at least 324 average daily concentration values; Must have at least 27 daily average concentration values each month (25 for February) |
| Sulfur Dioxide Nitrogen Dioxide | | Every year must have at least 144 evenly distributed average daily values; Every month must have at least 12 evenly distributed average daily values | |
| Particulates (Less than or equal to 10μm) | 24 Hour Average (Daily Average) | Must have at least 12 hours of sampling time per day | Must have at least 20 hours of average concentration values or sampling time per day |
| Sulfur Dioxide Nitrogen Dioxide Carbon Monoxide | | Must have at least 18 hours of sampling time per day | |

### *4. "Ambient Air Quality Index (AQI) Technnical Regulations (Trial)" Changes API to AQI*

In order to better represent China's ambient air quality situation and reflect the complex make up of atmospheric air pollution, as well as to provide better health guidance to the general public and eliminate their feelings that monitoring results do not completely reflect the reality of the situation, the new version of the "Ambient Air Quality standard" (GB2095-2012) was implemented at the same time as the "Ambient Air Quality Index (AQI) Technical Regulations (Trial)," which changed AQI to API.

Improvements mainly covered four areas: [35]

- The Air Pollution index (API) was changed to Air Quality Index (AQI) to be in line with international norms. This reflected the shift in focus from controlling pollutant emissions to environmental quality management.

- Pollutants to be evaluated were increased to include ozone, carbon monoxide and $PM_{2.5}$. This was done in order to better represent the state of ambient air quality and to mirror the complex make up of atmospheric pollutants in China today.
  The focus of environmental protection shifted from local bureau management and the control of individual primary pollutants to a unified and coordinated region-wide control of secondary pollutants.

- Revised the classification system for the index in order to better match up the air quality level with the level of effect that it has on people's health.

- Improved the way the Air Quality Index was published
  Changed the daily monitoring cycle from 12:00 – 12:00 to 00:00 – 00:00 and decided to publish real time hourly concentrations for sulfur dioxide, nitrogen dioxide, carbon monoxide, $PM_{2.5}$ and eight hour

[35] Legal Interpretation of the New Ambient Air Quality Standard, Wen/Xuling Zhuke, China HowNet.

concentrations for ozone.

# Section 4. Timetable for the Implementation of the New Standard

### *1. Timetable for the implemention of new standards*

Article 11 of the MEP Huanfa [2012] includes a step by step timeline for the implementation of the new standard in different areas:[36]

- 2012 - Key areas such as Beijing, Tianjin and Hebei, the Yellow River Delta and the Pearl River Delta as well as municipalities and provincial capitals.
- 2013 – The 113 Key Environmental Protection Cities and National Environmental Protection Model Cities.
- 2015 - All cities at prefecture level and above.
- By January 1, 2016 new standards implemented nationwide.

On May 21, 2012 the Ministry of Environmental Protection offices released environmental regulation [2012] article 81, regarding the notice on "New Regulations on Air Quality: First Stage Monitoring Implementation Plan." An attachment to the plan listed the "First Stage Implementation of New Standards and Number of State Controlled Air Quality Monitoring Sites."[37] The detailed names of these sites were made clear on the "Table of Names of National Urban Air Quality Monitoring Network Monitoring Sites".[38]

The "First Stage Monitoring Implementation Plan of the New Air Quality Standards" also clarified the time table for publication and the content to be published.

- Schedule:
  - Before the end of October 2012, all monitoring sites in the national network in cities in the first stage implemention should have completed construction of facilities and started test operations.
  - Before the end of December 2012, cities in the first stage of implemention need to start monitoring and disclosing data according to the requirements of the new air quality standard, and encourage implementation in all locations.

- Contents of Disclosure - Stations must publish six monitoring indexes: $SO_2$, $NO_2$, $PM_{10}$, $PM_{2.5}$, $O_3$ and CO.
  - Real-time hourly concentration values
  - Daily average concentration values
  - AQI
  - The area covered by the monitoring site

- To be disclosed by: the environmental protection department or environmental monitoring organization for each of the areas in the first stage implementation.

- Method of disclosure: through the related environmental department's website, environmental monitoring organization website, television and media broadcasts etc.

### *2. State of Implementation in Different Regions*

The "First Stage Monitoring Implementation Plan for the New Standards on Air Quality," requires that before

[36] Regarding the ‘‘Ambient Air Quality Standard’’ (**GB3095-2012) Notice, MEP February 29, 2012**

[37] Regarding the distribution of the notice on "First Stage Monitoring Implementation Plan of the New Air Quality Standards," MEP, May 31, 2012.

[38] Regarding the notice on the Commencement of Monitoring by the monitoring stations in the "12th Five Year Plan" National Air Monitoring Network, China National Environmental Monitoring Center, April 18, 2012.

the end of December 2012, cities in the first stage of implementation need to start monitoring and publishing data according to the requirements of the new air quality standard. This covers 496 monitroing sites in 74 cities.

Since the end of 2011 we have looked at information related to $PM_{2.5}$, CO and $O_3$ published by EPBs across the country as well as the National Environmental Monitoring Center. We found that progress in air quality information disclosure was unevenly distributed.

**a) Some areas have made fast progress**

Even before May 1, 2012, a number of provinces and cities disclosed air quality information for the three new pollutant indexes from one or more monitoring sites.

**Beijing**

- From January 21, 2012, the Beijing Municipal Environmental Monitoring Center website published hourly concentration values for $PM_{2.5}$ research data. This was for one monitoring site located at the Monitoring Center's Comprehensive Observation Laboratory.

**Fujian Province**

- From March 1, at 12.00 p.m. every day, the Xiamen Municipal EPB website published 24 hour average values for two $PM_{2.5}$ monitoring sites and eight sites monitoring 24 hour average ozone values.

**Guangdong Province**

- On March 8th, 2012 the Guangdong Province Environmental Information Comprehensive Publishing Platform published information from 62 monitoring sites in nine cities and one district. The information they published included hourly concentration values for $PM_{2.5}$, CO and $O_3$ as well as eight hour concentration values for ozone; the most recent hourly and 24 hour $PM_{2.5}$ and CO average values; hourly values for ozone, which include not only the previous hourly value, but also the largest hourly value in the previous 24 hours; eight hour values for ozone which included not only the previous eight hour value but also the largest eight hour value in the previous 24 hours.

- Guangzhou Municipal Real Time Air Quality Disclosure System: published real time pollutant concentration data from ten monitoring sites since May 2, 2012;
- Shenzhen Municipal Ambient Air Quality Report: published real time concentration data from 19 monitoring points since March 8, 2012;
- Dongguan Municipal Live Air Quality Disclosure: published real time pollutant concentration data from seven monitoring sites since March 27, 2012;
- Zhuhai Municipal Live Air Quality Disclosure Platform: published real time pollutant concentration data from four monitoring stations since June 5, 2012;
- Foshan Municipal Live Air Quality Disclosure Platform: published real time pollutant concentration data from ten monitoring sites since May 28, 2012;
- Zhongshan Real Time Air Quality Disclosure System: published real time pollutant concentration data from four monitoring sites since June 4, 2012.

**Shanghai Municipality**

- On March 9, 2012 the air quality real time disclosure system released $PM_{2.5}$ pilot test data from two monitoring sites.
- On June 28, 2012 they started to publish the most recent hourly concentration value and the most recent 24 hour average concentration value for ten state controlled sites.

**Zhejiang Province**

- On March 25, 2012 the Zhejiang provincial EPB started to release daily $PM_{2.5}$ average concentration data and also the AQI for each monitoring site in Hangzhou, Ningbo, Wenzhou, Huzhou, Jiaxing, and Shaoxing.
- On June 3, another monitoring site was added for Jinhua municipality as well as another two in Hangzhou and four in Ningbo.

**Jiangsu Province**

- Since March 27, 2012 Suzhou has published real time concentration values for three monitoring sites on the "Suzhou Ambient Air Quality Information Disclosure System," the same as the three sites on the provincial platform;
- April 1, 2012, the Jiangsu provincial and urban air quality $PM_{2.5}$ test monitoring data platform started to publish real time data from 17 state controlled stations from $PM_{2.5}$ monitoring equipment already installed in 13 provincial level cities. At the same time they also disclosed hourly and eight hour data for ozone and the most recent hourly average concentration for CO. Nanjing and Suzhou have three monitoring sites, while the other cities all have one each.
- Since June 21, 2012 the official Changzhou EPB Website has disclosed hourly $PM_{2.5}$ data from Changzhou Environmental Monitoring Center, the Changzhou Institute of Technology and City Construction School. The provincial platform publishes real time data fom one monitoring site.
- Since July 1, 2012 the Nanjing Urban Air Quality Real Time Disclosure System has published real time concentrations for three sites on the "Real Time Air Quality Test Monitoring Results" section of its website. The three sites on the provincial platform are identical.
- Nantong publishes real time $PM_{2.5}$ data for one site on its Nantong Urban Air Quality $PM_{2.5}$ Test Monitoring Data Platform.

**Sichuan Province**

- On March 30, 2012 the Sichuan Environmental Monitoring Center published air quality real time pilot monitoring results (real time concentrations for $PM_{2.5}$, CO, hourly $O_3$, eight hour $O_3$) and daily reports on ambient air quality test monitoring results from the Chengdu Renmin Nan Lu Siduan No.18 station, on their "air quality new standard test monitoring" section of the Website.

**Tianjin Municipality**

- On April 28, 2012, Tianjin province's Environmental Monitoring Center website published Tianjin's $PM_{2.5}$ pilot data for March. After this, at the start of every month, they published the previous' months $PM_{2.5}$ pilot monitoring data in the form of average daily concentrations from four monitoring sites for that month.

After May 1, 2012, many provincial cities started to disclose air quality information for new pollutant indexes from one or more monitoring sites inside their provincial jurisdictions.

**Wuhan Municipality**

- From March 25, 2012 Wuhan Municipal EPB published hourly average values and the most recent 24 hour average values from one monitoring site on the "$PM_{2.5}$ monitoring research data" section of their website.

**Hebei Province**

- Since June 1, 2012, Hebei province, through the Hebei province automatic air quality disclosure system, has disclosed hourly real time $PM_{2.5}$ concentrations from eight monitoring sites in seven cities. This included two monitoring sites in Shijiazhuang and one site in each of the cities of Tangshan, Qinhuangdao, Baoding, Zhangjiakou, Chengde, and Langfang.

**Shanxi Province**

- Since June 5, 2012, the Shanxi Environmental Protection Department, through the "$PM_{2.5}$ monitoring research data" section of their website, has published hourly $PM_{2.5}$ concentrations for 11 cities. However, the data has not been updated since July 26, 2012.
- The Shanxi Provincial Environmental Monitoring Center releases real time $PM_{2.5}$ data from exactly the same sites as the state controlled sites.

**Shaanxi Province**

- Since July 1, 2012, the "$PM_{2.5}$ Monitoring Data" section on the homepage of the Xi'an municipality EPB website has published daily average values from seven monitoring sites in Xi'an.

### *b) Some areas still do not disclose monitoring data*

In the list of the first stage implementation cities in the "First Stage Monitoring Implementation Plan for New Air Quality Standards," 29 cities in Chongqing, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Anhui, Jiangxi, Shandong, Henan, Hunan, Guangxi, Hainan, Guizhou, Yunnan, Tibet, Gansu, Qinghai, Ningxia, and Xinjiang have still not started to disclosure any information. These cities account for 39% of all the cities that are required to disclose. A couple of cities in these provinces announced that they estimated that by the end of October they would release data. However there are still some provincial cities that have not released their timetable for disclosing monitoring data to the public.

By August 31, 2012 $PM_{2.5}$ data from 192 monitoring sites in 56 cities was being published. Out of these, 151 sites were located in 45 of the first stage implementation cites. A summary of the status of disclosure in the 74 first stage implementation cities is detailed below:

Table 1.8 Status of disclosure for cities in the first stage implementation plan

| Status of Cities Implementing the New Standard (as of 08-31-2012) | | | | | |
|---|---|---|---|---|---|
| Province | City | No. of Sites | Actually Published | New Pollutants Covered | Frequency |
| Beijing | Beijing | 12 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| Tianjin | Tianjin | 15 | 4 | $PM_{2.5}$ | Monthly |
| Shanghai | Shanghai | 10 | 10 | $PM_{2.5}$ | Hourly |
| Chongqing | Chongqing | 17 | 0 | —— | —— |
| Hebei | Shijiazhuang | 8 | 2 | $PM_{2.5}$ | Hourly |
| | Tangshan | 6 | 1 | $PM_{2.5}$ | Hourly |
| | Qinhuangdao | 5 | 1 | $PM_{2.5}$ | Hourly |
| | Handan | 4 | 0 | —— | —— |
| | Baoding | 6 | 1 | $PM_{2.5}$ | Hourly |
| | Chengde | 5 | 1 | $PM_{2.5}$ | Hourly |
| | Cangzhou | 3 | 0 | —— | —— |
| | Hengshui | 3 | 0 | —— | —— |
| | Xingtai | 4 | 0 | —— | —— |
| | Zhangjiakou | 5 | 1 | $PM_{2.5}$ | Hourly |
| | Langfang | 4 | 1 | $PM_{2.5}$ | Hourly |
| Shanxi | Taiyuan | 9 | 8 | $PM_{2.5}$ | Hourly |
| Inner Mongolia | Hohhot | 8 | 0 | —— | —— |
| Liaoning | Shenyang | 11 | 0 | —— | —— |
| | Dalian | 10 | 0 | —— | —— |
| Jilin | Changchun | 10 | 0 | —— | —— |
| Heilongjiang | Harbin | 12 | 0 | —— | —— |
| Jiangsu | Nanjing | 9 | 3 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Suzhou | 8 | 3 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Wuxi | 8 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Changzhou | 6 | 3 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Yangzhou | 4 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Zhenjiang | 4 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |

| | | | | | |
|---|---|---|---|---|---|
| | Nantong | 5 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Taizhou | 4 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Xuzhou | 7 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Lianyungang | 4 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Huaian | 5 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Yancheng | 4 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Suqian | 4 | 1 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| Zhejiang | Hangzhou | 11 | 3 | $PM_{2.5}$ | Daily |
| | Ningbo | 8 | 5 | $PM_{2.5}$ | Daily |
| | Huzhou | 3 | 1 | $PM_{2.5}$ | Daily |
| | Jiaxing | 3 | 1 | $PM_{2.5}$ | Daily |
| | Shaoxing | 3 | 1 | $PM_{2.5}$ | Daily |
| | Zhoushan | 3 | 1 | $PM_{2.5}$ | Daily |
| | Wenzhou | 4 | 1 | $PM_{2.5}$ | Daily |
| | Jinhua | 3 | 1 | $PM_{2.5}$ | Daily |
| | Quzhou | 3 | 0 | —— | —— |
| | Taizhou | 3 | 0 | —— | —— |
| | Lishui | 3 | 0 | —— | —— |
| Anhui | Hefei | 10 | 0 | —— | —— |
| Fujian | Fuzhou | 6 | 0 | —— | —— |
| | Xiamen | 4 | 3 | $PM_{2.5}$、$O_3$ | Daily |
| Jiangxi | Nanchang | 9 | 0 | —— | —— |
| Shandong | Jinan | 8 | 0 | —— | —— |
| | Qingdao | 9 | 0 | —— | —— |
| Henan | Zhengzhou | 9 | 0 | —— | —— |
| Hebei | Wuhan | 10 | 1 | | Hourly |
| Hunan | Changsha | 10 | 0 | —— | —— |
| Guangdong | Guangzhou | 11 | 13 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Shenzhen | 11 | 19 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Zhuhai | 4 | 4 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Foshan | 8 | 10 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Jiangmen | 4 | 7 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Dongguan | 5 | 7 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Zhongshan | 4 | 4 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Huizhou | 5 | 7 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| | Zhaoqing | 4 | 4 | $PM_{2.5}$、CO、$O_3$ | Hourly |
| Guangxi | Nanning | 8 | 0 | —— | —— |
| Hainan | Haikou | 5 | 0 | —— | —— |
| Sichuan | Chengdu | 8 | 1 | | Hourly |
| Guizhou | Guiyang | 10 | 0 | —— | —— |
| Yunnan | Kunming | 7 | 0 | —— | —— |
| Tibet | Lhasa | 6 | 0 | —— | —— |
| Shaanxi | XI'an | 13 | 7 | | Daily |
| Gansu | Lanzhou | 5 | 0 | —— | —— |
| Qinghai | Xining | 4 | 0 | —— | —— |
| Ningxia | Yinchuan | 6 | 0 | —— | —— |
| Xinjiang | Urumqi | 7 | 0 | —— | —— |

Since all areas were supposed to start to publish air quality information according to the new standards, they have all published the basic concenteration values for the three new pollutants, and some have also published Air Quality Indexes. Looking at what has been published so far we found the following areas still need improvement:

**1. Systematic Disclosure**

The scope of air quality information disclosed by many cities proved very limited. A number of cities, including Wuhan and Chengdu, and some cities in Hebei, Jiangsu, and Zhejiang only published data from one monitoring site, which could not represent the entire municipal area's air quality.

**2. Timeliness**

Shanxi: The Shanxi Provincial Environmental Monitoring Center published $PM_{2.5}$ real time data; however the data coming from some of the monitoring sites was not released in a timely manner.

Figure 1.17 Shandong Province environmental monitoring center station $PM_{2.5}$ real-time data publishing section[39]

当前位置：首页 — 空气质量 — PM2.5实时数据

| 地市 | 测点名称 | 日期 | 时间 | $PM_{2.5}$ |
|---|---|---|---|---|
| 太原 | 上兰 | 2012-10-12 | 14:00 | 0.031 |
| 太原 | 涧河 | 2012-10-12 | 14:00 | 0.028 |
| 太原 | 尖草坪 | 2012-10-12 | 14:00 | 0.027 |
| 太原 | 金胜 | 2012-10-12 | 14:00 | 0.030 |
| 太原 | 南寨 | 2012-10-12 | 14:00 | 0.079 |
| 太原 | 桃园 | 2012-10-11 | 9:00 | 0.000 |
| 太原 | 坞城 | 2012-9-8 | 10:00 | 0.072 |
| 太原 | 晋源 | 2012-10-12 | 14:00 | 0.022 |
| 大同 | 红旗广场 | 2012-8-26 | 10:00 | 0.072 |
| 大同 | 教育学院 | 2012-10-12 | 10:00 | 0.035 |
| 阳泉 | 市中心 | 2012-10-12 | 14:00 | 0.073 |
| 阳泉 | 赛鱼 | 2012-10-12 | 14:00 | 0.031 |
| 阳泉 | 南庄 | 2012-10-12 | 14:00 | 0.017 |
| 阳泉 | 白羊墅 | 2012-10-12 | 14:00 | 0.020 |
| 阳泉 | 平坦 | 2012-10-8 | 22:00 | 0.164 |
| 阳泉 | 大阳泉 | 2012-9-26 | 9:00 | 0.000 |
| 长治 | 清华 | 2012-10-6 | 7:00 | 0.041 |
| 长治 | 监测站 | 2012-10-12 | 14:00 | 0.114 |
| 长治 | 澳瑞特 | 2012-10-12 | 13:00 | 0.185 |

[39] Shandong Province Environmental Monitoring Center, http://www.sxhjjcz.com.cn/newweb/kongqizhiliang/index.asp?leibie=PM2.5 , accessed on October 12, 2012.

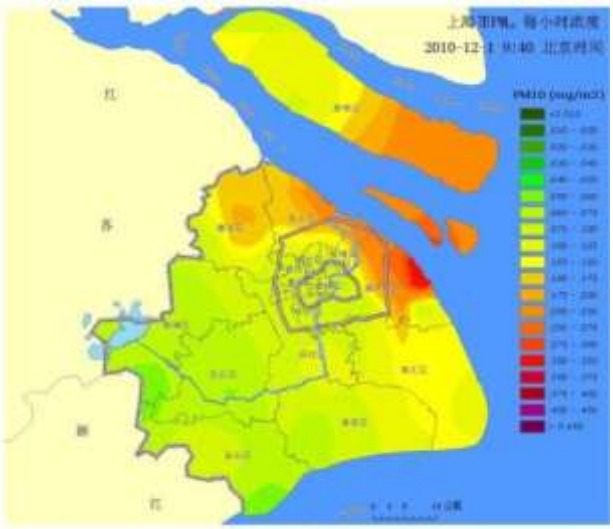
Xi'an, Xiamen, and Zhejiang only disclose data once a day.

Tianjin: only after a one month delay do they publish the previous month's daily average pollutant concentrations.

**3. User friendliness**

Except for Guangdong and Shanghai that display their air quality information on a map with areas colored according to the air quality index level, other cities generally only convey their data in writing or through tables and forms. In addition to this, apart from Chengdu and Tianjin where historical data can be viewed, air quality information from the other cities is just current concentration values. Historical data can not be viewed, meaning it is not very useful for further research.

Figure 1.18 Shanghai air quality map



During the previous AQTI evaluation process, we saw that in March 2010, Shanghai municipality started using the international real time air quality monitoring system (AIRNow International), and published detailed hourly monitoring concentration value information for $SO_2$, $NO_2$ and $PM_{10}$ for the World Expo area. They also published Shanghai's $PM_{10}$ concentrations every hour on a map. A disappointment to many people was that this type of user friendly method of publishing was not continued and stopped after the World Expo came to an end.

# Section 5. Disclosed Data still not being used Effectively

## a) Has been used in some applications

As the government has been publishing ambient air quality data, civil society has collected and used this data for research and further dissemination. Mobile phone applications have collected national EPB air quality data in one place for easy and convenient access for users.

The air quality index standard has changed in that the “Ambient Air Quality Index (AQI) Technology Regulations (Pilot)” was changed from API to AQI. The old Air Pollution Index became the Air Quality Index. At present a lot of data from government departments is published as the API but some phone apps publish the AQI.

Mobile phone apps (applications) allow users to download and compile data. It is important that air quality information is provided in real time and mobile phone apps provide the most up to date real-time information. Mobile apps do not only provide a good user experience, but information can be dissemminated very quickly and they are also interactive. Compared to traditional forms of media like television and internet, mobile apps can receive a larger amount of real time data. For the general public it is the quickest and most direct way of accessing government department data.

These mobile apps have strong abilities and allow users to access real time air quality reports from more than 100 cities. Currently the number of air quality apps in the marketplace is proliferating rapidly and each has its own merits. Below is an introduction to some of these apps:

Wooair (my air), created by Beijing Mind Alliance Consulting Company, allows users to obtain real time government air quality data from 120 cities. It uses the newest national Air Quality Index (AQI), and has IAQI values for each type of pollutant.

Figure 1.19 The “WOOAIR” app interface

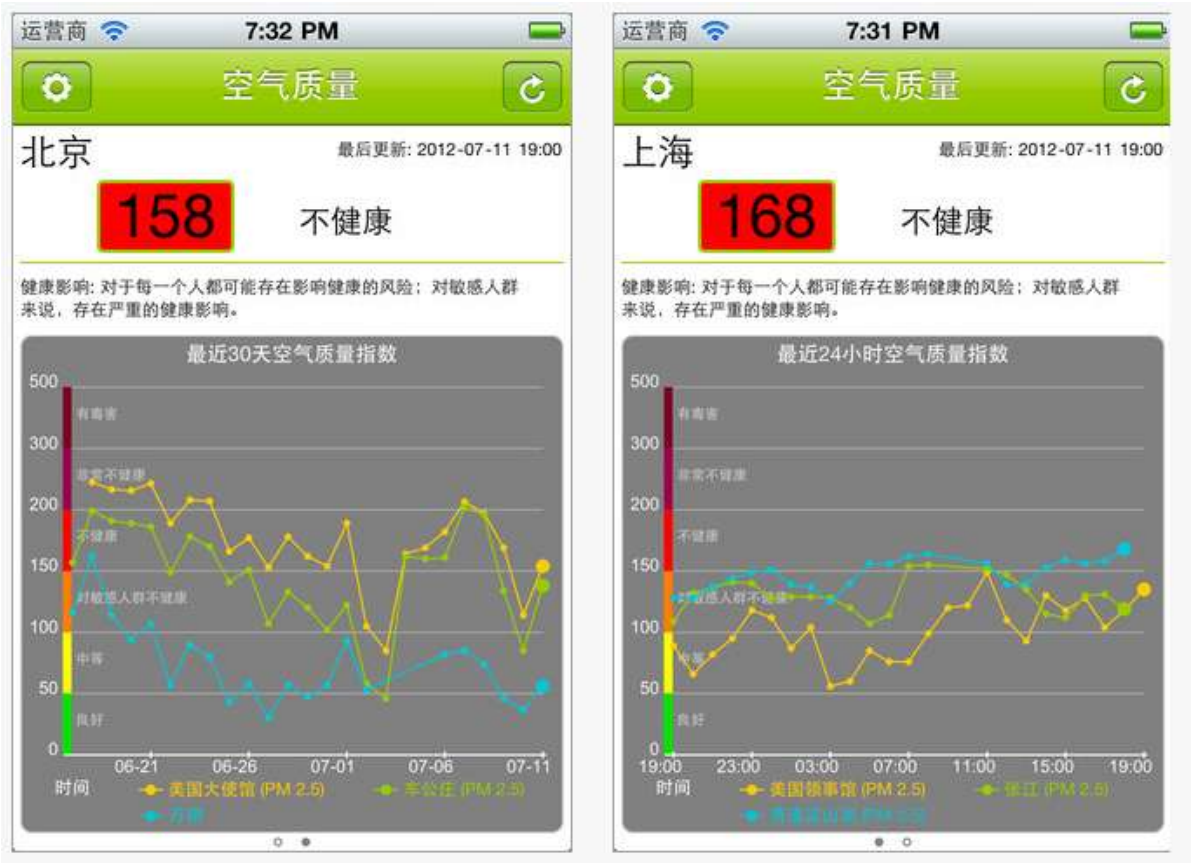
The majority of the cities have readings for $PM_{10}$, $SO_2$, and $NO_2$ and some have $PM_{2.5}$. Some cities have information from each of the National Urban Ambient Air Quality Monitoring Network sites and the user interface is split into a variety of colors depending on the severity of pollution and air quality status. It also provides historical data: 24 hour, seven day and 30 day data. It has background introductions for $PM_{2.5}$, $PM_{10}$, $SO_2$, $NO_2$, CO and $O_3$ which contain definitions and harmful impacts. It also contains definitions of the Air Quality Index and Air Pollution Index. Users are also able to post air quality information through Sina Weibo and Renren Wang.

Figure 1.20 WOOAIR information published on Sina Weibo[40]


A feature of another “National Air Quality” app is that a user can choose data from an air quality monitoring site. The user can choose data according to their location and the app provides a graph of air quality changes over a period of time.

[40] Sina Weibo, http://weibo.com/u/2722141183, accessed August 27, 2012.

Figure 1.21 “National Air Quality” app interface[41]




A feature of another app, the “National $PM_{2.5}$ Air Pollution Index,” is that it includes a map that users can conveniently use to look up a city’s air quality.

Figure 1.22 “National Air Pollution Index $PM_{2.5}$” app interface


[41] Google Play, https://play.google.com/store/apps/details?id=com.cas.airquality&feature=search_result#?t=W251bGwsMSwxLDEsImNvbS5jYXMuYWlycXVhbGl0eSJd,. Accessed September 18, 2012

## b) Still No Effective Harm Avoidance Measures

### i) Descriptions in the Pollution Index have still not been altered

In February and November 2011, the MEP published the Second and Third Draft Proposals for Technological Regulation of Ambient Air Quality Index (AQI) Daily Reports. Contained in these two draft proposals was a table that showed what impacts air quality can have on people's health. In February 2012 the MEP released the Technological Regulation of Ambient Air Quality index (AQI) Daily Reports (Pilot) to be implemented from January 1, 2016. Under this regulation, the impacts of air quality on health will be embedded into the "Air Quality Index and Related Information" table. Compared with the former tables on EPB websites, there have been many improvements, including increased information on potential health effects for sensitive groups, color displays, and suggestions of measures to be adopted. Worth noting is that the "Air Quality Index and Related Information" table published in February 2012 in the Technological Regulation of Ambient Air Quality index (AQI) Daily Reports (Pilot) includes recommended measures to be taken in heavy and serious pollution, with special asttention paid to children.

Table 1.9 Comparison of API and AQI individual index descriptions

| Air Pollution Index (API) | | Air Quality Index (AQI) | | |
|---|---|---|---|---|
| Air quality status and index | Health effects | Air quality status and index | Health effects | Suggestions of adoptive measures[42] |
| Excellent 0-50 | Can continue with regular activities | Excellent 0-50 | Air quality is satisfactory, basically no air pollution | All groups can continue with regular activities |
| Good 51-100 | | 良 51-100<br>Good 51-100 | Air quality is acceptable but certain pollutants may have a slight effect on very sensitive groups; will have relatively weak impact on healthy groups | Only extremely sensitive groups will have to reduce outdoor activities |
| Slightly Polluted 101-150 | Sensitive groups may have mildly intensified symptoms; healthy groups may experience some symptoms | Slightly Polluted 101-150 | Sensitive groups may have mildly intensified symptoms; healthy groups may experience some symptoms. | Children, the elderly and people with heart disease or respiratory illness should reduce prolonged or intensive outdoor activities |

[42] This column is a new addition to the AQI.

| | | | | |
|---|---|---|---|---|
| Lightly Polluted 151-200 | | Lightly Polluted 151-200 | Sensitive groups will have aggravated symptoms, and may affect cardiovascular and respiratory systems in healthy groups | Children and the elderly and people with heart disease or respiratory illness should reduce prolonged or intensive outdoor activities. All groups should reduce outdoor activities. |
| Moderately Polluted 201-250 | People with heart or lung disease will have intensified symptoms, ability to exercise outdoors is reduced; affects healthy groups | Heavily Polluted 201-300 | People with heart or lung disease will have intensified symptoms, ability to exercise outdoors is reduced; affects healthy groups | Children, the elderly and people with heart or respiratory illness should stay indoors and stop outdoor activity. All groups should reduce outdoor activity. |
| Heavily Polluted 251-300 | | | | |
| Severely Polluted >300 | Ability to exercise outdoors is reduced for all groups; there are clear symptoms, and some symptoms of illness may appear | Severely Polluted >300 | Ability to exercise outdoors is reduced for all groups; there are clear symptoms, and some symptoms of illness may appear | Children, the elderly and sick people should stay indoors and avoid physical exertion. All groups should avoid outdoor activities. |

Currently of the cities that publish daily online air quality reports, Guangzhou and Zhuhai inform people of health effects for each monitoring site. Furthermore, they use the table from the Technological Regulation of Ambient Air Quality index (AQI) Daily Reports (Pilot). Beijing, Shanghai, Nanjing and Shantou also have information on health impacts but many other cities only show air quality information as being “Good,” “Average” or “Poor” and do not point out health effects.

Figure 1.23 Zhuhai Air Quality Publishing Platform showing air quality index and related information[43]


**ii) Still a lack of contingency plans for sensitive groups**

Air pollution is dangerous to human health and has both acute and chronic effects. Acute effects occur after people have been exposed to pollution and the symptoms of illness appear within a short period of time. Chronic effects come about when people are exposed to low concentrations of persistent air pollutants for long periods of time. $PM_{2.5}$ particles have a very small diameter but a relatively large surface area and so they easily carry toxic air pollutants that can be inhaled into the lungs or the blood circulatory system, which can directly cause cardiovascular and respiratory illnesses.

Air is a fundamental element on which every living thing relies. If pollution occurs, there is no way for people to avoid it; therefore it is especially important that people in sensitive groups avoid severe air pollutants. As discussed in Zhang Shiqiu and Huang Desheng's "Prevention of Harmful Effects of Fine Particulate Pollution on the Environment and Health," everyone is exposed to the effects of $PM_{2.5}$ and susceptibility varies according to health status and age. Following the massive increase in levels of $PM_{2.5}$, various health risks have also increased accordingly. Since air is everywhere and it is only possible to avoid exposure to polluted air temporarily, there is a great need to reduce the production of air pollutants at their source.

There is a direct correlation between high levels of $PM_{2.5}$ and the number of patients hospitalized for respiratory illnesses. Results from research carried out by a public health professor at Beijing University's Medical Department, Pei Xiaochuan, showed that after $PM_{2.5}$ levels breach authorized standards, for each increase of 10 $mg/m^{3,}$, cardiovascular emergencies and deaths in the hospital increase by 6% to 7% and high blood pressure emergencies increase by 5%.[44]

The main sensitive groups that air pollutants affect are young children, the elderly, and sick people, especially those with heart disease or respiratory illness. The best method of prevention is to reduce outdoor activities. For children in particular, when the pollution is severe, they should not engage in outside sports activities. A number of international schools already use air pollution monitoring data from different sources to

[43] Zhuhai EPB, http://202.104.69.205:8089/zhuhaiAQIPublish/, accessed on Septemeber 20, 2012.
[44] PM2.5 Monitoring Controversy: Experts state that PM2.5 can enter the lungs and cause harm to the human body, China Business Net, December 7, 2011.

decide on moving outdoor activities indoors in order to reduce exposure to air pollutants.

Examples of International School:

Beijing City International School publishes a section on their Weibo account called "Today's Weather" that publishes a weather forecast and also the air quality index. It advises children on the intensity of outdoor activity according to the level of air quality, divided into: 1) the air quality is very suitable for children to perform outdoor activities; 2) there is a mild level of air pollution; it will not affect childrens' normal outdoor activities; 3) parents please keep your children inside and pay attention to whether or not your child has any difficulty breathing.

The Beijing French International School decides every day, according to the information from the Beijing Air Quality Index, whether or not there will be sports class on that day. If the air quality index exceeds 100, then they will not plan a sports class for the day. This is mainly targeted at children under 15 years old.

However, domestic schools are required to carry out the syllabus stipulated by the Ministry of Education so there is no way for them to arrange outdoor activities according to guidance from the health impacts table in the air quality information report. Therefore it is recommended that the Education Commission and the MEP work together and immediately launch related policy measures to ensure that primary school and middle school students are able to limit their exposure to pollution from outdoor activities on smoggy days.

On December 7, 2011, the Beijing Municipal Education Commission published the following on their Weibo: "For our network of friends and parents, we have the following statement on the problem of 'stopping outdoor activities for nursery, primary and middle school on polluted days': if we encounter very bad and 'foggy' weather, the municipal government will decide to stop classes. At the same time, the school can also make their own decisions to make adjustments to classes, and can use different ways of carrying out sports classes. For instance they could move classes indoors or delay the class until the weather is suitable." This caused a lot of discussion and some parents felt that sports classes could be substituted for other classes. However, a number of schools wanted to ensure that outdoor activities continue otherwise they would not be able to fulfill their "Sunshine Sports" requirement. Once again because there is currently no single regulation there is also no workable goal.

On March 24, 2012 at the Beijing Municipal Environmental Protection Conference, the Deputy Mayor, Hong Feng, stated that control of $PM_{2.5}$ in Beijing should be divided into three stages and that it would take at least 18-20 years to bring the levels within the authorized standards. The head of the Beijing EPB, Chen Tan, stated that this year Beijing will improve its contingency plan for heavily polluted days. In the case that the contingency plan is launched, primary and middle schools will stop sports classes and all government departments will stop driving government vehicles.

Disapointing for many is that since this plan was issued, Beijing has experienced many smoggy days; however a contingency plan for heavily polluted days has not been set in motion.

## c) Information disclosure promotes plans to reduce pollution emissions but as yet these plans have not been implemented

The public's interest in air pollution problems has advanced the expansion of atmospheric air pollution information disclosure. It has also pushed regions that have severe air pollution to draft more large-scale plans to reduce emissions.

**Beijing Municipality**—Clean Air Action Plan and the Atmospheric Pollution Control Area Plan.

The Clean Air Action Plan was put forward by the MEP and discussed and decided on by the municipal governments or EPBs. Relevant departments issue the documents in their name. Municipal governments set up leadership groups and a leadership office. Led by the MEP, each department will implement the plans. In April 2011, the Beijing municipality drew up the "Beijing Municipality Clean Air Action Plan" becoming the first city in the country to formulate a clean air action plan.

The "Beijing Municipality Clean Air Action Plan" goal for 2015 is to: "establish an atmospheric pollution joint control and protection mechanism for Beijing, Tianjin and Hebei and implement improvements in the area's entire ecological environmental quality. By 2015, $SO_2$, $NO_2$, CO, benzo[a]pyrene, fluoride, and lead levels for the whole city will consistently meet the relevant standards. Annual average concentrations for total suspended particles and respirable particles will fall approximately 10% from 2010 levels. The trend in the increase of ozone pollution will also slow down and the number of days that meet the level two standard or better will reach 80%." To this end, after April 2011, the Beijing Municipality will draft a clean air action plan for each area and county under its jurisdiction.

**Dongguan** – In August 2011 the Dongguan Municipal People's Government drew up the "Dongguan Clean Air Action Plan."

**Jinan** —In November 2011, Jinan municipality convened a seminar on clean air action plans and air quality information publishing.

**The National Clean Air Action Plan -** On March 10, 2012, in the third plenary session of the National CPPCC's $11^{th}$ five year meeting, the National CCPC's Population and Natural Resources Committee deputy head and the PRC Environmental Protection Agency fomer deputy chief, Wang Yuqing, said in a speech about the implementation of the "National Clean Air Action Plan" that, "$PM_{2.5}$ is very harmful and its sources are complex. It comes from the burning of coal, motor vehicle exhaust, dust particles in the air and emissions from burning biomass. It also comes from atmospheric $SO_2$, $NO_x$, ammonia, and volatile organic compounds that react to form secondary pollutants. These two aspects each account for 50% of the total amount. These touch on all aspects of industry, transportation, residential life and urban management. China's reliance on coal energy has made it the largest coal consumer in the world. China is also the country with the fastest increase in motor vehicles in the world, leading to motor vehicle exhaust emissions being a major source of air pollution. The task of controlling $PM_{2.5}$ and $O_3$ pollution and improving urban air quality is an arduous one. For this reason we would like to take the opportunity from the newly published amendments to the "Environmental Air Quality Standards" and will

consult international experience and draw up the implementation of the “National Clean Air Action Plan” according to the country’s current situation.

In May 2012, the MEP was considering the “Air Pollution Prevention and Control Plan for Key Areas (2011-2015).” Beijing, Tianjin, the Pearl River Delta, the Yellow River Delta, Chengdu and Chongqing regions are in the process of drawing up this plan.

Although each region has drawn up an air pollution action plan, it is still expected to be very difficult to implement these plans. Therefore we recommend that in order to promote the plan’s effective implementation these plans should be more open and should include a breakdown of annual targets and should also report to the public on progress every year.

# Part 2. Analysis of Air Quality Conditions in China's Key Cities

Between December 13, 2011 and July 18, 2012 we carried out tracking of the data for $SO_2$, $NO_2$, and respirable particles that was released by the MEP and the China National Environmental Monitoring Center for the automatic monitoring sites in 120 Key Environmental Protection Cities.[45]

The mean value for hourly monitoring data was calculated using data from this time period[46] and from this we obtained the pollution status and ranking ($PM_{10}$ as an example) for each city.

Table 2.0 $PM_{10}$ average concentration values and rankings for 120 cities ($mg/m^3$)[47]

| Rank | City | $PM_{10}$ | Rank | City | $PM_{10}$ | Rank | City | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | Urumqi | 0.2006 | 41 | Taiyuan | 0.0982 | 81 | Benxi | 0.0802 |
| 2 | Jining | 0.1988 | 42 | Hohhot | 0.0982 | 82 | Taizhou | 0.0794 |
| 3 | Mudanjiang | 0.1860 | 43 | Qiqihar | 0.0977 | 83 | Qingdao | 0.0793 |
| 4 | Zaozhuang | 0.1747 | 44 | Baoji | 0.0969 | 84 | Jinzhou | 0.0787 |
| 5 | Jinan | 0.1572 | 45 | Linfen | 0.0967 | 85 | Guangzhou | 0.0786 |
| 6 | Zibo | 0.1569 | 46 | Luoyang | 0.0961 | 86 | Shizuishan | 0.0782 |
| 7 | Weifang | 0.1452 | 47 | Changzhou | 0.0958 | 87 | Guiyang | 0.0766 |
| 8 | Anshan | 0.1399 | 48 | Hefei | 0.0958 | 88 | Guilin | 0.0752 |
| 9 | Lanzhou | 0.1352 | 49 | Baotou | 0.0956 | 89 | Wuhu | 0.0749 |
| 10 | Xianyang | 0.1342 | 50 | Jiaxing | 0.0956 | 90 | Nanning | 0.0731 |
| 11 | Tai'an | 0.1262 | 51 | Changsha | 0.0952 | 91 | Xiangtan | 0.0729 |
| 12 | Weinan | 0.1260 | 52 | Tangshan | 0.0944 | 92 | Weihai | 0.0719 |
| 13 | Beijing | 0.1249 | 53 | Shenyang | 0.0943 | 93 | Yibin | 0.0713 |
| 14 | Sanmenxia | 0.1238 | 54 | Daqing | 0.0943 | 94 | Karamay | 0.0692 |
| 15 | XI'an | 0.1213 | 55 | Shijiazhuang | 0.0942 | 95 | Dalian | 0.0690 |
| 16 | Kaifeng | 0.1204 | 56 | Lianyungang | 0.0937 | 96 | Yuxi | 0.0686 |
| 17 | Handan | 0.1178 | 57 | Mianyang | 0.0926 | 97 | Yantai | 0.0684 |

[45] From May 13 to May 28 due to a data computer malfunction, there was no tracking of records.

[46] The calculation method was as follows: daily concentration values for urban monitoring stations and sites: take an average of the 24 hourly concentration values; daily average concentration values for urban monitoring stations and sites: average of urban monitoring sites daily concentrations for the period during which values were tracked for; city daily concentration values: average results for sites and stations across the whole city; average city daily concentration values: average of city daily average values for the period when data tracking took place.

[47] A number of the results in this table appear the same because they have been rounded to four decimal points. Their rank in the table is based on the number not rounded to four decimal points.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18 | Chengdu | 0.1161 | 58 | Nantong | 0.0915 | 98 | Kunming | 0.0676 |
| 19 | Tianjin | 0.1135 | 59 | Fushun | 0.0900 | 99 | Zigong | 0.0670 |
| 20 | Jingzhou | 0.1121 | 60 | Luzhou | 0.0894 | 100 | Foshan | 0.0668 |
| 21 | Zhengzhou | 0.1120 | 61 | Yueyang | 0.0891 | 101 | Jiujiang | 0.0644 |
| 22 | Tongchuan | 0.1119 | 62 | Panzhihua | 0.0884 | 102 | Shaoguan | 0.0639 |
| 23 | Pingdingshan | 0.1113 | 63 | Baoding | 0.0882 | 103 | Qinhuangdao | 0.0638 |
| 24 | Jiaozuo | 0.1105 | 64 | Hangzhou | 0.0877 | 104 | Nanchong | 0.0636 |
| 25 | Yangzhou | 0.1097 | 65 | Changchun | 0.0871 | 105 | Ningbo | 0.0636 |
| 26 | Nanjing | 0.1076 | 66 | Datong | 0.0870 | 106 | Zhongshan | 0.0611 |
| 27 | Zhenjiang | 0.1060 | 67 | Shaoxing | 0.0870 | 107 | Beihai | 0.0600 |
| 28 | Chongqing | 0.1048 | 68 | Harbin | 0.0870 | 108 | Zunyi | 0.0598 |
| 29 | Yangquan | 0.1045 | 69 | Suzhou | 0.0858 | 109 | Qujing | 0.0596 |
| 30 | Wuhan | 0.1042 | 70 | Wenzhou | 0.0857 | 110 | Shenzhen | 0.0583 |
| 31 | Huzhou | 0.1035 | 71 | Changzhi | 0.0848 | 111 | Zhuhai | 0.0566 |
| 32 | Xining | 0.1030 | 72 | Wuxi | 0.0842 | 112 | Xiamen | 0.0557 |
| 33 | Yan'an | 0.1017 | 73 | Deyang | 0.0841 | 113 | Zhanjiang | 0.0542 |
| 34 | Xuzhou | 0.1010 | 74 | Nanchang | 0.0836 | 114 | Quanzhou | 0.0534 |
| 35 | Chifeng | 0.1009 | 75 | Zhangjiajie | 0.0828 | 115 | Shantou | 0.0528 |
| 36 | Anyang | 0.1001 | 76 | Rizhao | 0.0818 | 116 | Fuzhou | 0.0510 |
| 37 | Ma'anshan | 0.1001 | 77 | Changde | 0.0813 | 117 | Lhasa | 0.0489 |
| 38 | Jinchang | 0.0997 | 78 | Jilin | 0.0813 | 118 | Haikou | 0.0333 |
| 39 | Yinchuan | 0.0988 | 79 | Shanghai | 0.0810 | 119 | Sanya | 0.0214 |
| 40 | Yichang | 0.0987 | 80 | Liuzhou | 0.0804 | 120 | Zhuzhou | 0.0099 |

By comparing this list with the 20 most polluted cities in the "2012 Key Environmental Protection Cities Air Quality Status" as published by the MEP on August 20, 2012, we discovered some fairly large differences.[48] How these differences came about is worth further discussion.

[48] It should be noted that both use a short period of monitoing data that is not completely identical and the MEP publishing was data from the first half of the year, January 1, 2012 to June 30, 2012. The monitoring data for the research covered December 13, 2011 to July 18, 2012.

| Rank | City | $PM_{10}$ Av. Conc. |
|---|---|---|
| 1 | Urumqi | 0.173 |
| 2 | Lanzhou | 0.143 |
| 3 | Beijing | 0.124 |
| 4 | Chengdu | 0.121 |
| 5 | Tongchuan | 0.116 |
| 6 | Jining | 0.114 |
| 7 | Xi'an | 0.113 |
| 8 | Weinan | 0.112 |
| 9 | Kaifeng | 0.110 |
| 9 | Xining | 0.110 |
| 11 | Zhengzhou | 0.109 |
| 12 | Weifang | 0.108 |
| 13 | Yangzhou | 0.107 |
| 13 | Sanmenxia | 0.107 |
| 14 | Jinan | 0.106 |
| 15 | Tianjin | 0.105 |
| 15 | Shijiazhuang | 0.105 |
| 15 | Hefei | 0.105 |
| 15 | Zaozhuang | 0.105 |
| 15 | Anyang | 0.105 |
| 15 | Xianyang | 0.105 |
| 15 | Yan'an | 0.105 |

Figure 2.1 $PM_{10}$ concentration and ranking for first six months of 2012[49]

| Rank | City | $PM_{10}$ Av. Conc |
|---|---|---|
| 1 | Urumqi | 0.2006 |
| 2 | Jining | 0.1988 |
| 3 | Mudanjiang | 0.1860 |
| 4 | Zaozhuang | 0.1747 |
| 5 | Jinan | 0.1572 |
| 6 | Zibo | 0.1569 |
| 7 | Weifang | 0.1452 |
| 8 | Anshan | 0.1399 |
| 9 | Lanzhou | 0.1352 |
| 10 | Xianyang | 0.1342 |
| 11 | Tai'an | 0.1262 |
| 12 | Weinan | 0.1260 |
| 13 | Beijing | 0.1249 |
| 14 | Sanmenxia | 0.1238 |
| 15 | XI'an | 0.1213 |
| 16 | Kaifeng | 0.1204 |
| 17 | Handan | 0.1178 |
| 18 | Chengdu | 0.1161 |
| 19 | Tianjin | 0.1135 |
| 20 | Jingzhou | 0.1121 |

Figure 2.2 Interim $PM_{10}$ concentration ranking

Based on the results of this recorded data the characrteristics of China's urban air quality was analysed to understand the state of urban air quality in the country.

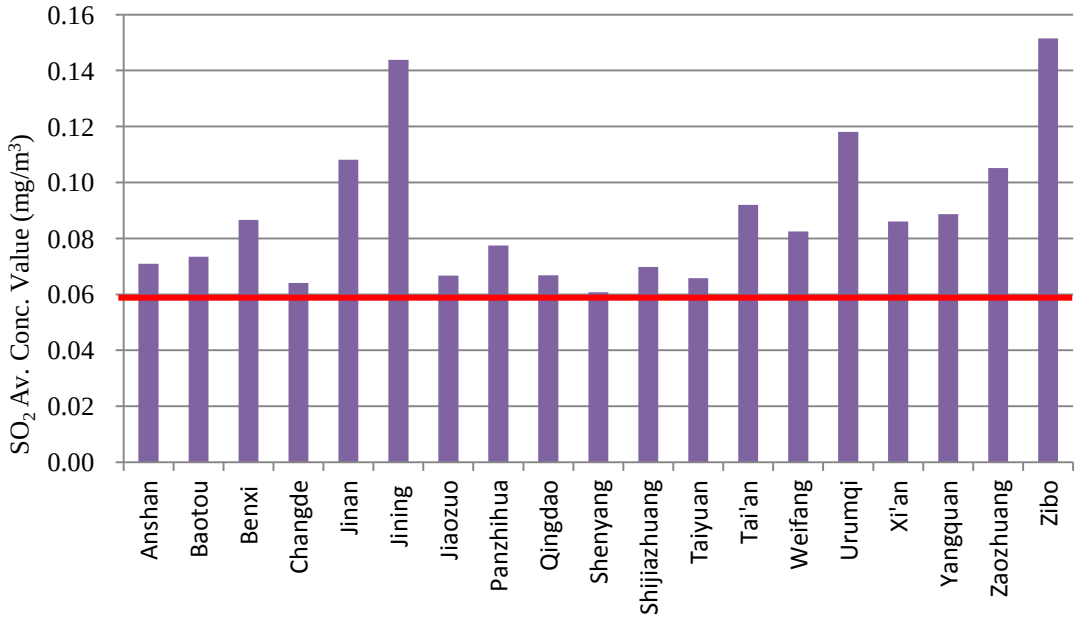
[49] The data came from the "Status of Air Quality for the first half of 2012 in Key Environmental Protection Cities Statistics" in the "Status of Air Quality for the first half of 2012 in Key Environmental Protection Cities," and was ranked by the IPE.

# Section 1. Overall Compliance with Air Quality Standards

## 1. $SO_2$

Within the data tracking period, out of 120 key cities, 11 (9.2% of the total) reached the level one standard for $SO_2$ average concentrations. These included Sanya, Fuzhou, Haikou, Lhasa, Shenzhen, Zhuhai, Shantou, Daqing, Zhanjiang, Hefei, and Beihai. 19 cities (15.8% of the total) breached the level two standard, as shown in Figure 2.3. It should be noted that out of the 19 cities that breached the level two standard there were seven cities located in Shandong province. This is closely related to the fact that in recent years Shandong has the highest rate of energy consumption in the country.

Figure 2.3 Key cities that breached standards for average $SO_2$ concentrations



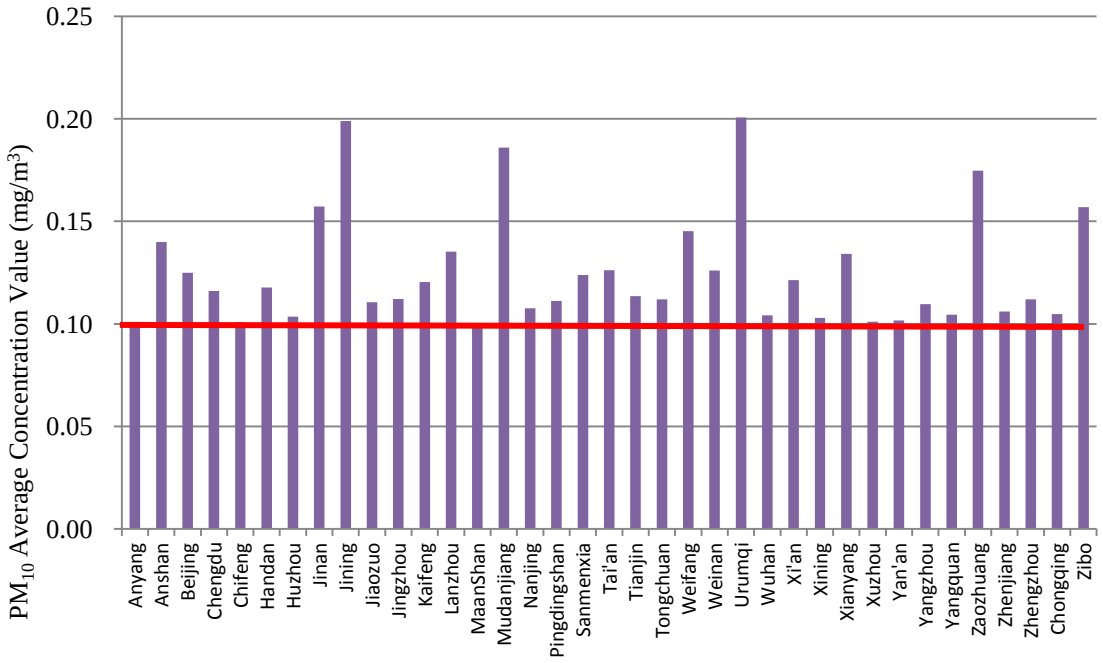

## 2. $NO_2$

During the data tracking period, 66 (55% of the total) out of the 120 key cities met the level one standard for average $NO_2$ concentrations. One city (0.8% of the total) breached the level two standard.

## 3. $PM_{10}$

During the data tracking period, two cities (1.7% of the total) out of the 120 key cities met the level one standard for average respirable particulate matter: Sanya and Haikou. 37 cities (30.8% of the total) breached the level two standard, as shown in Figure 2.4.

Figure 2.4 Key cities that breached respirable particles average concentration standards




# Section 2. Analysis of Air Pollution in Big Cities

## 1. Variations in spatial distribution

Table 2.1 shows average concentration values for the data tracking period for $SO_2$, $NO_2$ and $PM_{10}$ pollutants (data released from state controlled monitoring sites) in the cities of Beijing, Tianjin, Shanghai, Chongqing, Guangzhou, Chengdu, Wuhan, Nanjing and Jinan. From table 2.1 it can be seen that there are clear differences in the daily average concentration values for the three pollutants at the different monitoring stations in each city. The differences between the highest and lowest data are multiple times; the biggest difference was 3.9 times. This result shows two important things: one is that there is a comparatively large difference between different pollution concentration monitoring sites in cities, so it is essential that monitoring equipment must be installed in areas of a city that reflects an accurate level of air quality. The second point is that despite meeting citywide average air quality standards, there are areas that will not necessarily be able to meet the standards. Therefore, attention needs to be paid to the impacts on the environment and health in those areas.

Table 2.1 Average daily pollutant concentration values for state controlled monitoring sites in key cities (mg/$m^3$)

| City | Monitoring Site | $PM_{10}$ | $SO_2$ | $NO_2$ |
|---|---|---|---|---|
| **Beijing** | Wanshou Xigong | 0.13 | 0.038 | 0.047 |
| | Wanliu | 0.138 | 0.046 | 0.074 |
| | Dongsi | 0.136 | 0.04 | 0.046 |
| | Agricultural Exhibition Center | 0.131 | 0.04 | 0.053 |
| | Gucheng | 0.151 | 0.033 | 0.045 |
| | Temple of Heaven | 0.136 | 0.036 | 0.049 |
| | Olympic Sports Center | 0.131 | 0.032 | 0.042 |
| | Guangyuan | 0.125 | 0.047 | 0.052 |
| | Ming Tombs | 0.093 | 0.026 | 0.027 |
| | Changping Town | 0.111 | 0.04 | 0.035 |
| | Huairou | 0.109 | 0.031 | 0.025 |
| | Shunyi New Town | 0.116 | 0.033 | 0.037 |
| | High/Low Conc. Difference | **1.5** | **1.8** | **3** |
| **Tianjin** | Dongli Middle School | 0.116 | 0.06 | 0.033 |
| | Tianjin Beichen Hi-tech Industrial Park | 0.087 | 0.034 | 0.043 |
| | Nanjing Road | 0.107 | 0.059 | 0.049 |
| | Tuanbo Lake | 0.126 | 0.028 | 0.035 |
| | Tianshan Road | 0.09 | 0.035 | 0.02 |
| | Municipal Monitoring Center | 0.119 | 0.072 | 0.061 |
| | Jiche Cheliang Chang | 0.095 | 0.042 | 0.047 |
| | Yong Ming Road | 0.082 | 0.041 | 0.018 |
| | Hedong Station | 0.081 | 0.047 | 0.027 |
| | Hexi Station | 0.096 | 0.056 | 0.035 |
| | Taifeng Industrial Park | 0.133 | 0.043 | 0.024 |
| | Jidianqi Chang | 0.085 | 0.042 | 0.057 |
| | Meijiang District | 0.221 | 0.04 | 0.054 |
| | High/Low Conc. Difference | **2.7** | **2.5** | **3.3** |
| **Shanghai** | Shiwu Chang | 0.085 | 0.02 | 0.061 |
| | Sipiao | 0.082 | 0.027 | 0.057 |
| | Shida | 0.081 | 0.028 | 0.06 |
| | PuTuo | 0.087 | 0.026 | 0.053 |
| | Weifang | 0.077 | 0.037 | 0.043 |
| | Jing an | 0.083 | 0.023 | 0.55 |
| | Zhangjiang | 0.082 | 0.027 | 0.042 |
| | Chuansha | 0.067 | 0.027 | 0.036 |
| | Dianshan Lake | 0.084 | 0.027 | 0.047 |
| | High/Low Conc. Difference | **1.3** | **1.8** | **1.7** |
| **Chongqing** | Liang Road | 0.106 | 0.033 | 0.035 |
| | Renhe | 0.112 | 0.035 | 0.043 |

| | | | | |
|---|---|---|---|---|
| | Nanping | 0.11 | 0.048 | 0.025 |
| | Tang Jiatuo | 0.115 | 0.036 | 0.039 |
| | Tian sheng | 0.1 | 0.038 | 0.03 |
| | Lijia | 0.104 | 0.034 | 0.048 |
| | Jinyunshan | 0.049 | 0.036 | 0.014 |
| | Jiefangbei | 0.126 | 0.05 | 0.041 |
| | GaoJia Huayuan | 0.116 | 0.039 | 0.054 |
| | Yu Xin Street | 0.108 | 0.049 | 0.049 |
| | High/Low Conc. Difference | **2.6** | **1.5** | **3.9** |
| **Guangzhou** | Tianhe Kindergarten | 0.074 | 0.02 | 0.045 |
| | Municipal No. 5 Middle School | 0.091 | 0.028 | 0.065 |
| | Municipal No. 86 Middle School | 0.093 | 0.026 | 0.04 |
| | Municipal Monitoring Station | 0.067 | 0.022 | 0.061 |
| | Guangdong Business School | 0.061 | 0.021 | 0.054 |
| | Guangya Middle School | 0.091 | 0.025 | 0.063 |
| | Panyu middle school | 0.066 | 0.024 | 0.053 |
| | Huadu Shifan | 0.077 | 0.026 | 0.042 |
| | Luhu Park | 0.083 | 0.019 | 0.042 |
| | High/Low Conc. Difference | **1.5** | **1.5** | **1.5** |
| **Chengdu** | Sanheyao | 0.129 | 0.029 | 0.051 |
| | Sandaoyan | 0.065 | 0.034 | 0.023 |
| | Stadium | 0.119 | 0.025 | 0.049 |
| | Shilidian | 0.121 | 0.03 | 0.055 |
| | Liangjia Gang | 0.115 | 0.03 | 0.054 |
| | Shahepu | 0.123 | 0.026 | 0.055 |
| | Caotangsi | 0.123 | 0.028 | 0.05 |
| | Jinniu | 0.122 | 0.032 | 0.044 |
| | High/Low Conc. Difference | **2** | **1.4** | **2.4** |
| **Wuhan** | Donghu Liyuan | 0.091 | 0.037 | 0.047 |
| | Donghu Gaoxin | 0.106 | 0.045 | 0.049 |
| | Wujiashan | 0.106 | 0.041 | 0.049 |
| | Wuchang Ziyang | 0.101 | 0.055 | 0.069 |
| | Hankou Beach | 0.105 | 0.04 | 0.067 |
| | Hankou Huaqiao | 0.102 | 0.055 | 0.063 |
| | Hanyang yuehu | 0.099 | 0.039 | 0.065 |
| | Zhuankou district | 0.1 | 0.037 | 0.054 |
| | Qingshan Ganghua | 0.114 | 0.038 | 0.059 |
| | High/Low Conc. Difference | **1.3** | **1.5** | **1.5** |
| **Nanjing** | Zhonghuamen | 0.112 | 0.04 | 0.053 |
| | Xianlin University City | 0.113 | 0.033 | 0.055 |
| | Olympic Sports Center | 0.107 | 0.032 | 0.05 |
| | Zhongshan West Road | 0.105 | 0.042 | 0.056 |

| | | | | |
|---|---|---|---|---|
| | Pukou | 0.103 | 0.027 | 0.054 |
| | Xuanwu Lake | 0.107 | 0.048 | 0.058 |
| | Ruijin Road | 0.115 | 0.026 | 0.054 |
| | Caochangmen | 0.104 | 0.042 | 0.053 |
| | Manmao Bridge | 0.106 | 0.029 | 0.058 |
| | High/Low Conc. Difference | **1.1** | **1.6** | **1.2** |
| **Jinan** | Institute of Agricultural Science | 0.194 | 0.114 | 0.046 |
| | Municipal Monitoring Station | 0.147 | 0.112 | 0.054 |
| | Development Zone | 0.147 | 0.086 | 0.045 |
| | Jichuang Erchang | 0.161 | 0.115 | 0.039 |
| | Jinan Chemical Plant | 0.143 | 0.127 | 0.06 |
| | Provincial Seed Warehouse | 0.187 | 0.123 | 0.059 |
| | Kegansuo | 0.136 | 0.09 | 0.041 |
| | Changqing District Committee Party School | 0.146 | 0.096 | 0.055 |
| | High/Low Conc. Difference | **1.4** | **1.5** | **1.5** |

## 2. Seasonal Variations

Figure 2.5 and 2.7 shows seasonal variations in daily average concentration values for three different pollutants, $SO_2$, $NO_2$ and $PM_{10}$, at state controlled monitoring sites in Beijing, Tianjin, Shanghai, Chongqing, Guangzhou, Chengdu, Wuhan, Nanjing, and Jining. Winter was taken as the average of results from December, January and February. Spring was taken as the average of results from March, April and May; summer was taken as the average of results from June and July.

From the graph we can see that except for Chengdu, $SO_2$ concentrations in the eight cities were highest in the winter, then the spring, and lowest in the summer. The important difference is that in the winter coal is burned for heat and thus has a big influence on pollutant concentration levels. Regarding $NO_2$, with the exception of Beijing and Chongqing, the rest of the cities have the same patterns as for $SO_2$ concentrations. For $PM_{10}$, the five cities of Beijing, Tianjin, Shanghai, Chengdu and Nanjing have highest levels in the spring, second in the winter, and the remaining four cities' results follow the same pattern as for $SO_2$ and $NO_2$. This is probably related to the fact that sandstorms are more common in spring and create more dust in the air.

Figure 2.5 Seasonal variations in average $SO_2$ concentrations

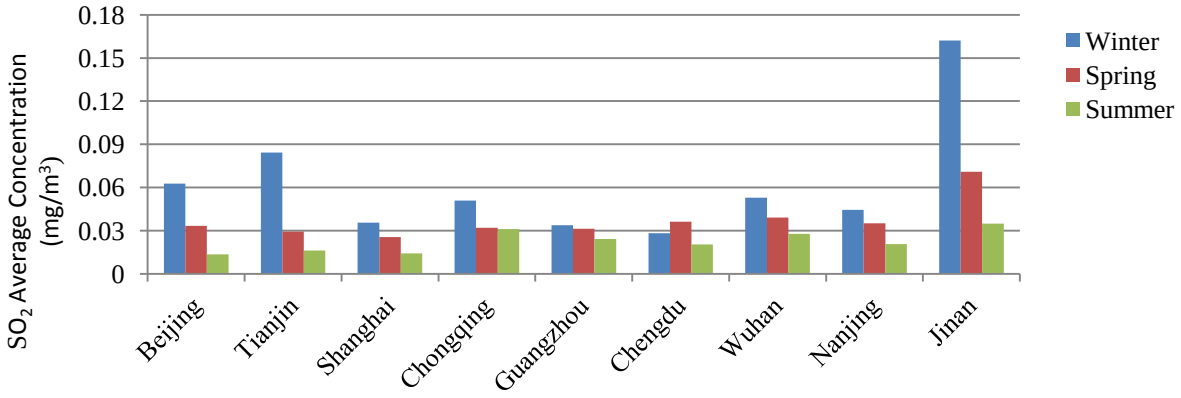



Figure 2.6 Seasonal variations in average $NO_2$ concentrations

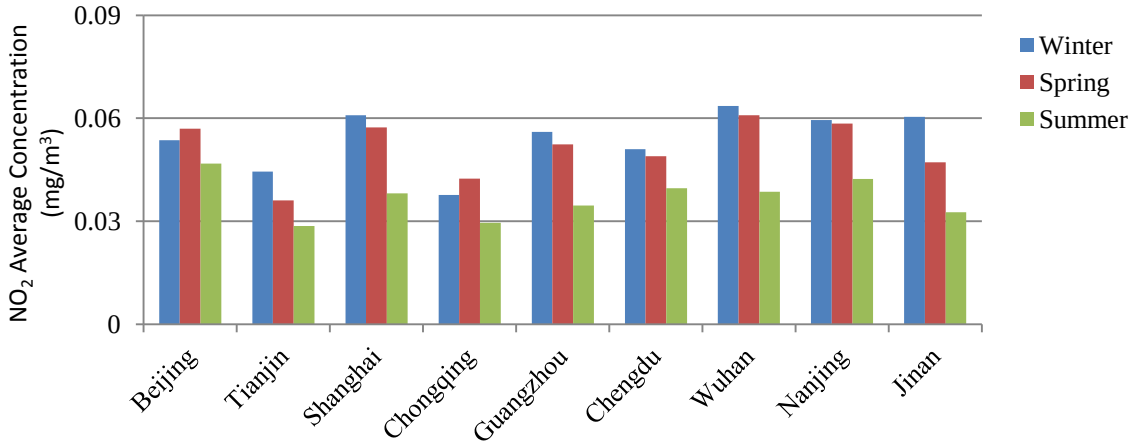
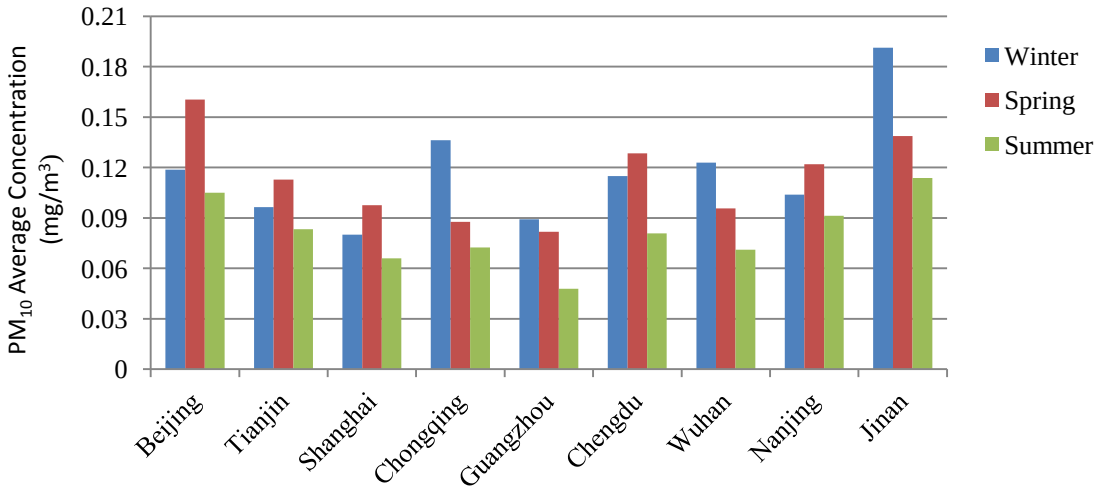



Figure 2.7 Seasonal variations in average $PM_{10}$ concentrations



## 3. Patterns of variation over time

Figure 2.8 and 2.9 show the average hourly values from the state controlled monitoring sites over a 24 hour period for both $NO_2$ and $PM_{10}$ in the cities of Beijing, Tianjin, Shanghai, Chongqing, Guangzhou, Chengdu, Wuhan, Nanjing, and Jinan. The graph shows a clear double peak during the 24 hours for both $NO_2$ and $PM_{10}$. The peaks can be seen first before and after nine in the morning then before and after nine in the evening, mainly due to emissions and dust created by traffic.

Figure 2.8 Patterns in average $NO_2$ concentrations

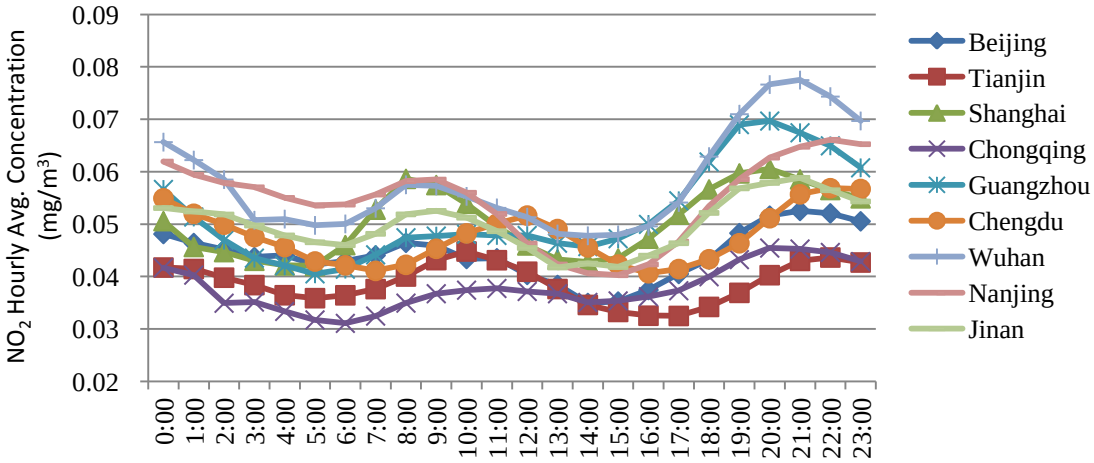
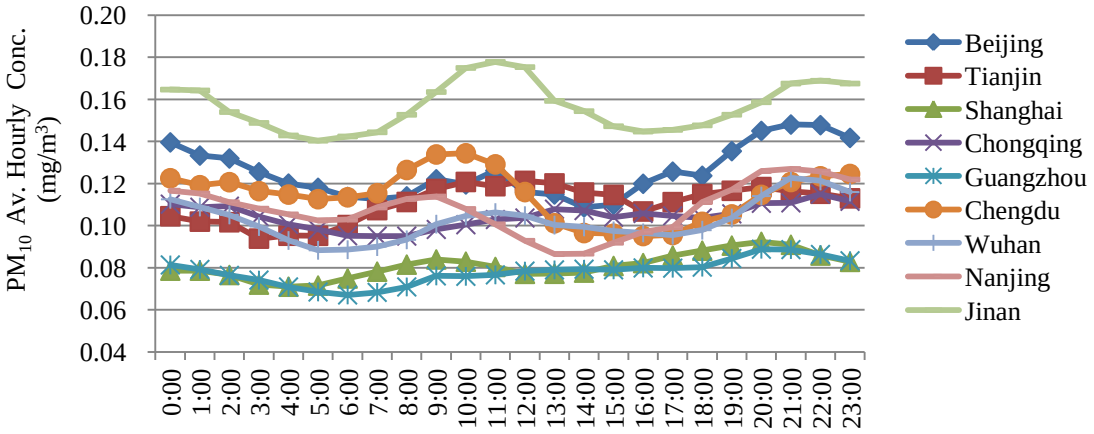



Figure 2.9 Patterns in average $NO_2$ concentrations




## 4. Characteristics of Regional Pollution

Figure 2.10, 2.11 and 2.12 show differences in average monthly concentrations for $SO_2$, $NO_2$ and $PM_{10}$ from state controlled monitoring sites in Beijing, Tianjin and Shijiazhuang (Beijing, Tianjin and Hebei region), Shanghai, Hangzhou, and Nanjing (Yellow River Delta region), Guangzhou, Shenzhen and Foshan (Pearl River Delta Region). It can be seen on the graph that the overall trend for the three pollutants in these three areas appears consistent. This reflects the regional nature of China's urban air pollution and so in order to control urban air pollution, different areas need to cooperate in order to achieve effective improvements in air quality.

Figure 2.10 Variations in monthly average concentrations for Beijing, Tianjin and Shijiazhuang

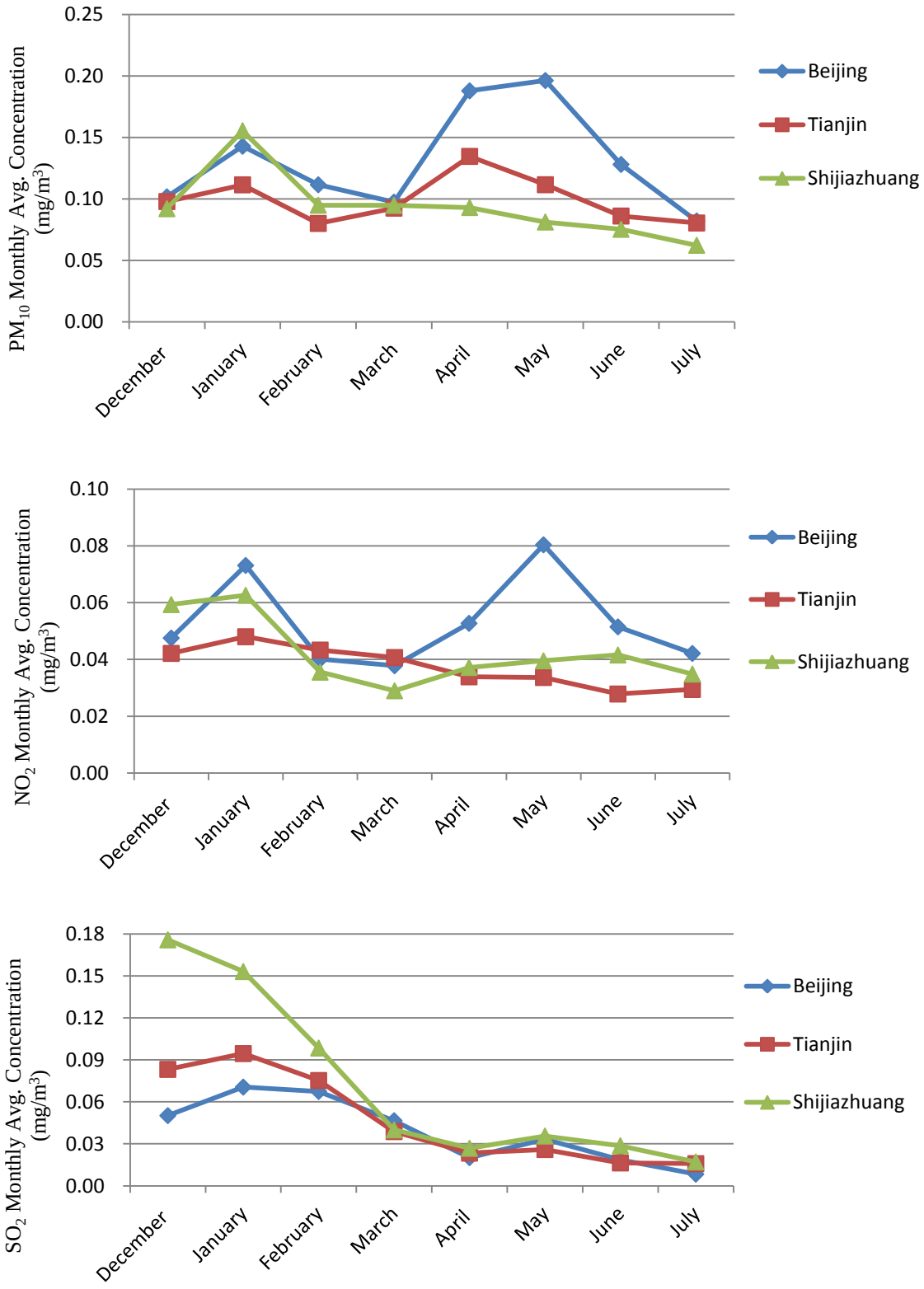


Figure 2.11 Variations in monthly average concentrations for Shanghai, Hangzhou and Nanjing

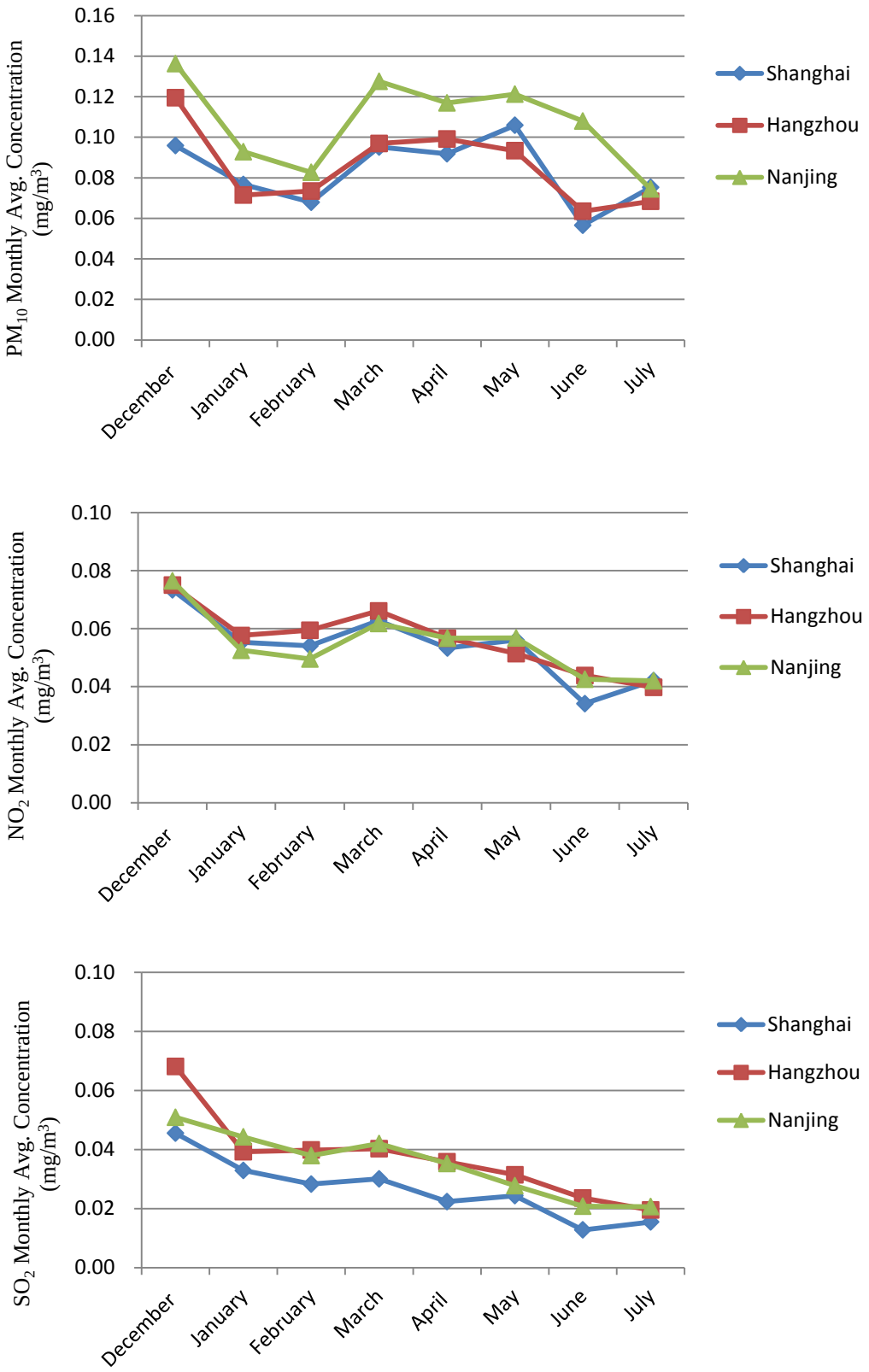
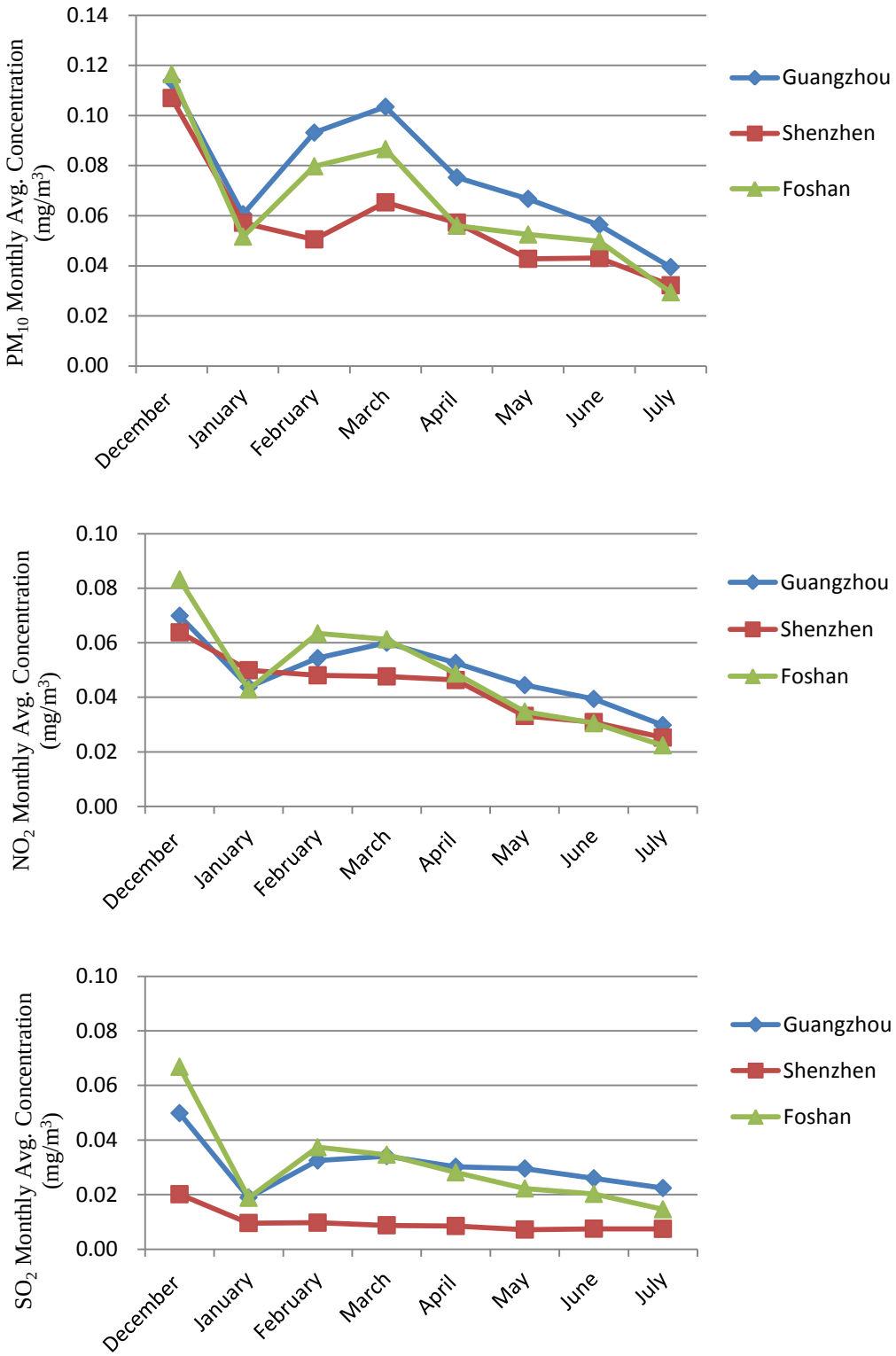


Figure 2.12 Variations in monthly average concentrations for Guangzhou, Shenzhen and Foshan



# Part 3. 2012 AQTI Evaluation Findings and Recommendations

## Key Findings

1. The overall level of air quality information disclosure has improved

a) The increase in scores is mainly due to substantial improvements in a few areas

b) The difference between high scoring Chinese cities and international cities has been reduced

c) Many areas still have low scores

2. Significant improvements have been made to air pollution information disclosure legislation

3. Information disclosure has shown that some areas have severe atmospheric pollution problems

## Main Recommendations

1. Levels of air pollution information disclosure should be further increased

2. Practical contingency plans for heavily polluted days should be urgently formulated and implemented

3. People in all sectors should use publically disclosed data to carry out more research