Air Quality Information Transparency Index

A Threat To Public Health: China's Urban Air Quality Disclosure Needs Urgent Improvement

—— 2010 Annual Urban Air Quality Transparency Index (AQTI) Results and Comparative Study of 20 Domestic and 10 International Cities.

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RUC Law (Renmin University of China School of Law)

Renmin University of China School of Law was the first formal institution of higher education for the study of law created after the founding of the People's Republic of China. Since its establishment in 1950, the school has endured 60 years of ups and downs, trials and tribulations, and has never once stopped its work. It has hence been termed the "cradle" of Chinese legal scholars. When the Ministry of Education announced their official national academic rankings, Renmin University of China School of Law was ranked first in the nation amongst law schools. In addition, the school has started to be ranked among the top law schools in the world.

IPE (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.

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Contents

Abstract

In recent years, air pollution has become one of the most pressing environmental problems faced by Chinese cities. Bad air quality not only impacts the lives of hundreds of millions of urban residents but also threatens their health and safety.

China is undergoing a period of rapid industrial and urban development, which is largely the cause of air pollution in many of its cities. Many western countries also experienced air pollution incidents during their development, such as the London Smog Disaster of 1952, photochemical smog in Los Angeles, and air pollution in Japan during the 1960s that resulted in what has become known as Yokkaichi asthma, a severe pulmonary condition. Incidents of air pollution such as these, which have entered environmental history, seriously impacted public health.

As a result of long-term efforts, urban air quality and overall environmental quality in western nations has improved significantly. Since the late 1980s, practice has shown that environmental information disclosure has become an important means of environmental management. By improving the monitoring, collection and public disclosure of urban air quality information, it is possible to raise public awareness of air pollution problems, thereby promoting improvements in air quality as well as preventing or lowering the risk that air pollution poses to public health.

Currently, China has not yet formulated a comprehensive national air pollution and health monitoring network. The collection and disclosure of information regarding urban atmospheric environmental quality is still unable to meet the needs of the public to protect their health. We believe that, in regards to air quality information disclosure, it is necessary to refer to existing international best practices.

In order to gain a more accurate understanding of China's existing air quality information disclosure standards, we developed the Urban Air Quality Information Transparency Index (AQTI). We evaluated the status of air quality information disclosure during 2010 in Beijing, Shanghai, Guangzhou and seventeen other Chinese cities based on how systematic and timely data was monitored and disclosed, and on the comprehensiveness and user-friendliness of the information given. We also selected New York, Paris, and eight other international cities as a reference group in order to carry out a comparative analysis.[1]

This comparative analysis of the AQTI results for domestic and international cities showed that there were obvious disparities between air quality disclosure methods. We hope to be able to identify and summarize domestic and international cases of good practice, as well as offer suggestions to improve air quality information disclosure for Chinese cities.

Trial operation of the air quality announcement system for key cities began in late 2010, allowing for substantial improvement of the timeliness and comprehensiveness with which information is published. This demonstrates the determination of the Chinese government to improve air quality information disclosure. We believe that an increase in environmental information disclosure will form a consensus that will lead to an improvement in China's air quality.

[1] The data used for this project was generally collected before the end of September 2010. The annual report information used for the 2010 AQTI evaluation targets generally use data from 2009. Because the averages for the annual report for Vienna, Austria, however, are released at the end of the year, the project group evaluated projected data from September, 2010.

Chapter 1
The Establishment of the AQTI Index System

When establishing the urban air quality transparency evaluation system, the following factors needed to be taken into consideration:

- Which atmospheric pollutants should be disclosed.
- The weight that should be given to each pollutant.
- How each pollutant should be evaluated.

Section 1. The Selection of Atmospheric Pollutants

When the goal of developing air quality information disclosure is to prevent and solve environmental health issues, it is necessary to first identify which pollutants should be disclosed. We believe that the following four factors are the most important to consider when selecting which pollutants should be included in air quality information disclosure.

- 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 in developed countries (or regions).
- The situation of, and the development trends for, urban atmospheric pollutant monitoring in China.

1. Potential Health Impacts of Atmospheric Pollutants

Since the 1950s, international organizations and countries around the world have studied the danger that airborne pollutants pose to human health. A wealth of research material and accumulated data has clearly shown that air pollutants have adverse effects on human health. According to recent international research on air pollution (European Commission 2005, U.S. Environmental Protection Agency 2006, The World Health Organization 2006; Department of Environment, Food & Rural Affairs 2007), potential health impacts can be divided into acute short-term and chronic long-term conditions. Short-term exposure is generally considered as having a duration between one hour and one day. Chronic health impacts generally re-occur throughout a typical lifespan of 70 years. Table 1.1 shows a partial summary of research results on the short-term and long-term health impact of different air pollutants.[2]

Chart 1.1 Major Air Pollutants: Long-Term & Short-Term Health Effects

Pollutant	Health Impacts from Short-Term Contact	Health Impacts from Long-Term Contact
Ozone (O_3)	* Increased lung inflammation * Increased lung permeability * Increased respiratory symptoms * Reduction in mucociliary clearance	* Reduction in children's lung capacity
Suspended Particles (PM_{10}\$PM_{2.5}$)	* Lung inflammation * Respiratory symptoms * Adverse effects on the cardiovascular system * Increased need for medication * Increased likelihood of hospitalization * Increased chance of short-term morality rate	* Increased cardiopulmonary and lung cancer mortality rate * Increased lower respiratory symptoms and reduction in child lung capacity * Increase in chronic obstructive pulmonary disease, and reduced lung function in adults
Nitrogen Dioxide (NO_2)	* Changes in asthma patients' lung function * Increased bronchial sensitivity in asthma patients	* Reduced lung capacity * Increased risk of respiratory symptoms
Sulfur Dioxide (SO_2)	* Changes in the pulmonary function and respiratory symptoms of asthma patients	* Increased mortality rate
Carbon Monoxide (CO)	* Causes fatigue * Causes chest pain in heart disease patients * Impaired vision and coordination * High concentrations can lead to death	* Impacts the cardiovascular system * Impacts the central nervous system
Volatile Organic Compounds (VOCs)	* Irritation to the eyes and skin * Respiratory symptoms * Gastrointestinal symptoms * Very high concentrations can cause unconsciousness	* Impacts the liver and kidney * Impacts the central nervous system * Some VOC's are carcinogenic
Lead (Pb)	* Can lead to Pb poisoning, especially in children * Increased blood pressure	* Impacts the central nervous system * Affects renal function * Affects the reproductive system
Benzo[a] pyrene (B[a]P)	* Irritates the eyes and skin	* Known to be carcinogenic * Known to be teratogenic * Known to be mutagenic
Mercury (Hg)	* High Hg levels in blood and urine * Hg poisoning (Abdominal pain, diarrhea, blood in urine)	* Neurological symptoms * Can cause stomatitis * Causes tremors
Dioxins	* Can cause digestive disorders * Can lead to liver damage * Can damage the skin and skin derivatives	* Disrupts normal endocrine processes * Known to be carcinogenic * Can lead to immunotoxicity * Affects the reproductive system

[2] See Hong Kong Environmental Protection Department: "Review of Hong Kong Air Quality Indexes and Long-Term Air Quality Management Strategies – Feasibility Study," Arup Inc., 07/2009, pg. F1, http://www.epd.gov.hk/epd/tc_chi/environmentinhk/air/studyrpts/files/appendix_f_ch.pdf

2. The Status of China's Urban Air Pollution

China's reliance on coal in the energy sector has not yet undergone any fundamental change. Coal smoke pollution comprises the main long-term pollution type. Sulfur dioxide (SO_2) and total suspended particle (TSP) pollution problems in the air of urban areas have not been comprehensively resolved. At the same time, the number of motor vehicles continues to rise, increasing the severity of exhaust pollution. Air pollution problems such as haze, photochemical smog and acid rain are becoming more prominent day by day. At present, sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter (TSP, PM_{10}, $PM_{2.5}$), carbon monoxide (CO), ozone (O_3), lead (Pb) and benzo[a]pyrene (B[a]P) are the pollutants that have the most obvious effects on the health of Chinese citizens.

2.1 Sulfur Dioxide (SO_2)

China's SO_2 problem has not been completely resolved; some higher-tier cities still have serious pollution problems. According to the 2001-2008 "State of the Environment in China" reports, the average daily concentration of SO_2 in urban air was between 1-389μg/m³. Starting in 2005, however, the nationwide urban maximum average daily concentration value gradually started to decrease, with an average value of 40μg/m³ in 2008.[3]

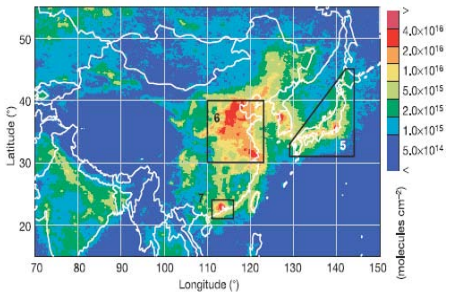
Chart 1.2 SO_2 Concentration Levels in China's Ambient Air (Concentration Units: μg/m³)[4]

Year	2001	2002	2003	2004	2005	2006	2007	2008
Number of Data Sets (Cities)	341	343	340	342	522	559	557	519
Concentration Range	1~384	2~303	2~283	1~284	1~389	1~167	1~130	1~105
Cities Meeting the Standards (%)	80.7	77.6	74.4	74.3	81.8	83.8	85.6	89.4
National Average Concentrations	45	43	49	49	42	56	52	40
Key Cities' Average Concentrations	52	51	63	63	57	53	52	48

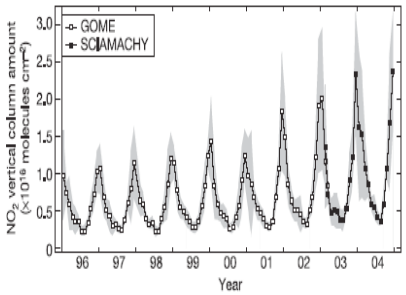
2.2 Nitrogen Dioxide (NO_2)

According to the Ministry of Environmental Protection's "Environmental Quality Report," since 2001 the average daily NO_2 urban air concentration in China fluctuated between 2 and 77μg/m³. However, there has been no great change in nationwide annual averages. All of the cities reported reached the National Ambient Air Quality Level Two Standard (since 2000 the annual average value for the Level Two Standard has been relaxed from 40μg/m³ to 80μg/m³). Documentation and satellite data make clear, however, that there is a large area of NO_2 pollution in China's eastern regions and Pearl River Delta region (Figure 1.1)[5](Ritcher et al., 2006), and that atmospheric NO_2 burdens are increasing rapidly in Beijing, Tianjin, Hebei Province, the Yangtze River Delta and the Pearl River Delta region.

Figure 1.1 Satellite Observations: Increase of NO_2 Concentrations in Eastern China



(a) NO_2 Density Distribution

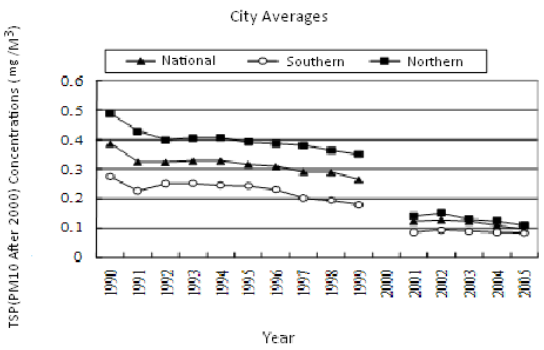


(b) Monthly Average NO_2 Concentrations

2.3 Particles (TSP, PM_{10}, $PM_{2.5}$)

At present, the particulate pollution in China's ambient air is very serious, with not only high levels of TSP concentrations but also comparatively high levels of PM_{10} and $PM_{2.5}$ concentrations. According to the "State of the Environment in China" reports, in general there was a distinct decline in TSP matter in over 300 cities nationwide. In 1999, the average TSP concentration in cities belonging to the national air quality monitoring network was 31.8% lower than in 1990. For nationwide urban TSP concentrations from 1990 to 1995, and PM_{10} concentration changes from 2001 to 2005, see Figure 1.2 and Figure 1.3.

Figure 1.2 Changes in National Urban PM_{10} Concentrations (1990-2005)



[3] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up . http://www.zhb.gov.cn/gkml/hbb/bgth/201011/t20101130_198128.htm
[4] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up http://www.zhb.gov.cn/gkml/hbb/bgth/201011/t20101130_198128.htm
[5] Richter, A., Burrows, J. P., Nüß, H., Granier, C, Niemeier, U.. Increase in tropospheric nitrogen dioxide over China observed from space. Nature, 437, 129-132, doi: 10.1038/nature04092, 2005

Figure 1.3, Figure 1.4 and Figure 1.5 show China's TSP, PM_{10} and $PM_{2.5}$ concentration levels.[6] They illustrate the severity of China's ambient airborne particulate pollution; TSP concentration levels are very high, as are PM_{10} and $PM_{2.5}$ concentration levels.

Figure 1.3 Annual Average TSP Concentrations for China's Major Cities[7]

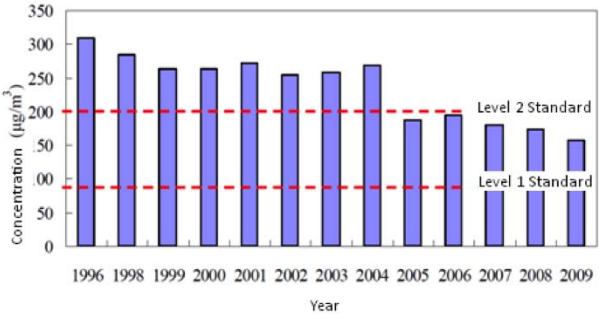


Figure 1.4 Annual Average PM_{10} Concentrations for China's Major Cities[8]

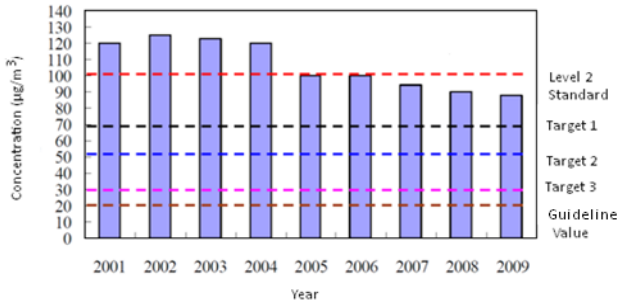
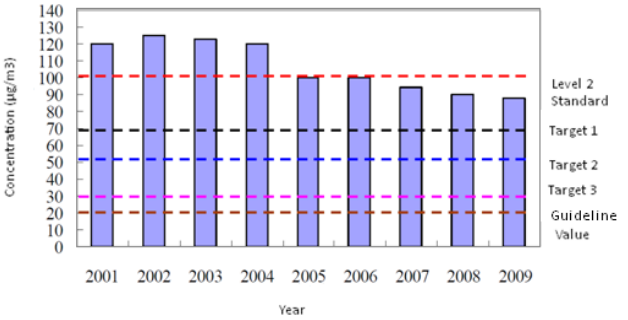


Figure 1.5 Annual Average $PM_{2.5}$ Concentrations for China's Major Cities[9] (Based on 50% of Annual Average PM_{10} Concentration)



According to the 2001-2008 "State of the Environment in China" reports, China's annual urban PM_{10} daily average concentrations were between 88 and 125μg/m³. Since 2005, the average has been lower than the National Ambient Air Quality Level Two Standard. It has been higher than the WHO's guidelines, however, as well as the three interim targets (above). For China's 2001-2008 PM_{10} ambient air concentration levels, see Chart 1.3 and Figure 1.4.[10]

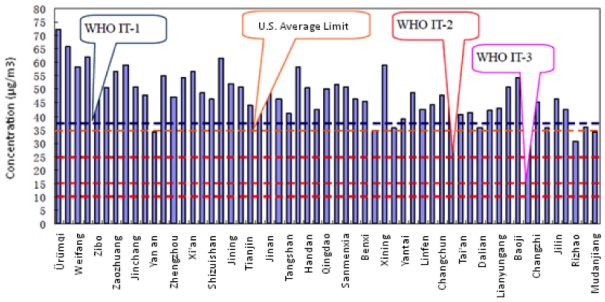
Chart 1.3 PM_{10} Concentration Levels in China's Ambient Air (Concentration units: μg/m³)[11]

Year	2001	2002	2003	2004	2005	2006	2007	2008
Number of Data Sets (Cities)	73	164	227	275	399	559	557	519
Concentration Range	35~260	31~493	22~490	8~440	7~339	120~363	22~496	14~216
Cities Meeting the Standards (%)	46	36	43.2	48	64.2	66.4	78.3	84.4
National Average Concentrations	–	124	113	107	99	100	94	90
Key Cities' Average Concentrations	116	126	120	115	100	100	94	89

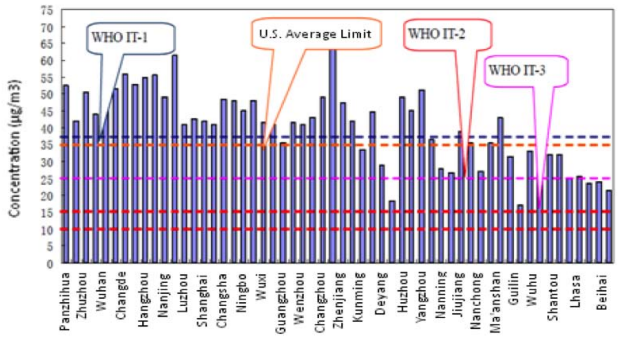
At present there is still no data for national urban atmospheric $PM_{2.5}$. According to the WHO, in developing countries the proportion of $PM_{2.5}$ found within PM_{10} readings is 50%. Using this calculation, Figure 1.6 shows $PM_{2.5}$ values in ambient air in the 113 cities during 2008. See Chart 1.4 for a description of which of the 113 cities met the WHO standards and which did not. It can be seen that in 2008 the $PM_{2.5}$ concentration levels for the 113 key cities all exceeded the WHO Interim Target 1 and the WHO guidelines. Only 19 cities attained the WHO Interim Target 1 and six cities attained the WHO Interim Target 2.[12]

Figure 1.6 113 National Key Cities $PM_{2.5}$ Ambient Air Quality Status (2008)[13]

a) Northern Cities



b) Southern Cities



[6] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[7] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[8] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[9] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[10] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[11] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[12] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[13] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).

Chart 1.4 113 National Key Cities $PM_{2.5}$ Ambient Air Quality Status (2008) [14]

WHO Targets	Interim Target -1 (35μg/m³)	Interim Target -2 (25μg/m³)	Interim Target- 3 (15μg/m³)	Guideline (10μg/m³)
Cities that reached the standards	Guilin, Liuzhou, Haikou, Zhanjiang, Beihai, Zhuhai, Lhasa, Shaoguan, Nanchong, Nanning, Deyang, Rizhao, Shenzhen, Quanzhou,Shantou, Mianyang, Kunming, Yan'an, Mudanjiang	Guilin, Liuzhou, Haikou, Zhanjiang, Beihai, Zhuhai	None	None
Cities that did not reach the standards	94	107	113	113

2.4 Ozone (O_3)

The areas in China with atmospheric monitoring stations for background ozone are: Shangdianzi in Beijing, Longfengshan in Heilongjiang, Lin'an in Zhejiang and Waliguan in Qinghai. From 1994 to 2002, Waliguan's ground-level O_3 concentrations were around 102μg/m³, and showed a trend of year over year increases. The monthly average ground-level O_3 concentration readings from the Longfengshan monitoring station were 75μg/m³, with the highest value reaching 93μg/m³.[15] From December 2003 to November 2004, the Lin'an atmospheric background monitoring station ground-level O_3 annual average concentration was 69μg/m³, with the highest monthly average concentration reading occurring in summer at 100μg/m³.[16]

Given that China has not implemented national O_3 air quality monitoring, at present there is still no national data for O_3 concentration levels in ambient air. In 2001 and 2002, the hourly concentrations in Beijing were between 14.4 and 232μg/m³, with an average of 88.9μg/m³. Widespread O_3 pollution and related pollution in Beijing and its peripheral areas, as well as in the Yangtze and Pearl River Deltas, is becoming an increasingly serious environmental problem.[17]

Research has shown that there are now frequent and widespread occurrences of photochemical smog pollution and high concentrations of O_3 pollution in the Beijing area, the Yangtze River Delta and the Pearl River Delta, with the maximum hourly O_3 concentration levels often exceeding 240ppb (European Alert Level). These results indicate that atmospheric O_3 concentrations will continue to rise in the future.

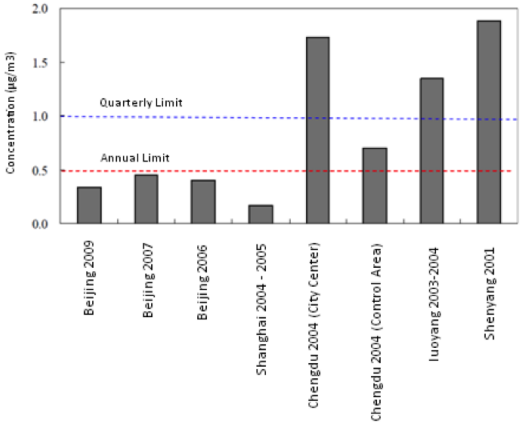
2.5 Carbon Monoxide (CO)

Given that China has not implemented routine CO monitoring, there is no widely available national CO concentration level data. According to the Beijing daily air quality reports, from 2001 to 2002 the hourly CO concentration for the region was between 0.8 and 56.5μg/m³, with an average concentration of 4.75μg/m³.[18]

2.6 Lead (Pb)

Even though China established air quality standards for Pb in the "Ambient Air Quality Standards" (GB 3095-1996), many areas throughout the country have not yet started Pb monitoring. According to survey data listed in several documents, the atmospheric Pb concentration levels in Chinese urban areas are generally higher than those of foreign developed nations. In addition, there are large differences between atmospheric Pb concentration levels in cities across the country. The atmospheric Pb concentration in Shanghai, Beijing and other large cities is rather low, while the atmospheric Pb concentration in some industrial cities is comparatively higher and even exceeds the 1.0μg/m³ annual average limit laid out in current national environmental air quality standards.[19]

Figure 1.7 Pb Concentrations in Selected Cities[20]



2.7 Benzo[a]pyrene (B[a]P)

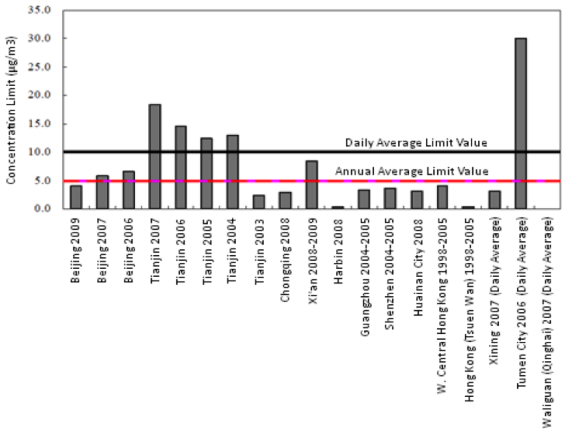
Documentation shows that the concentration of B[a]P in the air of Tumen and Tianjin exceeds the B[a]P concentration limit of 10ng/m³ stipulated by ambient air quality standards. Monitoring data from 2003 to 2007 show that the concentration of B[a]P in Tianjin's air is gradually increasing. Monitoring data for Qinghai, Chongqing, Guangzhou and Shenzhen show that the concentration of B[a]P in the air of these cities is lower than current air quality standards (see Chart 1.5 & Figure 1.8).[21]

[14] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[15] The explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up did not state the reference time period for the reorganization of data.
[16] ibid.
[17] ibid.
[18] ibid.
[19] ibid.
[20] ibid.
[21] ibid.

Chart 1.5 B[a]P Concentrations in China[22]

Area	Monitoring Period (Yr)	Concentration (ng/m³)	Area	Monitoring Period (Y)	Concentration (ng/m³)
Beijing	2009	4	Harbin	2008	0.35
	2007	5.9	Guangzhou	2004-2005	3.35
	2006	6.6	Shenzhen	2004-2005	3.67
Tianjin	2007	18.4	Huainan	2008	3.01
	2006	14.5	Hong Kong	1998-2005	4 (Central & Western China)
	2005	12.4			0.377 (Tsuen Wan)
	2004	12.9	Xining	2007	3.05453 (Daily Average)
	2003	2.4	Tumen	2006	30 (Daily Average)
Chongqing	2008	3	Waliguan (Qinghai)	2007	0.04151 (Daily Average)
Xi'an	2008-2009	8.31			

Figure 1.8 B[a]P Ambient Air Quality Status in Selected Cities[23]



3. International Organizations and Cities in Developed Countries: Ambient Air Quality Information Disclosure Procedures

The main pollutants in international ambient air quality standard regulations are generally SO_2, NO_2, PM_{10}, CO, O_3 and Pb. The majority of developed nations use $PM_{2.5}$ as a new control measurement, replacing the traditional TSP measurement. The European Union, Japan and others consider benzene (Ph–H) and other toxic and harmful VOCs as pollutants and are imposing regulations.

Chart 1.6 International Revisions in Ambient Air Quality Standards[24]

Country, Region, Organization	Year	Amendment
WHO	1997	Published the Global "Air Quality Guidelines (AQG)," adding 1,3-Butadiene along with other pollutants.
	2005	Published the "WHO Air Quality Guidelines Global Update 2005," amending guideline values for PM_{10}, $PM_{2.5}$, O_3, NO_2 and SO_2.
U.S.A.	1997	Published the standards for $PM_{2.5}$, setting the daily average concentration limit value at 65μg/m³ and the annual average concentration limit value at 65μg/m³.
	2006	Amended the $PM_{2.5}$ standard, setting the daily average concentration limit value as 35μg/m³ and cancelled the average concentrations limit value for annual PM_{10}.
	2008	New measures brought the O_3 concentration limit value to 160μg/m³; tightened the concentration limit value of Pb, lowering it to 0.15μg/m³ after March.
	2010	Added a daily maximum hourly average NO_2 concentration limit value of 190μg/m³.
E.U.	1999	Published the "First Daughter Directive (1999/30/EC)," stipulating the limit values for five pollutants: NO_X NO_2, SO_2, Pb and PM_{10}.
	2000	Published the "Second Daughter Directive (2000/69/EC)," stipulating the limit values for Benzene and CO.
	2002	Published the "Third Daughter Directive (2002/3/EC)," related to O_3, with separate stipulations to meet the 2010 targets for O_3 for the protection of human health and plants.
	2004	Published the "The Fourth Daughter Directive" relating to arsenic (As), cadmium (Cd), mercury (Hg,) nickel (Ni) and polycyclic aromatic hydrocarbons (PAHs), stipulating their 2012 target concentration limit values.
	2008	Published the Directive (2008/50/EC) "Ambient Air Quality & Cleaner Air for Europe," which stipulated the $PM_{2.5}$ concentration limit value target for 2010 at 25μg/m³.
Japan	1997	Raised the standards for Ph–H, trichloroethylene (TCE) and Perchloroethylene (PCE).
	1999/2001/2009	Separately increased the standards for dioxin, methylene chloride (Dichloromethane / DCM) and $PM_{2.5}$.
India	2009	Amended the 1986 measures for air quality standards, removing TSPs and adding $PM_{2.5}$, benzene, B[a]P, arsenic, and nickel, while tightening the concentration limit values on SO_2, NO_2, PM_{10}, O_3 and Pb.
Australia	1998	Based on health factors, adjusted the air quality standards of CO, NO_2, O_3, SO_2, Pb and PM_{10}.
	2003	Brought $PM_{2.5}$ into the air quality standards, setting the daily and annual average concentration limit value at 25.8μg/m³.
Canada	1998	Raised the concentration reference value for $PM_{2.5}$.
P.R.C. (Hong Kong)	2009	Reviewed the existing 2007-2009 standards and proposed amendments to the bill for new air quality standards based on the latest WHO air quality guidelines, raising the $PM_{2.5}$ standard.
P.R. China	2000	Cancelled the NO_X standard; raised the NO_2 Level 2 standard to level 3; adjusted the O_3 Level 1 standard concentration limit value from 0.12μg/m³ to 0.16μg/m³ and adjusted the Level 2 standard concentration limit value from 0.16μg/m³ to 0.20μg/m³.

[22] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[23] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).
[24] An 'X' does not exclude annual reports or summaries that were published late."

Chart 1.7 Pollutants Regulated by National and Regional Air Quality Standards

County, Region, Organization	Pollutants Regulated by National and Regional Air Quality Standards
P.R. China	
Mainland	SO_2, CO, NO_2, O_3, PM_{10}, TSP, Pb, B[a]P, Total Fluoride
Taiwan	SO_2, CO, NO_2, O_3, PM_{10}, TSP, Pb
Hong Kong	SO_2, CO, NO_2, O_3, PM_{10}, TSP, Pb
Developed Countries	
E.U.	SO_2, CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, Pb, B[a]P, Arsenic, Cadmium, Nickel
U.S.A.	SO_2, CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, Pb,
U.K.	SO_2, CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, Pb, Benzene, 1,3 -butadiene, polycyclic aromatic hydrocarbons
Australia	SO_2, CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, Pb
Norway	SO_2, CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, Fluoride
Germany	SO_2, CO, NO_2, O_3, PM_{10}, Pb, Benzene
Canada	SO_2, CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, Pb, Arsenic, Cadmium, Nickel, Vanadium, Hg, Fluoride (gaseous), Total Fluoride, Hydrogen Sulfide, Sulfate, Oxide, Suspended Particulate Matter, Dust
Japan	SO_2, CO, NO_2, Photochemical oxidants, PM_{10}, VOC (Benzene, TCE, PCE, Methylene Chloride), Dioxins (PCDDs, PCDFs & coplanar PCBs)
S. Korea	SO_2, CO, NO_2, O_3, PM_{10}, TSP, Pb, Benzene
Developing Countries	
Mexico	SO_2, CO, NO_2, O_3, PM_{10}, $PM_{2.5}$
India	SO_2, CO, NO_2, O_3, PM_{10}, TSP, Pb
Indonesia	SO_2, CO, NO_2, O_3, PM_{10}, TSP, Pb
Nepal	SO_2, CO, NO_2, PM_{10}, TSP, Pb
Philippines	SO_2, CO, NO_2, O_3, PM_{10}, TSP, Pb
Singapore	SO_2, CO, NO_2, O_3, PM_{10}
Sri Lanka	SO_2, CO, NO_2, O_3, TSP, Pb
Thailand	SO_2, CO, NO_2, O_3, PM_{10}, TSP, Pb
Vietnam	SO_2, CO, NO_2, O_3, TSP, Pb
Organizations	
W.H.O.	Includes 35 pollutants (2nd Edition): 16 Types of Organic Pollutants: such as CO, Benzene, Toulene, PCBs and PAHs. 12 Types of Inorganic Pollutants: such as, Arsenic, Asbestos, Cadmium, Chromium, Gaseous Fluoride, Hydrogen Sulfide, Pb and Nickel. Indoor Air Pollutants: Environmental Tobacco Smoke (ETS), Man-Made Glass Fibers and Radon. Typical Pollutants: NO_2, $O_3$and other Photochemical Oxidants as well as Particulate Matter and SO_2.

The WHO air quality standards regulate many air pollutants that we will not compare in this evaluation. The most commonly monitored air pollutants around the world are SO_2, NO_2, O_3, PM_{10}, CO, and Pb. Developed countries commonly add $PM_{2.5}$ to this list. More specifically:

1) The key pollutants commonly regulated by international air quality standards are SO_2, NO_2, O_3, CO, PM_{10}, and Pb.

2) A majority of developed countries have begun to regulate $PM_{2.5}$ in place of TSP.

3) Developing countries and regions (especially in Asia) continue to regulate TSP and have not begun regulation of $PM_{2.5}$.

4) The European Union, United Kingdom, Germany, and Japan also commonly monitor VOCs, polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzodioxins/ dibenzofurans (PCDDs, PCDFs) and other poisonous or harmful pollutants.

5) The European Union and Canada also regulate Arsenic, Cadmium, Nickel and other heavy metals produced from burning coal or found in vehicle emissions.

6) A small number of countries regulate fluoride under air quality control policy.

It should be explained that in the past few years the United States, the WHO, and other developed countries and organizations, have carried out systematic research on the sources of $PM_{2.5}$ and PM_{10}, as well as on their effect on the environment and on human health. Moreover, this research was compared to that done on PM_{10} and it was determined that the category of respirable particles needed to be divided into separate sub-categories; coarse particles ($PM_{2.5\text{-}10}$) and fine particles ($PM_{2.5}$), each with their own air quality standards.

Chart 1.8 refers to statistics listed on official government websites and shows some major world cities and the actual status of their air quality information disclosure programs.

Chart 1.8 Pollutants Included within Major World Cities' Air Quality Information Disclosure

Country	City	PM10	PM2.5	SO2	NOX	NO2	CO	O3	VOCs	Pb	Hg	B[a]P	Dioxins
U.S.A.	New York	√	√	√	√	√	√	√	√	√	√	X	X
	Los Angeles	√	√	√	√	√	√	√	√	√	X	X	X
	Houston	√	√	√	√	√	√	√	√	√	√	X	X
	Pittsburgh	√	√	√	X	√	√	√	√	√	√	X	X
	San Francisco	√	√	√	√	√	√	√	√	√	√	X	X
	Chicago	√	√	√	√	√	√	√	√	√	√	X	X
U.K	Manchester	X	√	√	√	√	X	√	√	√	√	X	X
	London	√	√	√	√	√	√	√	√	√	√	√	√
	Aberdeen	√	√	√	√	√	√	√	√	X	X	X	X
	Edinburgh	√	√	√	√	√	√	√	√	X	X	√	X
Russia	Moscow	√	√	√	√	√	√	√	√	X	X	√	X
	St. Petersburg	√	X	√	√	√	√	√	X	X	X	√	X
	Rostov	√	X	√	√	√	√	√	√	√	X	√	X
	Khabarovsk	√	X	√	√	√	√	X	√	X	X	√	X
Germany	Berlin	√	√	√	√	√	√	√	√	√	X	√	X
	Hamburg	√	√	√	√	√	√	√	√	X	X	X	X
Austria	Vienna	√	√	√	√	√	√	√	√	√	X	√	X
Japan	Tokyo,	√	√	√	√	X	√	X	√	√	√	X	X
	Yokohama	√	√	√	√	X	√	X	√	√	√	X	X
	Osaka	√	X	√	√	X	√	X	√	√	√	X	X
	Kyoto	√	X	√	√	X	√	X	√	√	√	X	X
	Fukuoka	√	√	√	√	X	√	X	√	√	√	X	X
China	Hong Kong	√	X	√	√	√	√	√	√	√	X	√	√
France	Paris	√	√	√	√	√	√	√	√	√	X	√	X
Mexico	Mexico City	√	√	√	X	√	√	√	√	√	X	X	X
India	New Delhi	√	√	√	√	√	√	√	X	X	X	X	X

"√"Included; "X" Not included.[25]

By comparing the data in Chart 1.8, we can see that:

1) Every major city in developed countries publishes information for SO_2, NO_2, O_3, CO, PM_{10}, $PM_{2.5}$ and Pb, as required by their national air quality standards.

2) Some cities in developed countries not only publish the pollutants set out in their national air quality standards, they also release data for pollutants such as VOCs (i.e.; benzene), Polycyclic Aromatic Hydrocarbons (PAHs, i.e.; B[a]P), heavy metals (i.e.; Hg), and dioxins (i.e.; PCDD's and PCDFs).

4. China's Urban Atmospheric Pollutant Control, Monitoring Status and Developments

4.1 Current Monitoring Status

China's current air quality standards give control limit values for ten pollutants. However, across the country the air pollutants that are currently monitored are still only SO_2, NO_2, and PM_{10}. These are used as the basis for urban air quality daily monitoring reports, forecasts and for establishing air quality monitoring networks. In the past few years there has been a progressive development of O_3 monitoring in some cities.

Chart 1.9 National Ambient Air Quality Monitoring Network

Required Category	Optional Category
Sulfur Dioxide (SO_2)	Total Suspended Particles (TSP)
Nitrogen Dioxide (NO_2)	Lead (Pb)
Respirable Particulate Matter (PM_{10})	Fluoride (F)
Carbon Monoxide (CO)	Benzo[a]Pyrene
Ozone (O_3)	Toxic Organic Compounds

4.2 Development Trends of China's Environmental Monitoring Management

During the period of the "12th Five Year Plan" China's urban atmospheric quality monitoring trends will be as follows:

1) The monitoring network will be laid out based on population density distribution to increase and optimize the distribution of urban monitoring sites in the network.

2) The current focus on a limited number of key cities' ambient air quality will shift progressively to encompass nationwide urban ambient air quality and peri-urban air quality.

3) The primary monitoring focus, in addition to SO_2, NO_2, and PM_{10}, will be on online monitoring for O_3, $PM_{2.5}$ and VOCs in key cities. In addition, harmful toxic organic compounds such as B[a]P, dioxins, as well as Mercury and Pb and other heavy metal particles, will be subject to periodic monitoring.

[25] Renmin University of China Associate Professor Zhu Xiao, PhD, and Huang Xiangyang, PhD, were independent contributors to the development and writing of the PITI index system.

Based on the four factors outlined above, we ultimately decided to include the following nine categories that cover 11 types of pollutants for the AQTI evaluations:

Chart 1.10 The Basis for the AQTI Evaluation Index Selection

No.	Pollutant	Factor
1.	Respirable Particulate Matter (PM_{10})	* Public health impact * Large and wide-reaching environmental burden * Included in the 'WHO Air Quality Guidelines' as a "conventional" pollutant * Under common management in developed countries * Already incorporated into domestic air quality management
2.	Fine Particulate Matter ($PM_{2.5}$)	* Public health impact * Large and wide-reaching environmental burden * Included in the 'WHO Air Quality Guidelines' as a "conventional" pollutant * Under common management in developed countries * Has not been incorporated into air quality standards domestically, but may be included in the future
3.	Sulfur Dioxide (SO_2)	* Public health impact * Large and wide-reaching environmental burden * Included in the 'WHO Air Quality Guidelines' as a "conventional" pollutant * Under common management in developed countries * Already incorporated into domestic air quality management
4.	Nitrogen Dioxide (NO_2)	* Public health impact * Large and wide-reaching environmental burden * Included in the 'WHO Air Quality Guidelines' as a "conventional" pollutant * Under common management in developed countries * Already incorporated into domestic air quality management
5.	Carbon Monoxide (CO)	* Public health impact * Environmental burden is quite large * Included in the 'WHO Air Quality Guidelines' as a "conventional" pollutant * Under common management in developed countries * Already incorporated into domestic air quality management, however the monitoring system is not complete
6.	Ozone (O_3)	* Public health impact * Included in the 'WHO Air Quality Guidelines' as a "conventional" pollutant * Under common management in developed countries * Already incorporated into domestic air quality management, however the monitoring system is not complete
7.	VOCs	* Public health impact * Internationally, some countries or cities are already conducting management * Has not been incorporated into air quality standards domestically, but may be included in the future
8.	Lead (Pb)	* Public health impact * Included in the 'WHO Air Quality Guidelines' as a "conventional" pollutant * Internationally, some countries or cities are already conducting management * Already incorporated into domestic air quality management, however the monitoring system is not complete
9.	Others (Mercury, Benzo[a]Pyrene, Dioxins)	* Public health impact * Some international cities have already incorporated them into atmospheric environmental information transparency disclosure.

Section 2. The Weight Assigned to Each Pollutant Evaluated

After determining the categories and pollutants to be evaluated, it was necessary to consider the weight that each pollutant should be given on a one hundred-point scale. The following four factors were taken into consideration:

- Health Risk
- Environmental Load
- Regulation Status and Trends in Developed Countries
- Domestic Regulation Status and Capability

The nine evaluation categories have been divided into "high," "moderate," and "low" classifications in each of these four categories. The details are as follows:

i. Health Risks

As outlined by Chart 1.11, the eleven pollutants included under the nine evaluation categories all pose a large health risk. Some other pollutants, such as fluorides, have a relatively low health risk.

ii. Environmental Load

a) High: Large overall amount, widespread affected area.
Pollutants: SO_2, CO_2, PM_{10}, $PM_{2.5}$

b) Moderate: Large overall amount and small affected area, or small overall amount and large affected area.
Pollutants:O_3, VOCs, CO

c) Low: Small overall amount, small affected area.
Pollutants: Pb, B[a]P, mercury, dioxins

iii. Regulation Status and Trends in Developed Countries

a) High: Commonly regulated internationally.
Pollutants: PM_{10}, $PM_{2.5}$, SO_2, CO_2, CO, O_3

b) Moderate: Regulated by some countries or cities.
Pollutants: Pb, VOCs

c) Low: Not commonly regulated.
Pollutants: B[a]P, mercury, dioxins

iv. Domestic Regulation Status and Trends

a) High: Already included under quality standards, monitoring system has been completed.
Pollutants: SO_2, CO_2, $PM_{10.}$

b) Moderate: Already included under quality standards, but monitoring system has not been completed, or has not been included under quality standards, but a monitoring system has been developed and will be included under quality standards.
Pollutants: CO, O_3, Pb, B[a]P, $PM_{2.5}$, VOCs

c) Low: Has not been included under quality standards, monitoring has not been developed, not likely to be monitored in the future.
Pollutants: Mecury, dioxins

Chart 1.11 AQTI Evaluation Index:
Factors for the Quantitative Weight Determination

Pollutant	Degree of Health Risk	Environmental Burden	Developed Countries' Management Status & Trends	Domestic Management Status & Trends
Respirable Particulate Matter PM_{10}	High	High	High	High
Fine Particulate Matter $PM_{2.5}$	High	High	High	Medium
Sulfur Dioxide SO_2	High	High	High	High
Nitrogen Dioxide NO_2	High	High	High	High
Carbon Monoxide CO	High	Medium	High	Medium
Ozone O_3	High	Medium	High	Medium
VOCs	High	Medium	Medium	Medium
Lead Pb	High	Low	Medium	Medium
Benzo[a]Pyrene B[a]P	High	Low	Low	Medium
Mercury Hg	High	Low	Low	Low
Dioxins	High	Low	Low	Low

Given that the "health risk" for all the above pollutants is considered "high," our comparison focused on the three other categories. Of these three categories, the most important to consider was "environmental load."

Therefore, after comprehensive analysis, we determined that PM_{10}, $PM_{2.5}$, SO_2, and NO_2 would be the primary pollutants (category one) evaluated in the AQTI, with a weight of 60%, or 15 points per pollutant. We also determined that CO, O_3, and VOCs would be the secondary pollutants (category two), with a weight of 30%, or ten points per pollutant. In addition, it was determined that heavy metals (Pb and mercury), B[a]P, and dioxins would be category three pollutants in the AQTI, with a weight of 10%. Of this 10%, five points would be for Pb, and five points total for mercury, B[a]P, and dioxins, which would be considered "other pollutants" (disclosing information for any of these pollutants would be sufficient to obtain the corresponding points for "other pollutants"). These three categories of pollutants altogether add up to 100 points.

Figure 1.9 Pollutant Weight Allocations

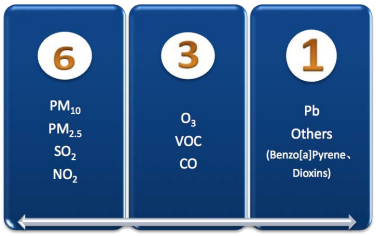


Chart 1.12 Specific Weight of Each Evaluated Pollutant

Sub-Score	Pollutant
15 pts.	Respirable Particulate Matter PM_{10}
15 pts.	Fine Particles $PM_{2.5}$
15 pts.	Sulfur Dioxide SO_2
15 pts.	Nitrogen Dioxide NO_2
10 pts.	Carbon Monoxide CO
10 pts.	Ozone O_3
10 pts.	VOCs
5 pts.	Lead (Pb)
5 pts.	Others (Mercury, Benzo[a]Pyrene, Dioxins)

Section 3. The Evaluation Method for Each Pollutant

The evaluation system for the AQTI borrows from the evaluation methods developed by the Institute of Public & Environmental Affairs (IPE) and the Natural Resources Defense Council (NRDC)[26] for the Pollution Information Transparency Index (PITI).[27] The status of information disclosure for every measure is evaluated based on systematic disclosure of data, timeliness, comprehensiveness and user-friendliness of the data.

- **Systematic Disclosure**

How systematically the information is disclosed, based primarily on two factors: scope and continuity (or regularity).

i. Scope: Determined by evaluating how broad of an area is covered by the air pollution information that is announced.

ii. Continuity: Determined by evaluating whether or not the published air pollution information covers the entire year.

- **Timeliness**

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

- **Comprehensiveness**

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

- **User-friendliness**

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

For more details regarding AQTI evaluation standards, please see: http://www.ipe.org.cn

Section 4. Expert Guidance & Assistance

In August of 2009, Ma Jun consulted Professor Zhang Shiqiu from Peking University School of Environmental Sciences and Engineering, while at the same time Zhu Xiao consulted Zhu Tong, also from the Peking University School of Environmental Sciences and Engineering. They questioned them on the necessity, content, methods, and procedures of the project's research. In September 2009, they invited Dr. Jennifer Holdaway, an expert on environment and health interdisciplinary studies from the Social Science Research Council, to have an informal discussion and to offer advice. In October 2009, the project group contacted Professor Ian Cook from Liverpool John Moores University, as well as Professors Shigeru Takahashi and Zhou Qian from Hitotsubashi University in Japan, via e-mail and consulted them about evaluation methods, evaluation categories, and how to measure the weight of each item. In July of 2010, while participating in an American Sociological Association-sponsored training seminar on interdisciplinary studies in environment and health, Zhu Xiao consulted Wang Wuyi and other Chinese and foreign environment and health experts.

The project group held several general meetings, where they agreed upon a preliminary plan for the evaluation methods, categories, and weight given to each category. They then carried out test evaluations of domestic and international cities. After completing these test evaluations they adjusted the weight given to the evaluation categories. Having established these preliminary procedures, a meeting was held at the Renmin University of China on July 27th, 2010, in order for experts to be able to weigh in on the evaluation methods. Among those invited were Professor Zhang Shiqiu from the Peking University School of Environmental Sciences and Engineering, Professor Guo Xinbiao from the Peking University Health Science Center, and Associate Professor Duan Lei from Tsinghua University. That afternoon, the project group held a discussion in order to determine how to solve the issues raised by the experts. By the end of the meeting the group had decided upon the evaluation methods, categories, and the weight assigned to each category used in the project.

[26] For a more detailed description of the PITI evaluation methods, please see: http://www.ipe.org.cn/En/about/report.aspx

[27] Based on recent air quality reports from the Zhengzhou Environmental Monitoring Station, information disclosure is not particularly complete. During a visit on December 7th, 2010, was accessible, and even then there were some missing data.

Chapter 2
AQTI Evaluation Results for Domestic Cities & International Reference Cities

Section 1. Evaluation Cities and Reference Cities

In mainland China we chose Beijing, Guangzhou, Shanghai, Ningbo, Chengdu, Guiyang, Wuhan, Tianjin, Chongqing, Fuzhou, Dalian, Kunming, Nanning, Nanchang, Hohhot, Changsha, Nanjing, Zhengzhou, Lanzhou, and Urumqi as the first group of 20 cities to be evaluated in the AQTI (hereafter referred to as the "evaluation group").

We chose New York, Los Angeles, London, Paris, Berlin, Vienna, Hong Kong, Moscow, Mexico City, and New Delhi to serve as comparative reference cities for the evaluation work done in the first AQTI (hereafter referred to as the "reference group").

Please refer to Figure 2.1 for the distribution of these 30 cities. Those marked in blue are the evaluation group, while those marked in red are the reference group.

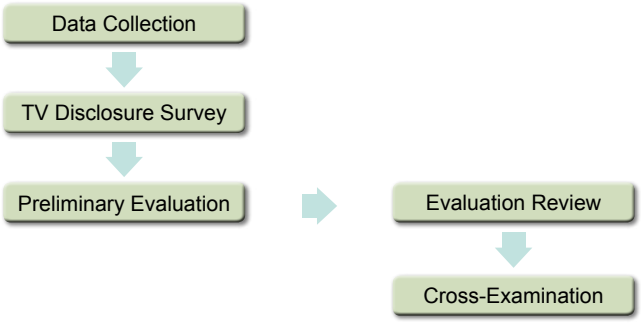
Figure 2.1 Map of AQTI Evaluated Cities

Section 2. Determining the Evaluation Process

In developing the 2010 AQTI evaluation, we used official air quality data released online by governmental departments as the basis of our evaluation of the cities, complemented by relevant information publicized by television media (only applicable for domestic cities).

The evaluation process included gathering and sorting data, surveying television programs, preliminary evaluation, the evaluation review, and cross-examination.

Figure 2.2 Evaluation Procedure Flow Chart



Section 3. The Evaluation Group's Assessment Results

We used the Air Quality Transparency Index (AQTI) evaluation method outlined above to carry out a systematic evaluation of the status of the 20 Chinese cities' 2010 air quality transparency. The evaluation scores are shown in Chart 2.1.

Based on the evaluation group's assessment, the main findings are:

Chart 2.1 2010 AQTI Evaluation Sub-Scores & Final Scores (20 Chinese Cities)

Rank	City	Total AQTI Score (Max. 100 pts.)	Respirable Particulate Matter PM_{10} (15 pts.)	Fine Particles $PM_{2.5}$ (15 pts.)	Sulfur Dioxide 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	Beijing	38	8.8	0	8.8	8.8	6	0	0	2.8	2.8
2	Guangzhou	37	10.8	0	10.8	10.8	0	4.6	0	0	0
3	Shanghai	33.6	12	0	10.8	10.8	0	0	0	0	0
4	Ningbo	29.8	9.6	0	9.6	9.6	0	0	1	0	0
5	Chengdu	25.2	8.4	0	8.4	8.4	0	0	0	0	0
5	Wuhan	25.2	8.4	0	8.4	8.4	0	0	0	0	0
7	Chongqing	22.8	7.6	0	7.6	7.6	0	0	0	0	0
7	Nanjing	22.8	7.6	0	7.6	7.6	0	0	0	0	0
9	Guiyang	21.6	7.2	0	7.2	7.2	0	0	0	0	0
10	Tianjin	21	7	0	7	7	0	0	0	0	0
11	Fuzhou	18.8	6.8	0	6	6	0	0	0	0	0
12	Dalian	18.6	6.2	0	6.2	6.2	0	0	0	0	0
12	Kunming	18.6	6.2	0	6.2	6.2	0	0	0	0	0
12	Nanning	18.6	6.2	0	6.2	6.2	0	0	0	0	0
12	Nanchang	18.6	6.2	0	6.2	6.2	0	0	0	0	0
16	Hohhot	18	6	0	6	6	0	0	0	0	0
17	Changsha	17.4	5.8	0	5.8	5.8	0	0	0	0	0
18	Zhengzhou	16.2	5.4	0	5.4	5.4	0	0	0	0	0
18	Lanzhou	16.2	5.4	0	5.4	5.4	0	0	0	0	0
20	Ürümqi	15	5	0	5	5	0	0	0	0	0

1. All domestic cities that were evaluated have some level of air quality monitoring information disclosure.

The evaluation results show that in all 20 cities the public can obtain a certain degree of air quality monitoring information.
The main monitored pollutants for domestic cities are SO_2, NO_2, and PM_{10}. Monitoring of $PM_{2.5}$ has not been implemented, and of the cities which were evaluated only those in Guangdong Province include O_3 in daily air quality monitoring. Additionally, only Beijing announces CO monitoring results and only Ningbo discloses monitoring statistics for volatile organic compounds (VOCs).

With the exception of Urumqi—where information is released via the Xinjiang Uighur Autonomous Region Environmental Protection Office website—residents of each city are able to obtain monitoring information released by its environmental protection bureau, which announces daily average values in all the cities that were evaluated. In addition, the provincial-level environmental protection bureau also announces the air quality information for some cities.

The domestic cities that were evaluated primarily release API values and primary pollutant values in their air pollution monitoring reports. Only Shanghai, Guangzhou, Zhengzhou,[28] Guiyang, Tianjin, Ningbo, and Wuhan release specific quality information for monitored pollutants. Of these cities, Ningbo also releases specific concentration values for monitored pollutants, as well as their corresponding API values.

Many of the domestic cities evaluated do not release air quality statistics for each of their specific monitoring sites. Only Beijing, Dalian, Zhengzhou, Guangzhou, Ningbo, Wuhan, Changsha, Nanchang, Nanning, and Nanjing release air quality statistics for specific sites. Beijing, Shanghai, Tianjin, Chongqing, Guangzhou, Chengdu, Ningbo and some other cities also release air quality statistics for city districts.

Of the 20 cities evaluated, Beijing, Shanghai, Chongqing, Ningbo, Nanjing, Hohhot and Urumqi not only release air quality statistics on their own websites, but also announce them via television.

2. On the whole, air quality information disclosure for the evaluated domestic cities is still at a rudimentary level.

On the 100-point evaluation scale, the 20 cities evaluated scored an average of 22.65 points. The lowest scoring city was Urumqi, with 15 points. For more details, please see Figure 2.3.

Figure 2.3 2010 AQTI Evaluation Scores for 20 Chinese Cities

3. Some of the domestic evaluated cities have already developed good practices independently.

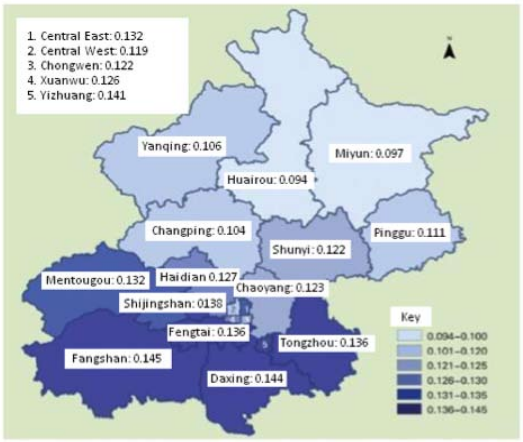
3.1 Beijing: Publishes monitoring information for many pollutants and ranks the highest out of all domestic cities.

The Beijing Environmental Protection Bureau website's "Air Quality" section releases daily air quality reports, forecast information, and air quality maps. It publishes the API values and primary values for 27 monitoring stations. The monitored pollutants include PM_{10}, SO_2, NO_2 and CO.[29] Within the 20 city domestic evaluation group Beijing does better than other cities on its monitoring of airborne fluoride, Pb particles, and B[a]P. It also publishes city-wide annual average concentration values in its annual State of the Environment report.

[28] Based on recent air quality reports from the Zhengzhou Environmental Monitoring Station, information disclosure is not particularly complete. During a visit on December 23rd, 2010, only information from before December 7th, 2010, was accessible, and even then there were some missing data.

[29] According to the "Beijing Automated Air Quality Monitoring System" announcement on the Beijing Public Net for Environmental Protection website, the automated monitoring system established by the city can monitor sulfur dioxide, carbon monoxide, nitrogen dioxide, nitric oxide, ozone, particulate matter and other pollutants. Daily air reports for Beijing, however, only release pollution index and primary pollutant (sulfur dioxide, carbon monoxide, nitrogen dioxide, and particulate matter) information. Annual environmental status reports do not release monitoring data for ozone.

Figure 2.4 2009 Annual Average Concentration Values for Airborne PM_{10} in Beijing Center, Districts & Counties[30]



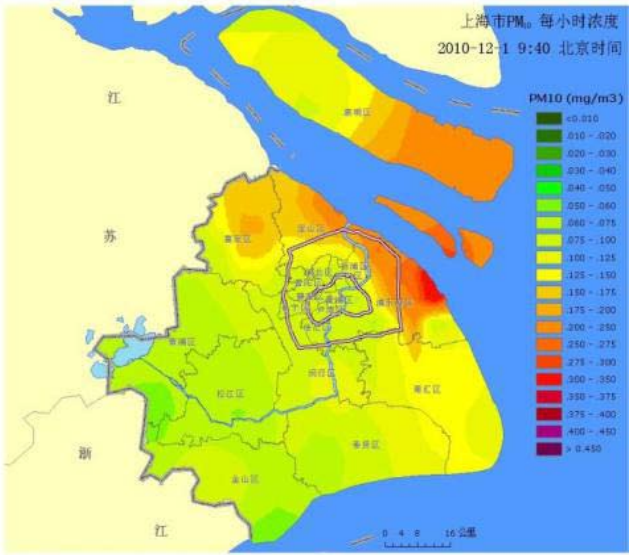
Starting on January 1st, 2003,[31] Beijing TV's Public Channel began the "Beijing Air Quality Broadcast," which announces daily air quality information every evening at around nine o'clock[32], as well as air quality information forecasts for the following day.

Figure 2.5 Beijing Air Quality Broadcast[33]

3.2 Shanghai: Combines maps with real time developments to publish monitoring concentrations.

The Shanghai Environmental Protection Bureau publishes an air quality daily report for every district and county on its website. These reports include the API values, as well as primary pollutant values. In addition, in May 2010 Shanghai began using an international real-time air quality monitoring system (AIRNow-International)—jointly developed by the U.S. Environmental Protection Agency, the Shanghai Environmental Protection Bureau, the Shanghai Environmental Monitoring Center, and the Shanghai Institute of Environmental Sciences. The system publishes hourly SO_2, NO_2 and PM_{10} monitoring concentration values for the World Expo site, as well as spatial distribution charts for hourly concentrations of PM_{10} throughout Shanghai.

Figure 2.6 Shanghai Air Quality Distribution Map[34]



3.3 Guangzhou: Provides Cross-publication of information on multiple platforms.

The air quality daily report section of the Guangzhou Environmental Protection Bureau website publishes API values and values for each monitored pollutant by monitoring site. The monitored pollutants that are published include SO_2, NO_2 and PM_{10}. The Guangdong province environmental information GIS integrated publishing platform collects SO_2, NO_2, PM_{10} and O_3 data from every prefecture level city in the province, and the Guangdong Province Environmental Protection Department website publishes air quality status information,[35] mainly API and primary pollutants, for each monitoring site. By choosing a Figure on the website, it generates a graph showing changes in the chosen city's air quality during a designated time frame.

[30] 2009 Beijing Municipal Environmental Status Report: Beijing Municipal Environmental Protection Bureau (June 6th, 2010): http://www.bjepb.gov.cn/bjhb/Portals/0/fujian/zwgk/hjzl/%E5%8C%97%E4%BA%AC%E7%8E%AF%E5%A2%83%E7%8A%B6%E

[31] "Xiao Lanmu, Da Shiye (Small Part, Big Business)," Beijing Municipal Environmental Education Center, 10/02/2009: http://www.cesp.com.cn/hjjy/stbh_show.asp?cid=74149&parentid=224&nodeid=22

[32] BTV Public - Upcoming Events: http://www.btv.org/btvindex/jmyg/node_16684.htm

[33] Youku.com Website: http://v.youku.com/v_show/id_XMTg0NDkyNTcy.html

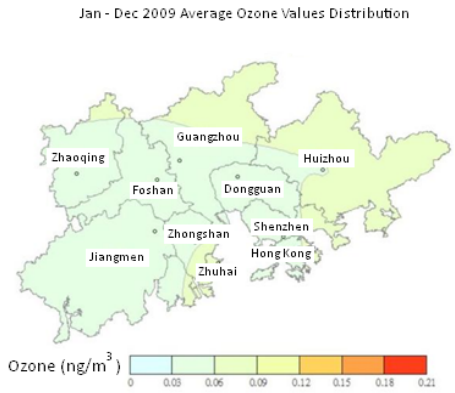
[34] 2010 Shanghai World Expo Air Quality: http://www.semc.gov.cn/expoair/WebFront/intro_pic.aspx

[35] Guangdong monitoring sites include: Guangya High School, Guangzhou No. 5 High School, the Municipal Monitoring Station, Guangdong University of Business Studies, Guangzhou No. 86 High School, Panyu High School, and Huadu Normal University.

Figure 2.7 Guangzhou Province Environmental Information GIS Integrated Publishing Platform[36]

Annual monitoring reports for the atmospheric pollution monitoring network in Guangdong, Hong Kong and the Pearl River Delta compile air quality monitoring information for cities within the monitoring network. Furthermore, the report publishes air quality information combined with maps and annual average concentration values for each individually monitored pollutant.

Figure 2.8 O_3 Average Values Distribution[37]



3.4 Ningbo: Publishes concentration values for each monitored pollutant.

The daily air quality reports published by Ningbo Environmental Air Quality Data Center include air quality information for each of its monitoring stations. The pollutants monitored include SO_2, PM_{10} and NO_2. Apart from API values, Ningbo also publishes the concentration values for specific monitored pollutants and it is the only city out of the 20 evaluated that publishes pollutant concentration values for individual monitoring sites.

Moreover, air quality information is released through the Ningbo News Channel. In addition, Ningbo also describes monitoring results for VOCs in its report entitled '2009 State of the Environment in Ningbo.' Of the 20 cities evaluated, it was the only one that published VOC information.

Figure 2.9 Ningbo City Air Quality Daily Report[38]

空气质量日报 Air Quality Daily Report

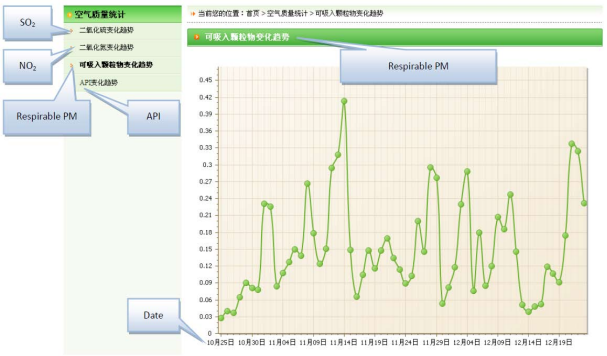
A.Q. Daily Report Inquiry : 2010-12-23 Search 显示本月截止当前日期的详情

2010年12月23日

Monitoring Area	Sulfur Dioxide	API	Nitrogen Dioxide	API	Respirable PM	API	Air Pollution Index	Main Pollutant	Level	Quality
Urban Area	0.078	64	0.116	95	0.230	140	140	Respirable PM	III (1)	Minor Cont.
Zhenhai Dtr.	0.065	58	0.116	95	0.240	145	145	Respirable PM	III (1)	Minor Cont.
Beilun Dtr.	0.060	55	0.112	90	0.201	126	126	Respirable PM	III (1)	Minor Cont.
Yinzhou Dtr.	0.055	53	0.104	80	0.183	117	117	Respirable PM	III (1)	Minor Cont.
Gaoxin Dtr.	0.048	48	0.099	74	0.236	143	143	Respirable PM	III (1)	Minor Cont.
Dongqian Lk.	0.053	52	0.040	25	0.129	90	90	Respirable PM	II	Good
Daxie Is.	0.008	8	0.037	24	0.163	107	107	Respirable PM	III (1)	Minor Cont.
Cixi Cty.	0.080	65	0.098	72	0.149	100	100	Respirable PM	II	Good
Yuyao Cty.	0.051	51	0.084	55	0.180	115	115	Respirable PM	III (1)	Minor Cont.
Fenghua Cty.	0.052	51	0.077	49	0.200	125	125	Respirable PM	III (1)	Minor Cont.
Ninghai Cnty.	0.048	49	0.070	44	0.148	99	99	Respirable PM	II	Good
Xiangshan	0.033	33	0.054	34	0.152	101	101	Respirable PM	III (1)	Minor Cont.
Rural Areas	0.027	27	0.045	29	0.113	82	82	Respirable PM	II	Good
Average	0.055	53	0.085	57	0.181	116	116	Respirable PM	III (1)	Minor Cont.

Ningbo also collects and reports data for SO_2, NO_2, PM_{10} and API from the previous three months, with an accompanying diagram showing changes over time.

Figure 2.10 Ningbo City Trends in PM_{10} Levels[39]



4. China's urban air quality information disclosure made significant progress towards the end of 2010.

The state of air quality information disclosure for the 20 evaluated domestic cities is briefly shown in Chart 2.2.

[36] Guangdong Province Environmental Protection Department Website: http://www.gdep.gov.cn
[37] Guangdong, Hongkong, Pearl River Delta Region, Air Monitoring Network 2009 Monitoring Results Report: Guangdong Province Environmental Monitoring Center, Hong Kong Special Administrative Region Environmental Protection Department. http://www.gdep.gov.cn/hjjce/hjxt/201010/P020101021411267720792.pdf
[38] Ningbo Municipal Environmental Protection Bureau Website: http://hbj.ningbo.gov.cn/Info_More.aspx?ClassID=814271e0-70a9-4a48-9b4c-52fd56cadcd9
[39] Ningbo Municipal Environmental Protection Bureau Website: http://hbj.ningbo.gov.cn/Info_More.aspx?ClassID=6350c441-3c05-47b2-9195-eb9f3a7bd47d

Chart 2.2 Description of Urban Air Quality Information Disclosure in Each of the 20 Domestic Cities

City	Description of Urban Air Quality Information Disclosure in Each of the 20 Domestic Cities
Beijing	• Air quality daily report information is released for individual monitoring sites, and covers PM_{10}, SO_2, NO_2 and CO. In addition to being available on an official website, this information is also announced on television and radio. • Annual environmental status bulletins are accompanied by air quality information maps, which visually display the air pollution situation of each area. Information on fluoride, atmospheric Pb particles, B[a]P and other pollutants is also published.
Guangzhou	• The Guangzhou Municipal Environmental Protection Bureau website's daily air quality report publishes the API value for all monitored pollutants from each monitoring site. • The Guangzhou Province Environmental Information GIS integrated publishing platform combines air quality information with maps, making it possible to view images of the trends and changes at air quality monitoring sites over certain periods of time.
Shanghai	• The daily air quality report published by the Shanghai Municipal Environmental Protection Bureau website lists information by county and district, as well as by pollutant. • The website dedicated to ambient air quality for the 2010 Shanghai World Expo site publishes a data set at an hourly frequency, releasing monitored concentration values for SO_2, NO_2 and PM_{10} accompanied by a map in order to visually display the spatial distribution of PM_{10} in Shanghai. • In addition to announcing air quality information on its official websites, Shanghai also releases air quality information on televisions throughout the public transport network.
Ningbo	• The daily air quality report published by the Ningbo Municipal Environmental Air Quality Data Center lists air quality information by monitoring site. Pollutants include SO_2, PM_{10} and NO_2. Apart from publishing API values—as is common in China—Ningbo also publishes the concentration values for specific monitored pollutants and was the only city out of the 20 evaluated cities to publish information on pollutant concentration values by monitoring site. • Ningbo also broadcasts air quality information through the Ningbo News Channel. • In addition, in its "2009 Ningbo City Environmental Status Bulletin" Ningbo gave a description of VOC monitoring. Ningbo was the only city out of the twenty cities evaluated to publish information on VOCs.
Chengdu	• The "Air Quality" section of the Chengdu Municipal Environmental Protection Bureau website provides daily air quality reports and forecasts by district and county. The content published includes API values, primary pollutant values and air quality levels, as well as a diagram comparing the air pollution situations of different regions. • In addition, Chengdu announces air quality information by county and district in annual environmental quality reports.
Guiyang	• The "Air Quality" section of the Guiyang Municipal Environmental Protection Bureau website publishes daily air quality reports, API values for SO_2, NO_2 and PM_{10}, as well as air pollution levels.
Wuhan	• The "Environmental Monitoring" section of the Wuhan Environmental Protection Bureau website publishes air quality information with accompanying maps, and releases API values by monitoring site. This section of the website also publishes the SO_2, NO_2 and PM_{10} API values for the entire city. It shows changes over the last seven days, as well as the air quality trends from specific monitoring sites for the last two months. Charts taken from annual environmental status reports show the SO_2, NO_2 and PM_{10} average concentration values for specific monitoring sites.
Tianjin	• Ambient air quality reports for Tianjin, as well as air quality forecast information, are published under "Air Information" on the Tianjin section of the website enorth.com.cn. The air quality report includes maps and publishes the SO_2, NO_2 and PM_{10} API values for each district and county. The annual average SO_2, NO_2 and PM_{10} values for the entire city are published in the annual environmental status report.
Chongqing	• The "Environmental Quality" section of the Chongqing Municipal Environmental Protection Bureau website publishes daily air quality reports that contain API values and primary pollutant values by district and county. District and county air quality information is also released through Chongqing news channel's "Everyday 630" program. • Annual environmental status bulletins publish the annual average concentration (SO_2, NO_2 and PM_{10}) values according to district and county.
Fuzhou	• The "Fuzhou Environmental Quality" section of the Fuzhou Municipal Environmental Protection Bureau website publishes daily air quality reports and forecast information, which include API values and primary pollutant values for the whole city. • The 2009 Fuzhou City Environmental Status Report combined annual air quality information with a map that displayed the 2009 annual average API values for Fuzhou.
Dalian	• The "Air Quality Forecast" section of the Dalian Municipal Environmental Protection Bureau website publishes the air quality information for specific monitoring sites, and includes API values and primary pollutant values. • The "Dalian City Ambient Air Quality Report," published in 2009, uses a histogram to compare the average concentration values of SO_2, NO_2 and PM_{10} in the city center and in its districts and counties.
Kunming	• The Kunming Municipal Environmental Protection Bureau website publishes air quality information, including API values and primary pollutant values. • The "Kunming Environmental Status Report," published in 2009, includes ambient air quality information for Kunming's eleven districts and counties.
Nanning	• The "Air Quality" section of the Nanning Municipal Environmental Protection Bureau website publishes daily air quality reports and forecast information. Daily air quality reports publish information taken from seven monitoring stations, including API values and primary pollutant values, as well as the average API for the entire city. This section also displays average concentration values for city districts, monthly air pollutant average concentration values, and the percentage of good air quality days per month.
Nanchang	• Air quality information, including API values and primary pollutant values, for all urban districts in Nanchang is published under the "Nanchang City Air Quality Status" section of the Nanchang Municipal Environmental Protection Bureau website. This section also publishes common sense information about air quality—the dangers of SO_2, for example, or how to make an assessment of air quality.
Hohhot	• The daily air quality report on the Hohhot Environmental Protection Bureau website publishes API and primary pollutant values for Hohhot; gaps appear in the information published, however. When viewed on December 24th, 2010, this column only displayed air quality information pertaining to October 17th, 2010. • Hohhot air quality information is also published through the Inner Mongolian News Network.
Changsha	• The "Ambient Air Quality" section of the Changsha Municipal Environmental Protection Bureau website publishes information for the entire city and for each of the seven air quality monitoring stations. The information published includes API and primary pollutant values. • The daily air quality report on the Hunan Province Environmental Department website publishes air quality information for all cities, including Changsha, with accompanying maps.
Nanjing	• The daily air quality report on the Nanjing Municipal Environmental Protection Bureau website publishes API and primary pollutant values. The API is also broadcasted after "Nanjing News" on the Jiangsu City Channel. In addition, the "Yangzte River Delta" subsection in the 2010 Shanghai World Expo ambient air quality section of the Shanghai EPB website publishes air quality conditions for the past week in Nanjing.
Zhengzhou	• The "Air Quality History Search" section of the Zhengzhou Municipal Environmental Protection website publishes daily air quality reports and forecasts. The information published, however, is not continuous and is sometimes interrupted. Furthermore, the information published only includes air quality levels. • The Zhengzhou Municipal Monitoring station publishes air quality information for central Zhengzhou, including API values and values for SO_2, NO_2, and PM_{10}, as well as forecast information and API and primary pollutant values for the city's nine monitoring sites. When visited on December 26, 2010, however, this column had last been updated on December 7, 2010.
Lanzhou	• The "Lanzhou Environmental Quality Status" section of the Lanzhou Municipal Environmental Protection Bureau website publishes API values and primary pollutant values for the entire city.
Ürümqi	• The Ürümqi Municipal Environmental Protection Bureau does not publish air quality information, as it is published through the Xinjiang Uighur Autonomous Region Environmental Protection Department. Information published includes API values and primary pollutant values. Furthermore, every evening at around nine o'clock Xinjiang Television Station publishes air quality reports for all urban districts, including the API and primary pollutant values for Ürümqi.

In addition to the discoveries outlined above, we also found that air quality information disclosure in the evaluated cities made important improvements in 2010.

On November 25th, 2010, the China National Environmental Monitoring Centre, a division of the Ministry of Environmental Protection of the People's Republic of China, began trial operation of its air quality announcement system for key cities. This system announces monitoring data for 113 cities online, updating once per hour, and includes SO_2, NO_2, and PM_{10} concentration data for each monitoring site.

Compared to previous air quality information announcement methods, this system has three highlights:

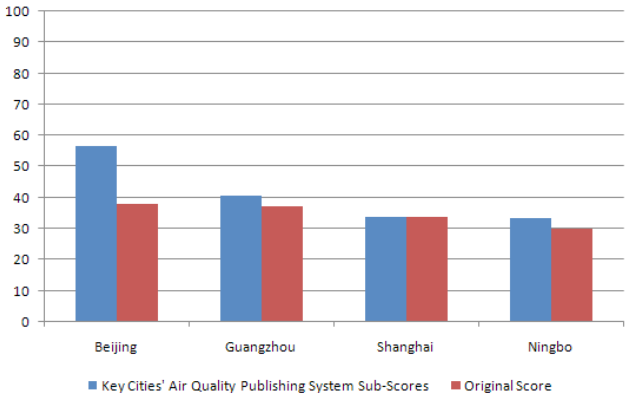
- Increased timeliness: it updates monitoring information every hour.

- Increased specificity: it releases monitoring information for specific sites.
- Increased comprehensiveness: it releases specific pollutant monitoring values, rather than only releasing a comprehensive API value.

Figure 2.11 Key Cities' Air Quality Announcement System[40]

Since this system was only announced at the very end of the evaluation period it was not included in this round of evaluation. If this announcement system had been considered in the evaluation the scores for Beijing, Guangzhou, Shanghai and Ningbo would be raised to 56.6, 40.6, 33.6 and 33.4 respectively. A comparison of before and after scores can be seen in the following diagram:

Figure 2.12 Comparing Air Quality Announcement System Scores for Key Cities



We hope that the 113 cities that this system covers can link up their own air quality information announcement systems to this national system, in order to begin hourly publication of pollutant values by monitoring site.[41] Only if the announcement system is integrated in this way will it be possible for large numbers of urban residents to conveniently obtain important monitoring data. This would allow them to promptly carry out effective protective measures so as to reduce or prevent the harm that air pollution can have on their health, thereby better protecting the environmental interests of the general public.

Section 4. The Reference Group's Assessment Results

In order to examine the credibility of the evaluation methods used in the urban Air Quality Transparency Index (AQTI), and in order to discover what differences exist between the practices of the 20 evaluated cities and their global counterparts, as well as identify what valuable lessons could be learned from international experience, we decided to evaluate the status of air quality information disclosure in 10 chosen international cities.[42]

Chart 2.3 2010 10 International Reference Group Cities AQTI Final Score and Sub-Score

Rank	City	Total AQTI Score (Max 100 pts.)	Respirable Particulate Matter PM_{10} (15 pts.)	Fine Particles $PM_{2.5}$ (15 pts.)	Sulfur Dioxide 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	Paris	89.2	14.4	12.6	12.6	14.4	8	9.6	8.4	4.6	4.6
2	Los Angeles	87.2	14.4	14.4	12.6	14.4	9.6	9.6	7.6	4.6	0
3	New York	85.8	13.2	14.4	13.2	13.2	8.8	9.6	8.8	4.6	0
4	London	78.8	15	8.2	15	15	10	10	5.6	0	0
5	Vienna	76.8	14.4	2.4	14.4	14.4	9.6	9.6	2	5	5
6	Hong Kong	76	15	0	15	15	10	10	2.2	4.4	4.4
7	Berlin	69.8	12.6	2.4	13.2	13.2	8.8	8.8	1.6	4.6	4.6
8	Moscow	68.4	13.2	2.4	13.2	13.2	8.8	8.8	8.8	0	0
9	Mexico City	57.8	12	3	12	12	8	8	0	2.8	0
10	New Delhi	37.6	7	7	7	7	4.8	4.8	0	0	0

[40] Key Cities Air Quality Publishing System: http://58.68.130.147/air/air/airtestpage.html

[41] The Shanghai Environmental Monitoring Center has announced the "Shanghai Air Quality Real-time Announcement System," which will announce respirable particulate matter, sulfur dioxide, and nitrogen dioxide concentration values for nine monitoring sites every hour. It has been noted that the data are updated at the same time as the "Key Cities Air Quality Announcement System."

[42] Given that there are limitations to the research that can be done into foreign cities' air quality information management methods, the evaluation results only reflect what is understood of their situations.

The project group discovered the following during its analysis of the reference group:

1. Every international city evaluated releases air quality information to a considerable degree.

All ten international cities have established channels for releasing air quality data, which they do very systematically. All cities release daily and annual air quality reports, and provide information about monitoring sites and how to interpret air pollution indexes.

Many of the international cities evaluated also have a comprehensive scope of air quality monitoring. The main pollutants monitored include PM_{10}, SO_2, NO_2, CO, and O_3, the information for which is all released by monitoring station. All nine cities other than Hong Kong monitor and disclose fine particulate matter ($PM_{2.5}$),[43] including Mexico City and New Delhi, both of which are cities in developing countries.

With the exception of Mexico City and New Delhi, all the cities announce air quality information for VOCs. On the California Air Resources Board official website, Los Angeles additionally announces methane and non-methane hydrocarbon monitoring data from each monitoring site, and releases annual concentration values, as well as the lowest and highest recorded values at each monitoring station for 32 organic pollutants containing benzene and ethylbenzene. With the exception of London,[44] Moscow, and New Delhi, all cities release information on Pb concentrations in the air. Paris, Hong Kong, Berlin, Vienna, and Moscow monitor B[a]P and release monitoring results. Hong Kong has also implemented dioxin monitoring, and releases results to the public.

Many of the international cities release their air quality information in a timely manner. Real-time data for PM_{10}, SO_2, NO_2, CO, and O_3 is available in cities such as New York and Paris. Some of New Delhi's monitoring sites update their concentration values once every 15 minutes. In preparation for the Commonwealth Games to be held there in October, 2010, the System for Air Quality Forecasting & Research for Commonwealth Games 2010 (SAFAR) updates the city's air quality index every minute. Mexico City has ozone data updated every 20 minutes.

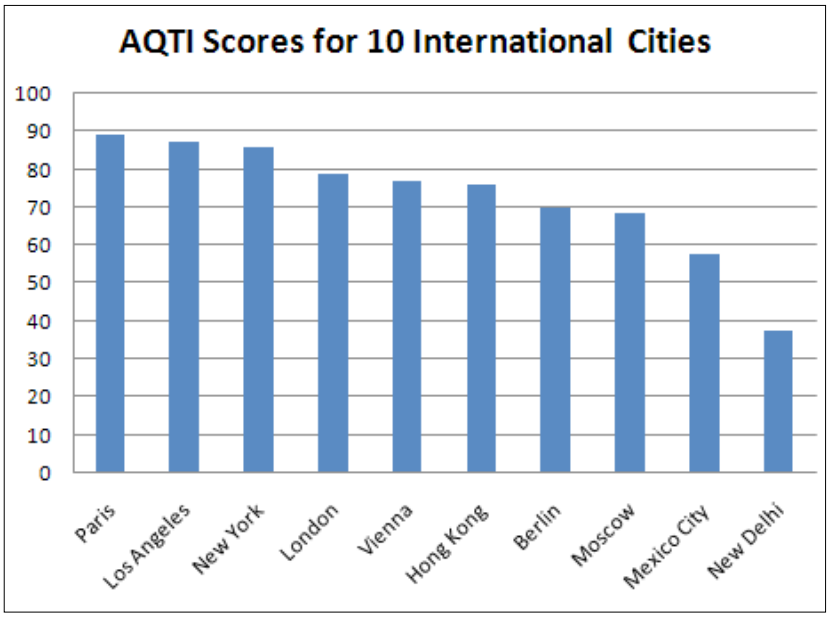
The air pollutant monitoring information for the evaluated ten international cities is primarily presented by combining API values with recorded concentrations for specific air pollutants.

Many of the international cities evaluated score high in the user-friendliness criteria. With the exception of Delhi and Moscow, all websites use maps to display API values and forecasts. Mapped monitoring sites or regions are color coded by API grade (from low to severe) so that air quality levels can be immediately conveyed and quickly understood. Los Angeles, London, and Mexico City air quality data can be followed on Twitter or Facebook, and London's network also has an iPhone application for air quality alerts that can be accessed at any time. The U.S. Environmental Protection Agency has a program called Enviroflash that allows users to have air quality information for the state or city of their choice sent directly to their email.

2. International developed cities have a relatively high level of air quality disclosure.

Out of the maximum 100 points in the AQTI evaluation system, the eight international cities in developed countries/regions had an average of 79 points. The city that earned the highest number of points was Paris with 89.2 points, followed by Los Angeles, New York and London. Mexico City and New Delhi, both located in developing countries, received 57.8 points and 37.6 points respectively.

Figure 2.13 2010 Evaluated Reference Group City Ranking Chart



[43] Of the 10 international cities assessed, Hong Kong had not released detailed PM2.5 information.

[44] The UK National Air Quality Archive website has annual statistics for the entire country for lead and other heavy metals. Because the annual report for 2009 was not published until January 1st, 2010, it was not included in the evaluation.

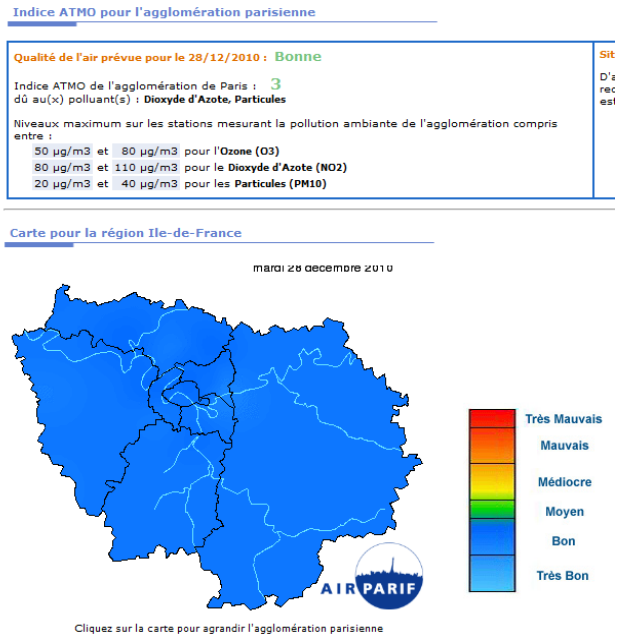
3. Best Practice of Three International Reference Group Cities

3.1 Paris

France's air quality information index, Indice ATMO, monitors O_3, SO_2, NO_2, and PM_{10} and rates each on a 1 to 10 scale with six different grades. AIRPARIF is the main website for publishing air quality information for the Ile-de-France region, which includes Paris and the greater Paris region. AIRPARIF has monitoring data for an extensive amount of pollutants, has detailed statistical data available, and an easy-to-use search function. AIRPARIF is also the primary partner of the CITEAIR project, Common Information to European Air, which has a website that provides air quality data for cities throughout the E.U. On a voluntary basis, European cities can join and disclose their data (according to set standards) to be put on the map. The site shows both roadside and background AQI, is updated hourly with current AQI values and updated daily with the previous day's values, and allows the public to compare air quality across the E.U. and between cities.

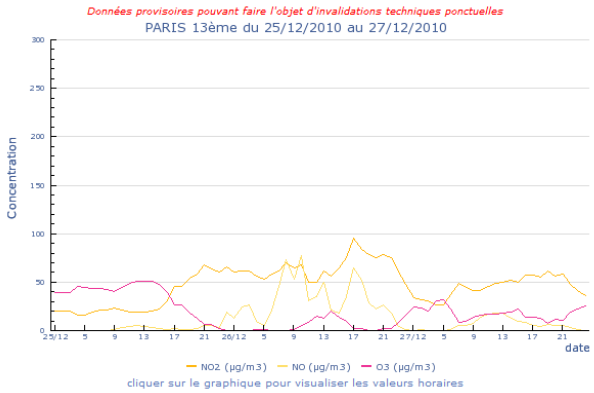
Daily Forecasts: Every day at 11:00 there is an air quality forecast for the greater Paris region, which includes forecasts for the AQI, air quality grade and major pollutants.

Figure 2.14 December 27-28 2010 Daily Air Quality Forecast for the Greater Paris Region[45]



Daily Reports: Users can search by monitoring station for graphs that show changes in the concentrations of $PM_{2.5}$, PM_{10}, SO_2, CO, O_3, NO_2, benzene, toluene, ethyl benzene, and xylene for the previous or following three or one day period of any given time from the past 15 months. Users can also perform a similar search for concentration data for a specific pollutant—$PM_{2.5}$, PM_{10}, SO_2, CO, O_3, NO_2, benzene, toluene, ethyl benzene, or xylene. The values of the daily monitored pollutants are all available—the most available out of the ten international reference group cities.

Figure 2.15 Paris 13th Monitoring Station December 25 to 27 2010 NO_2, NO and O_3 Concentration Trends[46]



AIRPARIF set up a specialized "results" function of its website, which provides many different ways to search for data—such as "results by station," "results by pollutant," "statistical" and "archive," which displays pollutant information and multiple years' worth of accumulated monitoring data.

Historical Air Quality: Air quality index values are available from 1998 to 2010, as well as monthly air quality index averages and daily maps showing the air quality level.

Highest recorded annual values: Highest recorded annual values are available for NO, O_3, SO_2 and PM_{10} from 1986 to 2009. AIRPARIF also maps the average annual values recorded by monitoring sites in the greater Paris region (available from 1999-2009) for SO_2, PM10, $PM_{2.5}$, O_3, NO_2, and benzene, visually displaying the pollution levels that are color coded for each area.[47] Maps of historical traffic and total emissions are also available from 2003 for the greater Paris region for NO_x, CO, PM, CO_2, hydrocarbons and benzene. AIRPARIF is also currently developing an improved map that displays real-time emissions.

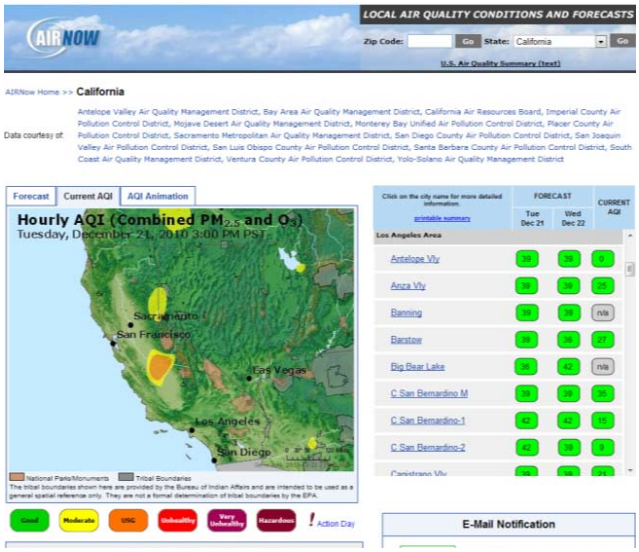
Annual report: Annual reports are available from 1991-2009 for CO, SO_2, PM_{10}, $PM_{2.5}$, O_3, NO, NO_x, and NO_2, and include "P50 values," "P98 values," maximum 1-hour values, date of maximum hourly values, maximum 8-hour values, and date of maximum 8-hour values for each monitoring site, as well as annual averages for monocyclic aromatic hydrocarbons, polycyclic aromatic hydrocarbons, Pb, arsenic, cadmium and nickel.[48]

[45] AIRPARIF,http://www.airparif.asso.fr/pages/indices/resultats?jour=aujourdhui
[46] AIRPARIF,http://www.airparif.asso.fr/pages/resultats/stations
[47] There are no SO2, O3 images for the year 2009.
[48] Determined by pollutant category.

3.2 Los Angeles

The United States' national air quality monitoring network is well established and very comprehensive. The U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) weather service have set up a website for the disclosure of air quality information. The U.S. EPA's AirNow website discloses air quality information for the whole United States AirNow acquires air quality information from state EPAs and local actors who manage air quality monitoring stations. Users can search by state and city for daily AQI values and forecasts. Hourly AQI values are available and are calculated using combined O_3 and $PM_{2.5}$ data. Users can also view an animated AQI map for every 20 minutes.

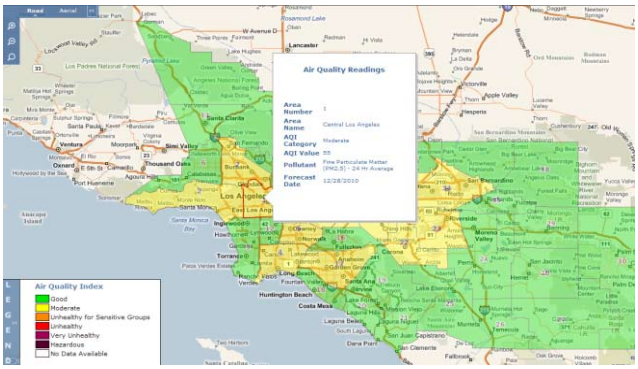
Figure 2.16 December 21, 2010 California Daily AQI (left) and Los Angeles Daily and Second Day Forecast (right)[49]



The National Oceanic and Atmospheric Association provides one and eight-hour forecasts for O_3 concentration values. It is updated twice a day and shares its data with AirNow.[50] In addition to government sources, the Weather Channel posts daily and forecasted air quality data and primary pollutant values for every state in the United States on its website.[51] In addition to AirNow, the California Environmental Protection Agency's Air Resources Board (CARB), and the South Coast Air Quality Management District (AQMD), a well established monitoring system for Los Angeles and its surrounding areas, are responsible for Los Angeles' comprehensive and accessible air quality data.

Forecast: the South Coast AQMD website[52] posts daily and forecasted AQI values along with primary pollutant values on its website, using different colors to mark the degree of pollution (color coded to AQI level) on a map.

Figure 2.17 December 28, 2010 South Coast Air Quality[53]

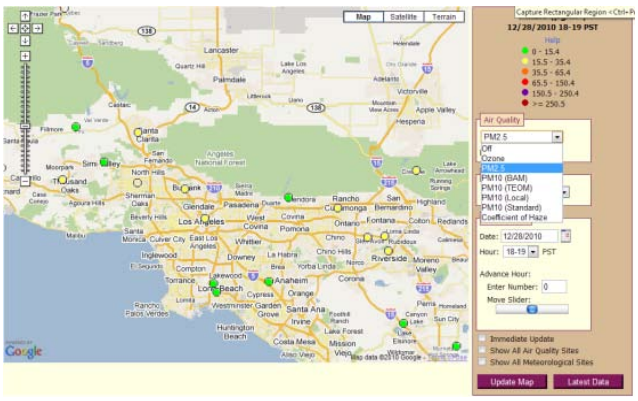


Yellow areas are "moderate," green areas are "good."
Downtown Los Angeles' API and pollutant data (24-hour average $PM_{2.5}$ value) are outlined in the white box.

Daily report: The South Coast AQMD website uses a map that is updated daily to show AQI values and primary pollutant data for the Los Angeles monitoring area. Its written report presents more information, including current $PM_{2.5}$, PM_{10}, CO, O_3, and NO_2 AQI values, as well as current and previous day highest recorded pollutant values.

The Air Resources Board posts O_3, $PM_{2.5}$, PM_{10}, and smog data for the past 24 hours and the following 24 hours on its website.

Figure 2.18 Local Time December 28, 2010, 18:00-19:00 Los Angeles $PM_{2.5}$ Concentration Range[54]



[49] AirNow,http://airnow.gov/index.cfm?action=airnow.local_state&stateid=5&tab=2
[50] http://www.weather.gov/aq-expr/sectors/conus.php
[51] http://www.weather.com
[52] http://www.aqmd.gov/smog/index.html
[53] South Coast AQMD Website: http://www.arb.ca.gov/aqmis2/map_pages/gmap.php

Statistical Data: The South Coast AQMD website has air quality data and annual trends from 1994 to 2008. The Air Resources Board website also has a very effective search tool[55] for retrieving current and historical data. It provides daily pollutant averages, daily maximum values and annual average values[56] for every monitoring site throughout the state. Of particular note, the California Air Resources Board has an Annual Toxics Summary, which publishes annual averages, maximum values, minimum values, P90 values, etc., by area and station for 32 types of VOCs, six types of Aromatic Hydrocarbons, and 34 types of heavy metals.

Figure 2.19 Los Angeles North Main Street Monitoring Station Pb Concentration Statistics

Air Resources Board

View a Different Site
View a Different Substance
Order a Data CD

Annual Toxics Summary
Los Angeles-North Main Street
Lead
nanograms per cubic meter

ADAM
FAQs

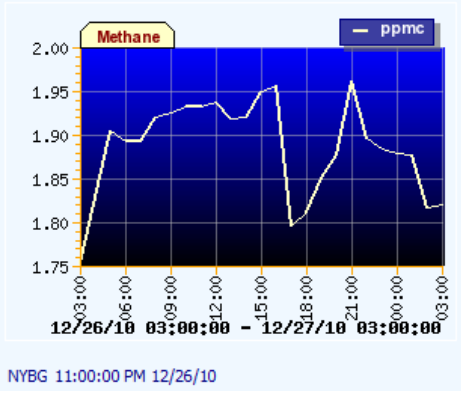
Year	Months Present	Minimum	Median	Mean	90th Percentile	Maximum	Standard Deviation	Number of Observations	Detection Limit	Estimated Risk
2009		0.75	10	12.2	23	32	7.00	30	1.5	0.1
2008		*	*	*	*	*	*	0	*	*
2007		3.9	12	*	26.5	43	10.1	18	1.5	*
2006		*	*	*	*	*	*	0	*	*
2005		*	*	*	*	*	*	0	*	*
2004		*	*	*	*	*	*	0	*	*
2003		7.0	*	*	*	34	9.88	5	3.0	*
2002		7.0	19	22.2	35.4	48	10.3	29	3.0	0.3
2001		2	19	*	32.8	48	11.4	22	4.0	*
2000		2	18	18.5	30	52	11.6	31	4.0	0.2
1999		5.0	20	31.1	33	570	101	30	4.0	0.4
1998		2	19	*	30.5	45	9.97	26	4.0	*
1997		2	22	*	43.2	59	15.0	17	4.0	*
1996		5.0	32	35.3	66.2	97	22.3	29	4.0	0.4
1995		2	29	34.3	64	77	21.2	28	4.0	0.4
1994		2	38.5	55.5	93.7	310	59.8	28	4.0	0.7
1993		14	36	*	83.4	250	48.8	23	4.0	*
1992		2	59	*	120	170	39.5	21	4.0	*
1991		17	68.5	80.5	140	190	44.1	28	4.0	1
1990		23	67	*	120	170	37.4	28	1.0	*
1989		*	*	*	*	*	*	0	*	*

Graph It!

3.3 New York

Real Time Data: The New York State Department of Environmental Conservation's website publishes New York City's AQI on a map and provides real time pollutant data by monitoring site. It also publishes $PM_{2.5}$, SO_2, CO, O_3, and NO_2 concentrations, with $PM_{2.5}$ data disclosed every hour and pollutant concentration data disclosed every three hours accompanied by graphs.

Figure 2.20 NYBG Monitoring Station Data[57]



	AQI 23	
	Good	
O3	0.031 ppm	Non Methane 3	0.12 ppmc
SO2	4.087 ppb	Total HC	1.95 ppmc
CO	0.3 ppm	TEMP	Deg F
NO	0.001 ppm	RH	%
NO2	0.008 ppm	BP	28.89 in HG
NOx	0.009 ppm	Precipitation	0.00 in
Methane	1.82 ppmc		

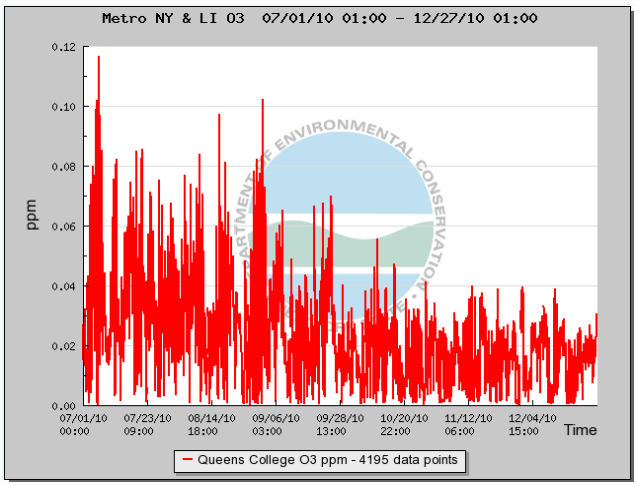
Click Here To Produce Reports

Hover over the table for instant charts.

December 27, 2010, NYBG (New York Botanical Garden) monitoring station monitors O_3, SO_2, CO, NO, NO_2, No_x, CH_4, and total hydrocarbon concentrations

Statistical Data: New York City Department's website has annual reports available from 2000-2009, with statistics for each monitoring station, including annual average concentrations, maximum values for each pollutant and hourly changes for the past 180 days of data.

Figure 2.21 July 1, 2010 1:00 Queens College New York University O_3 Concentration Trends[58]



3.4 London

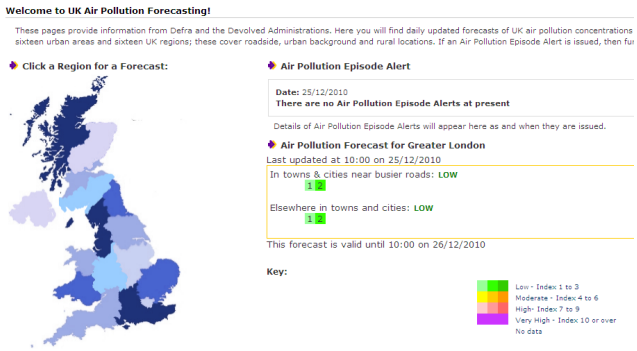
Benefiting from a well-developed atmospheric monitoring network and a sound environmental information disclosure system, London's air quality monitoring has a large and comprehensive amount of air quality information. The data is disclosed in a timely manner and the website has a convenient search tool (a common feature of developed countries).

The U.K Air Quality Index (Air Pollution Index, API) has four levels ranging from one to ten points: air quality is considered low from one to three points, moderate from four to six points, high from seven to nine points, and very high at ten points. API evaluated pollutants include SO_2, PM_{10}, NO_2, O_3 and CO.

[55] Determined by pollutant category.
[56] California Annual Air Toxics Summary,, California Air Resources Board Website. http://www.arb.ca.gov/adam/toxics/sitelists/pbsites.html
[57] NYSDEC Air Quality Monitoring website: http://www.dec.ny.gov/airmon/stationStatus.php?stationNo=62
[58] NYSDEC Air Quality Monitoring website: http://www.dec.ny.gov/airmon/stationStatus.php?stationNo=62

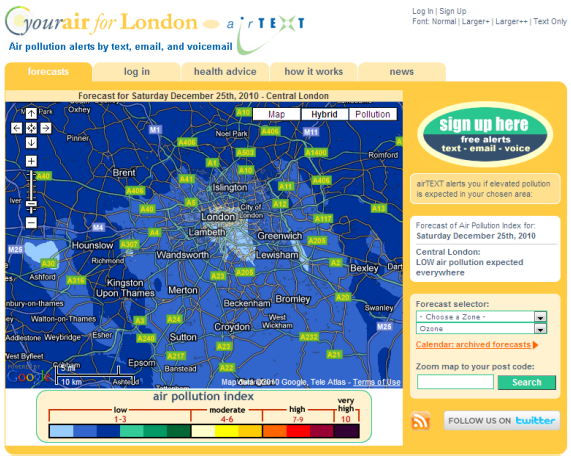
Forecasts: The U.K. National Air Quality Archive website provides API values and forecasts for the areas around heavily trafficked roads throughout the Greater London region, as well as AQI forecasts for other regions. Users also have access to data from the previous hour and weekly concentration graphs by monitoring points. The U.K. Automatic Urban and Rural Network also has air quality monitoring stations located throughout the U.K., which are integrated with the London Air Quality Network stations.

Figure 2.22 U.K. National Air Quality Archive[59]



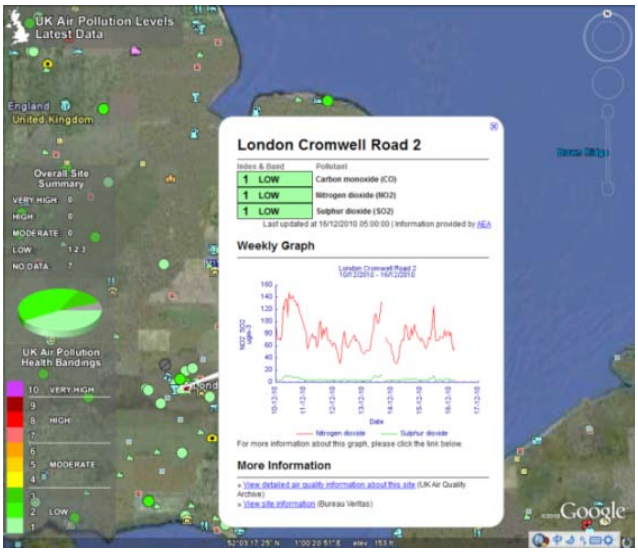
The website "Your Air for London" publishes the API value for each area of the city. Users can search by zone or by pollutant, including total health index, NO_2, O_3, and particles. The map is color-coded based on the API value, allowing users to see if the level is high or low at a glance. Users can sign up for air quality alerts by text or email and also follow the site on Twitter.

Figure 2.23 December 25, 2010 London Air Quality Index Forecast[60]



Among these various modes for publishing daily air quality, both the London Air Quality Network (LAQN) run by King's College London and the U.K. National Air Quality Archive website publish real time air quality data and have unique features on their respective websites. The U.K. National Air Quality Archive website displays API values for each area of London's monitoring sites, along with hourly concentrations and weekly trends for each pollutant. Users can also see statistics and pollution episodes for each site. The website also uses Google Earth, which, once installed, can be used to view all the monitoring sites in the British Isles along with their hourly API value and a weekly trend graph.

Figure 2.24 December 16, 2010 5:00 London Cromwell Road No. 2 Monitoring Station Air Quality Index Data and Weekly Graph[61]



London's Air Quality Network website also has a Google Map that shows all monitoring sites color-coded according to their hourly API value and weekly trend graph. The website's "Nowcast" feature gives comprehensive monitoring data and the current calculated air quality for different areas.

The London Air Quality Network has an effective and convenient search tool function, with data available from 1993. Users can look up monitoring data 15-minute average values, hourly average values, eight-hour average values, and 24 hour average values as well as daily average and annual average values for SO_2, PM_{10}, NO_2, O_3 and CO.[62] Users can also find and download diagrams comparing different monitoring values within specific time frames. The website also has alerts available through Twitter, Facebook and even has an iPhone application called London Air that gives the latest API readings from LAQN monitoring sites and alerts when air quality changes. These methods of sharing air quality information are raising public awareness and increasing accessibility of air quality information.

[59] UK Department for Environment Food & Rural Affairs (DEFRA) website: http://www.airquality.co.uk
[60] Your Air for London: http://www.airtext.info/
[61] KMZ Document Download Address: http://uk-air.defra.gov.uk/google-earth/uk_airpollution.kmz
[62] Determined by pollutant category.

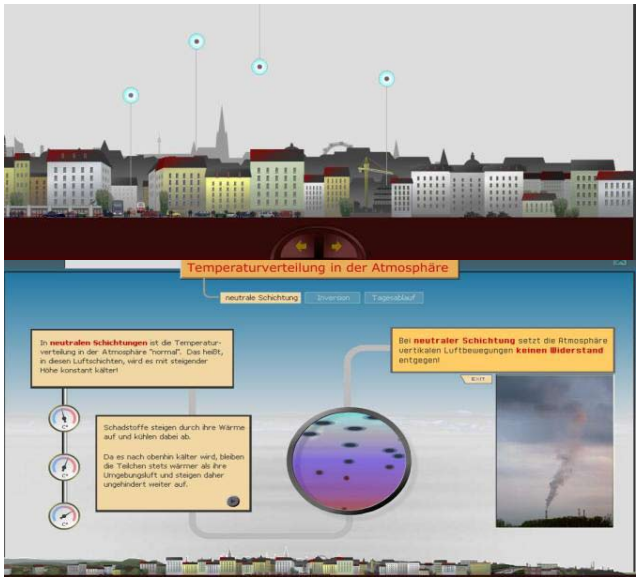
3.5 Vienna

Austria's Federal Environmental Protection Agency has established a section of its website that issues air quality information for all major cities, including Vienna. Besides a daily report, monthly report, and annual report, the column also publishes the daily air quality based on O_3, NO_2, PM_{10}, and $PM_{2.5}$, plus detailed information on which sites have exceeded concentration values. Monitored concentrations for PM_{10}, O_3, SO_2, NO_2, CO are released every 30 minutes, in conjunction with maps and air quality index information.

Figure 2.25 Austria Air Quality Information Disclosure System[63]

Vienna publishes an annual report that lists concentration values for $PM_{2.5}$, O_3, SO_2, NO_2, CO, benzene, B[a]P, Lead, cadmium, arsenic, nickel and other monitored pollutants by monitoring site. Vienna also publishes annual trends graphs in correlation with the above-mentioned information. In addition, they also have a description of PM_1 monitoring.

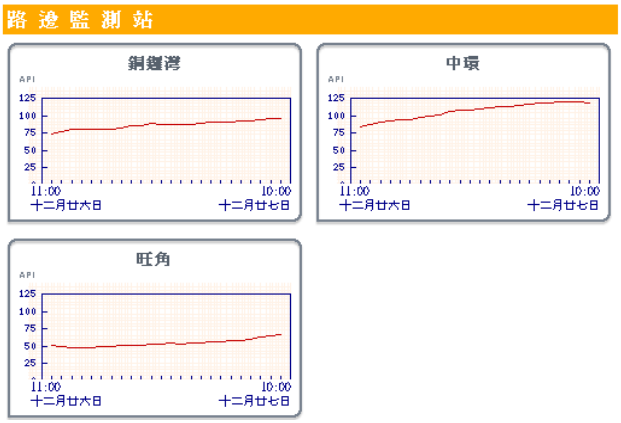
Figure 2.26 Vienna, Austria—Atmospheric Quality Monitoring Information Flash[64]



3.6 Hong Kong

The Hong Kong Environmental Protection Department website discloses air quality data every hour in real time for each monitoring site and roadside monitoring station. Monitored pollutants include PM_{10}, NO_2, SO_2, O_3, and CO. The published information includes API values, "effects of pollution," as well as concentration values for each monitored pollutant and API trends for the past 24 hours. Air quality data is collected and analyzed every month and quarter.

Figure 2.27 Past 24 Hours Roadside Monitoring Station API Data[65]



The Hong Kong Environmental Protection Department publishes an annual air quality report, which includes information on three monitoring stations: one in the central/west region, one in Kwun Tong, and one in Yuen Long. These sites all provide specific pollution information for wet and dry depositions, with total information containing NH^{4+}, NO^{3-}, SO^{4-}, Cl-, F-, Na+, K+, formate, acetate, and other pollutant details. The annual air quality report also publishes information from the Tsuen Wan and Central/Western monitoring stations, which measure toxic air pollutant levels and release data for heavy metals: hexachrome, Pb, benzene, B[a]P, 1,3 - butadiene, formaldehyde, perchloroethylene and annual average concentrations of dioxins.[66]

In the category of user-friendliness, Hong Kong's Environmental Protection Department broadcasts a daily air quality report, as well as publishes air quality information in local newspapers. The department's real time air quality data is accompanied by maps, making it easy for the public to see detailed air quality information for different areas.

[63] Austrian Federal Environmental Department Website: http://luft.umweltbundesamt.at/pub/gmap/start.html#
[64] Vienna Environmental Protection Bureau Website: http://www.robertkern.at/uli/
[65] Hong Kong Special Administrative Region Government Environmental Protection Department Website: http://pc211.epd-asg.gov.hk/gb/www.epd-asg.gov.hk/tc_chi/24api/24api.html
[66] Based on the data released, the sampling sites are Tsuen Wan and Central. Each monitoring site samples once per month.

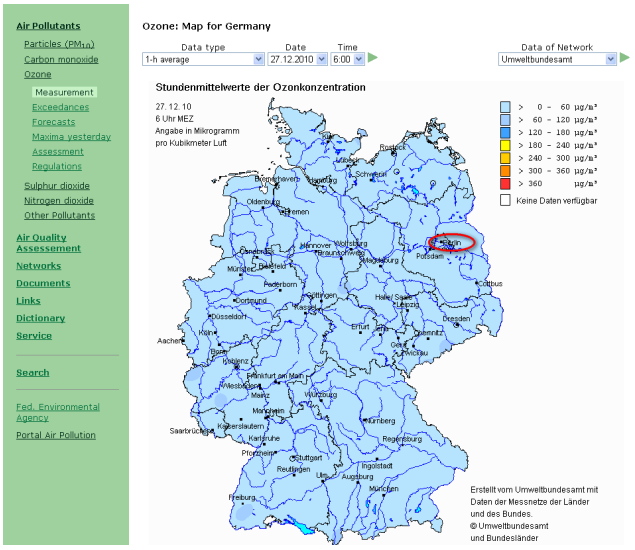
Figure 2.28 Hong Kong Current Air Pollution Index[67]

The lack of PM_{10} monitoring data is the main flaw in Hong Kong's air quality information announcement system. Hong Kong is the only evaluated international city that doesn't release PM_{10} monitoring data.

3.7 Berlin

Germany's State Environmental Protection Department's website has an "air" section that presents air quality information and maps and publishes air quality information by monitoring site. In addition to giving daily average values for PM_{10}, users can also look up NO_2, SO_2, CO, and O_3 averages and hourly air quality concentration information.[68] With regards to the criteria of systematic disclosure, pollutant concentration values are available for seven monitoring sites and users can view the pollutant concentration values for the previous hour. By choosing a data type, users can look up different types of monitoring data, such as O_3, as well as hourly average values, eight-hour average values, and maximum value information.

Figure 2.29 December 27, 2010 Germany State O_3 Air Quality Conditions[69]



Berlin's official website[70] for publishing monitoring information has set up an air quality information announcement section that not only introduces Berlin's plan for the improvement of air quality, but also provides real time air quality monitoring data for Berlin. The website publishes an annual report with pollutant information for each monitoring site, including PM_{10}, $PM_{2.5}$, NO_2, SO_2, O_3, benzene, benzo[a]pyrene, particles, arsenic, cadmium, nickel, and annual average concentration values for Pb.

3.8 Moscow

The air quality section of the Moscow environmental monitoring organization's website[71] releases concentration values by monitoring site for CO_2, NO_2, NO, O_3, SO_2, ammonia, hydrogen sulfide, methane, formaldehyde, xylene, styrene, and PM_{10}, as well as 13 other pollutants, with information updated every hour.

[67] Hong Kong Special Administrative Region Government Environmental Protection Department Website: http://pc211.epd-asg.gov.hk/gb/www.epd-asg.gov.hk/tc_chi/current/current.html

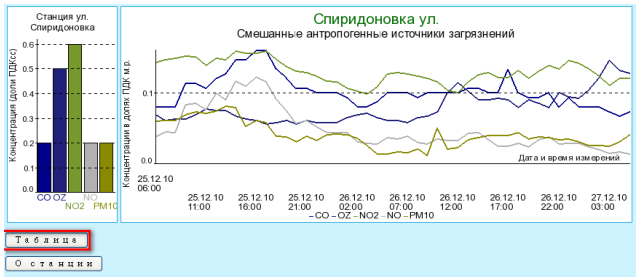
[68] Based on observations during the evaluation period, air quality information is not updated during the night from 22:00 to 6:00. At 7:30, air quality monitoring data from 1:00 to 6:00 is released, and then data is released once every three hours.

[69] German Federal Environmental Protection Department Website: http://www.env-it.de/umweltbundesamt/luftdaten/pollutant.fwd?comp=O3

[70] www.berlin.de

[71] Different monitoring sites monitor different pollutants.

Figure 2.30 December 27, 2010 Moscow's Air Quality Conditions[72]



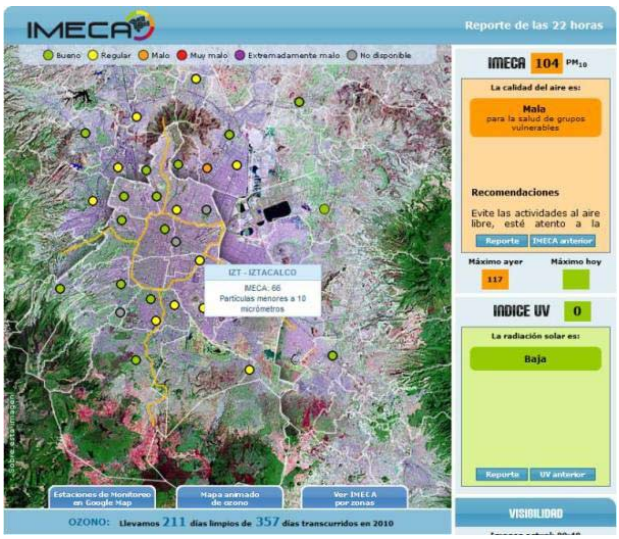
As well as starting a web platform from which air quality information can be published, Moscow has also launched various quick and convenient channels for the public to find air quality information, such as the following:

- Moving towards a level of providing real time air pollution information for residents, since December 2002, electronic bulletin boards have been set up in Pushkin Square and in places of heavy foot traffic, which broadcast daily environmental information.
- Electronic bulletin boards have also been installed in more than ten large supermarkets and entertainment/shopping centers.
- Moscow's major publications, TV broadcasts and news agencies also announce air quality information.
- Citizens can text "Э К О" to the number 6677 to receive local atmospheric conditions and forecasts.
- Citizens can dial a 24-hour hotline, 205-85-62, to get local atmospheric conditions and forecasts.

3.9 Mexico City

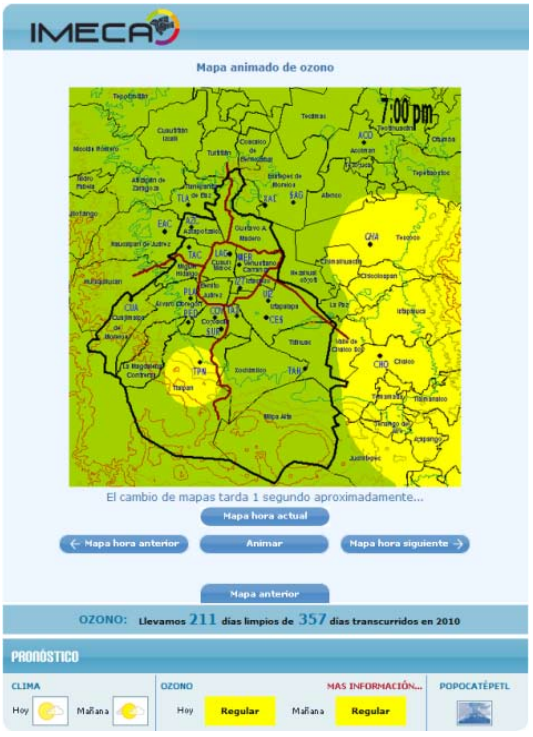
The website of Mexico City's air quality monitoring system, SIMAT (Sistema de la Secretaría del Medio Ambiente de la Ciudad de México), run by Mexico's Federal Special Environmental Department (Secretaría del Medio Ambiente del Gobierno del Distrito Federal, SMA-GD) publishes accessible air quality information. Mexico City's air quality index, IMECA (Índice Metropolitano de la Calidad del Aire) includes SO_2, NO_2, O_3 and CO. The website's homepage displays a map where users can see hourly AQI (IMECA) values for the Northwest, Northeast, Central Southwest and Southeast regions of the city. Users can then see specific monitoring points within those regions that show color-coded IMECA values and the primary pollutants monitored at that site.[73]

Figure 2.31 December 24, 2010, 1:00, IMECA and Primary Pollutant Values by Monitoring Site[74]



Mexico City also places a great deal of importance on the monitoring and publishing of O_3 data. IMECA provides an animated map showing hourly changes in O_3 for the previous 24 hours and updates every 20 minutes.

Figure 2.32 Map: Mexico City 24-Hour O_3 Changes[75]



The yellow boxes show the AQI (IMECA) values for the current day and next day.

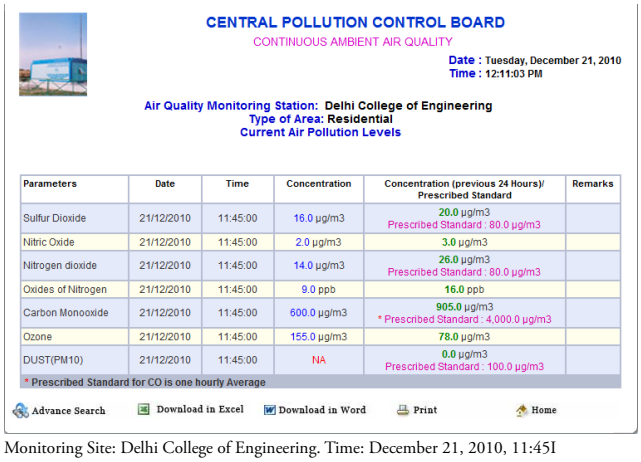
[72] Moscow Environmental Monitoring Agency Website: http://www.mosecom.ru/air/air-today/station/
[73] On workdays, updates occur from 7:00 until 22:00, while on weekends and holidays updates occur from 8:00 to 20:00.
[74] Mexico City Atmospheric Monitoring System Website: http://www.sma.df.gob.mx/simat2/
[75] Mexico City Atmospheric Monitoring System Website: http://www.sma.df.gob.mx/simat2/index.php?opcionimeca=1&ani=y

With regards to annual statistical monitoring data, Mexico City's SIMAT website provides monitoring data from 2000-2010, including daily and hourly SO_2, PM_{10}, NO_2, O_3, CO, total IMECA values, as well as 2009's SO_2, PM_{10}, $PM_{2.5}$, NO_2, O_3, CO and Pb average concentrations. The website also provides comparisons with WHO recommended standards and United States recommended standards. It also has annual emissions inventory reports available. "La Calidad del Aire en la Ciudad de Mexico" can be followed on Twitter, and publishes daily announcements on Mexico City's pollution as well as IMECA values and primary pollutant values.

3.10 New Delhi

New Delhi has fewer air quality monitoring sites and monitors a smaller number of pollutants than the cities in more developed countries. However, the timeliness of its monitoring data compares favorably to that of developed countries. India's National Air Quality Monitoring Programme (NAMP) has established monitoring stations in New Delhi that monitor SO_2, PM_{10}, $PM_{2.5}$, NO, NO_2, NO_x, O_3 and CO. Each monitoring site provides data for each monitored pollutant through the website of NAMP's Central Pollution Control Board (CPCB). Users can view data for the four air quality monitoring stations in New Delhi. The ITO site and the Delhi College of Engineering site update their data every 15 minutes, the CPCB site has new data every 30 minutes and the SIRI Port site's data is updated every two hours. New Delhi does not have comprehensive annual reports readily available, however, and the CPCB website only has NO_2 and SO_2 pollutant concentration data for 2006.

Figure 2.33 New Delhi Air Pollutant Concentrations[76]



CENTRAL POLLUTION CONTROL BOARD

CONTINUOUS AMBIENT AIR QUALITY

Date : Tuesday, December 21, 2010
Time : 12:11:03 PM

Air Quality Monitoring Station: Delhi College of Engineering
Type of Area: Residential
Current Air Pollution Levels

Parameters	Date	Time	Concentration	Concentration (previous 24 Hours)/ Prescribed Standard	Remarks
Sulfur Dioxide	21/12/2010	11:45:00	16.0 µg/m3	20.0 µg/m3 Prescribed Standard : 80.0 µg/m3	
Nitric Oxide	21/12/2010	11:45:00	2.0 µg/m3	3.0 µg/m3	
Nitrogen dioxide	21/12/2010	11:45:00	14.0 µg/m3	26.0 µg/m3 Prescribed Standard : 80.0 µg/m3	
Oxides of Nitrogen	21/12/2010	11:45:00	9.0 ppb	16.0 ppb	
Carbon Monooxide	21/12/2010	11:45:00	600.0 µg/m3	905.0 µg/m3 * Prescribed Standard : 4,000.0 µg/m3	
Ozone	21/12/2010	11:45:00	155.0 µg/m3	78.0 µg/m3	
DUST(PM10)	21/12/2010	11:45:00	NA	0.0 µg/m3 Prescribed Standard : 100.0 µg/m3	

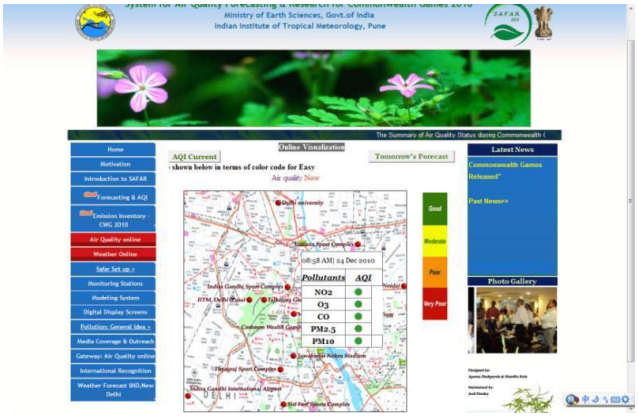
* Prescribed Standard for CO is one hourly Average

Advance Search | Download in Excel | Download in Word | Print | Home

Monitoring Site: Delhi College of Engineering. Time: December 21, 2010, 11:45I

In October 2010 the British Commonwealth Games marked a turning point and opportunity for New Delhi to fill in the gaps in its broadcasting of real time air quality data and AQI forecasts. India's Ministry of Earth Sciences, Government of India, together with the Indian Institute of Tropical Meteorology, Pune, established a System for Air Quality Forecasting & Research for Commonwealth Games 2010 (SAFAR), which has established twelve monitoring sites, including those set up at the airport and stadium. These stations will monitor PM_{10}, $PM_{2.5}$, NO_2, O_3 and CO and update data every minute, providing AQI and primary pollutant values.

Figure 2.34 New Delhi's Real Time AQI Broadcast[77]



[76] Central Pollutant Control Board Website: http://www.cpcb.nic.in/air.php
[77] System for Air Quality Forecasting & Research for Commonwealth Games 2010 : http://safar.tropmet.res.in/

Chapter 3
Comparisons in Urban Air Quality Information Transparency in China and Abroad, Including Suggestions for Improvement

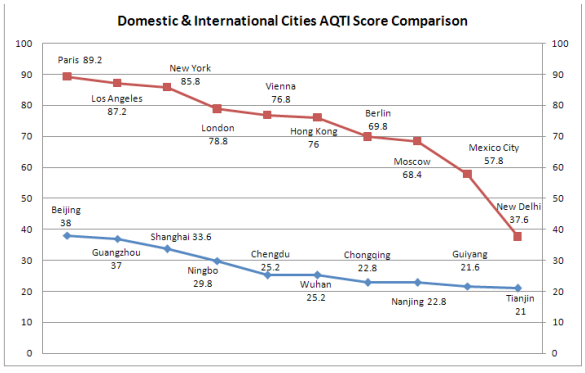
Section 1. Comparisons Between the Evaluation Group and Reference Group's AQTI Evaluation Results

Through comparative analysis of the differences in AQTI evaluation results between the domestic evaluation group cities and the international reference group cities, we came to these preliminary conclusions:

1. For the cities that were assessed, the total information disclosure level of the domestic cities clearly lagged behind that of the major cities in developed countries (regions).

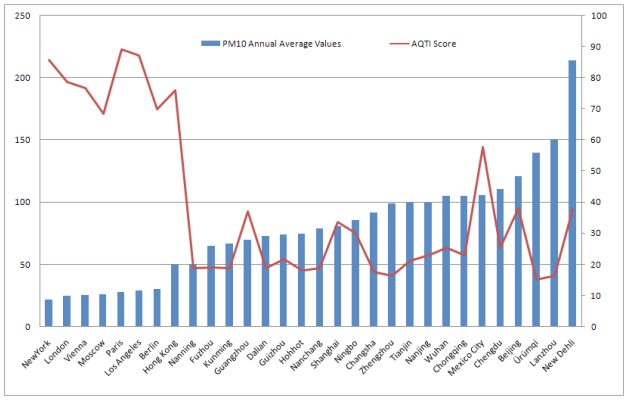
In the evaluation group of 20 domestic cities, the city with the highest score was Beijing, with 38 points. The average score in the evaluation group was 22.65 points and the average score for the top ten cities was only 27.7 points. In the reference group of ten international cities, the city with the highest score was Paris with 89.2 points and the average for the eight cities in developed countries or regions was 79 points. The cities acting as a reference group for developing nations were Mexico City and New Delhi, which scored 57.8 points and 37.6 points respectively. Among the 20 domestic cities, only the number one ranked city, Beijing, had a higher score than a reference group city, New Delhi.

Figure 3.1 Score Comparison between the Evaluated Domestic Cities and International Reference Cities



For the domestic cities that were assessed, the air pollution levels were much higher than the levels in many cities in developed countries and regions, and the information disclosure situation was also far inferior to that of reference group cities.

Figure 3.2 Comparison between AQTI Evaluation Score and Average Annual PM_{10} Value[78]



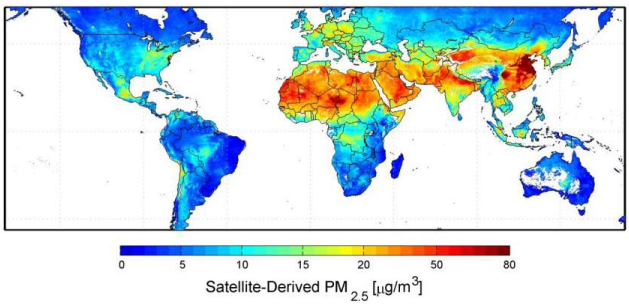
From the figure above we can see that with the exception of New Delhi, the cities which have a large contrast between information transparency and air pollution status—such as Urumqi, Lanzhou, Changsha, Zhengzhou, Tianjin, Chongqing, Chengdu and Nanjing—all come from the evaluation group.

[78] Among the evaluation group, the concentration values for PM10 for Ningbo, Nanning, Changsha, Zhengzhou, Lanzhou, Urumqi, and Nanjing came from the "2009 China Environmental Quality Report." The data for the remaining cities came from local environmental status/quality reports. Among the reference group, the PM10 concentration values for New Delhi, Mexico City and Paris came from annual reports, while data for the remaining cities was determined by averaging the annual averages from each of their monitoring sites.

2. In the assessed cities, the domestic cities had a lower number of monitored atmospheric pollutants than the cities from developed countries (regions).

At present, domestic air quality information transparency mainly concentrates on PM_{10}, SO_2 and NO_2. While the monitoring and publication of fine particulate matter ($PM_{2.5}$) is already generally carried out in cities in developing countries (regions), China has not yet begun monitoring $PM_{2.5}$. Figure 3.3 shows that in the world, China is the country that suffers from the most serious fine particulate matter ($PM_{2.5}$) pollution and it is vital that China begin monitoring and disclosing $PM_{2.5}$ as soon as possible.

Figure 3.3 Global Distribution of $PM_{2.5}$[79]



This figure, which shows global fine particulate matter ($PM_{2.5}$) pollution, was made by two Canadian scientists based on data from a NASA satellite. From the map it is not hard to see that the areas where China's population is most concentrated and the economy is most developed are also among the areas on the map with the deepest red color. These areas convey the parts of the world with the highest concentrations of fineparticulate matter.

China's Ministry of Environmental Protection carried out a pilot haze monitoring project. According to statistics, from January 1st, 2009, to December 31st, the number of hazy days in each test city was between 51 and 211. Tianjin had 51 days, Shanghai 134 days, Chongqing 133 days, Nanjing 211 days, Suzhou 169 days and Shenzhen 115 days. The number of hazy days accounted for between 14.0% and 57.8% of the total number of monitored days.[80]

Particles with a diameter of less than 2.5 microns are known as $PM_{2.5}$. Medical research shows that $PM_{2.5}$ is more easily inhaled into the deep respiratory tract. In addition, these fine particles act as carriers of many pollutants, so they have a far more harmful effect on human health than larger respirable particles. People exposed to high concentrations of $PM_{2.5}$ can have increased blood viscosity and albumin levels that can in turn lead to blood clotting. Some chemical elements such as lead, cadmium, nickel, manganese, vanadium, bromine, zinc, B[a]P and other polycyclic aromatic hydrocarbons (PAHs) have potential toxicity and are mainly attached to particles less than 2.5 microns. These particles are easily deposited in the pulmonary alveoli, allowing various toxins to be easily absorbed into the blood, which can affect the reproductive system.[81]

AQTI research found that, apart from Hong Kong, the cities in the reference group all had different levels of $PM_{2.5}$ information disclosure, whereas the Chinese cities evaluation group did not disclose $PM_{2.5}$ data.

Chart 3.1 Status of Domestic and International Cities' $PM_{2.5}$ Information Disclosure

International Cities	Publishes $PM_{2.5}$	Domestic Cities Evaluated	Publishes $PM_{2.5}$	Domestic Cities Evaluated	Publishes $PM_{2.5}$
New York	Yes	Beijing	No	Dalian	No
Los Angeles	Yes	Guangzhou	No	Kunming	No
London	Yes	Shanghai	No	Nanning	No
Moscow	Annual Report	Ningbo	No	Nanchang	No
Berlin	Annual Report	Chengdu	No	Hohhot	No
Vienna	Annual Report	Wuhan	No	Changsha	No
Hong Kong	No	Chongqing	No	Nanjing[82]	No
Paris	Yes	Guiyang	No	Zhengzhou	No
Mexico City	Annual Report	Tianjin	No	Lanzhou	No
New Dehli	Yes	Fuzhou	No	Ürümqi	No

Developed countries and cities generally monitor and disclose CO, O_3 and VOCs. In China, only Beijing monitors and discloses CO; Guangzhou monitors and discloses O_3, and Ningbo monitors and discloses VOCs. Some of the international cities in the reference group not only monitor and disclose these pollutants, but additionally carry out monitoring and disclose results for airborne heavy metals.

[79] http://www.nasa.gov/images/content/483897main_Global-PM2.5-map.JPG

[80] Please refer to the explanation of how the "Ambient Air Quality Standards" (Feedback draft) were drawn up (see footnote 2).

[81] Please refer to: Dong, Xueling. "Daqi kexirukeliwu dui huanjinghe renti jiankang de weihai" ("Atmospheric Respirable Particulate Matter Poses a Danger to the Environment and to Health"). Ziyuan Chanye ("Resources and Industries"), 2004. Vol. 6, Issue 5, pp. 50-53.

[82] The Air Quality Forecasting System for Nanjing established by the School of Atmospheric Sciences at Nanjing University forecasts pollutant concentration values for four upcoming times for the current day, eight for the next day, and seven for the third day, as well as the API for the second and third day. It also uses maps to show forecasted changes in concentrations. The pollutants monitored are PM10, PM2.5, SO2, NO2, and O3. For more information, please refer to: http://as.nju.edu.cn/forecast/index.htm (Chinese link)

3. In general the assessed domestic cities do not disclose monitoring information on specific pollutants.

International cities in the reference group, with regards to air quality information disclosure, tend to disclose the concentration and the pollution level of every monitored pollutant, so that the general public can completely and accurately see the levels of specific monitored pollutants. Most of the cities in the domestic evaluation group, however, still publish only AQI information and main pollutant information.[83]

4. In general the assessed domestic cities do not publish air quality information by monitoring site.

Domestic cities in the evaluation group, apart from the cities of Beijing, Dalian, Zhengzhou, Guangzhou, Ningbo, Wuhan, Changsha, Nanchang, Nanning and Nanjing, rarely disclose air quality information by monitoring site. Most of the cities only publish citywide average air quality information, with only a few cities publishing air quality information by district and county. The ten international cities in the reference group all published air quality information by monitoring site.

5. The assessed domestic cities lack real-time disclosure of air quality information

The ten international cities from the reference group all publish real time air quality information. With the exception of Berlin, which has a rather large time lag in its publication of air quality information, the cities all publish real-time air quality information at a rate of once every one or three hours. Some of the monitoring stations in New Delhi update the monitored pollutant concentrations every 15 minutes and under the air quality announcement system planned for the Commonwealth Games that takes place in October 2010, updates are provided every minute. In the domestic cities that were evaluated, apart from Shanghai, data is published once a day.

6. The air quality information disclosure systems of the assessed domestic cities were not as user-friendly as those of the reference group.

The daily air quality information reports from the ten international cities in the reference group were all published in conjunction with maps. Maps also accompanied many of the cities' annual air quality reports. For the 20 domestic cities in the evaluation group, with the exception of Shanghai, Beijing, Guangzhou and Wuhan—which all publish air quality information with maps—published data sets do not give a particularly illustrative or visual display of air quality information. It would also be beneficial for China to have a text service or hotline where citizens can receive quick air quality information, or to incorporate air quality information into a national map so that air quality levels can be compared across the country, such as in the E.U.

In addition, the air quality information disclosure systems that are in operation in many of the international reference group cities have very effective search functions. They also store long periods of historical data, which is particularly useful for users conducting research related to environmental protection. It would be valuable for domestic cities to learn from these examples.

7. The locations and concentration of domestic monitoring sites, as well as the specificity of monitoring sites, were not given the same consideration as those in the reference group.

Many international cities in the reference group have a large number of air quality monitoring sites. For instance, London has 103 sites[84] just for monitoring PM_{10}. In addition, Paris and Hong Kong also monitor and publish roadside pollution information. Although the ambient air quality monitoring sites in the evaluation group of domestic cities can give a picture of the overall environmental quality, the small number of monitoring sites offers insufficient representation and area coverage. The pollutants monitored, the monitoring networks, the number of monitoring sites and the positions of sites do not meet the needs of evaluating the health effects of pollution exposure in key regions.

[83] This was greatly improved following the EPB's implementation of hourly air quality announcements.

[84] Obtained from the London Air Statistics website, where one can look up how many monitoring sites report PM10. Please refer to: http://www.londonair.org.uk/london/asp/dataspecies.asp?species=PM10

Section 2. Suggestions for Improving Urban Air Quality Information Disclosure in China

After comparing the domestic and international AQTI evaluation results, we propose the following suggestions for improving urban air quality information disclosure in China:

- **Make up for deficiencies in domestic urban air pollutant monitoring and publish the results for the missing pollutants**
  - As the region of the world that suffers from the worst fine particulate matter pollution, China should begin monitoring and disclosing $PM_{2.5}$ as soon as possible.
  - Monitor and disclose O_3, CO and VOCs.
  - Launch airborne heavy metal pollutants monitoring and disclose the monitoring results.
- **Increase comprehensiveness of information disclosure**
  - In addition to publishing API values, detailed information for pollutant concentration values should also be published so that the general public can be fully and accurately informed about specifically monitored pollutant levels.
- **Increase comprehensiveness of information disclosure**
  - Add monitoring sites to expand the coverage areas. The positioning of the sites should be considered for better evaluation of the health effects from pollutant exposure in key regions.
  - In order to protect people living around specific pollution sources like roads, power plants and large-scale fixed pollution sources, the sites should be located where they can measure the concentrations of air pollutants where they will be representative of the exposure levels that people will experience. For urban monitoring sites an "industrial area station" could be built to reflect the effect that industrial emission levels have on the area, a "downtown and commercial area station" could be built to reflect the effects of transportation and a "residential area station" could be built to reflect the levels of exposure to residents.
  - Disclose air quality information by monitoring site.
- **Increase timeliness of information disclosure**
  - Disclose real-time air pollutant monitoring data.
- **Increase user-friendliness of information disclosure**
  - Publish air quality information in conjunction with maps so that the general public can have a more visual understanding of an area's air quality information, thus showing the public how to better protect their health.
  - In addition to publishing daily reports at a set time each day, a website or database should be created to provide real- time monitoring data and historical data.

In addition, based on what came to light during the research, we would like to put forward these other suggestions:

- **Air quality standards should be periodically revised and re-examined based on the results of the latest research on environment and health.**
- **In addition to monitoring air quality data, emissions data for key pollutants should also be methodically monitored and published in a timely manner.**
- **An early warning system should be established so as to give the public a timely warning about atmospheric pollution that could have serious effects on public health.**
  - An early warning system would allow the public to swiftly adopt safeguarding measures and reduce the harm air pollution can have on health. In addition, this would mobilize communities to adopt safeguarding and emergency measures,[85] limit atmospheric pollutant emissions and prevent air pollution incidents from occurring.
  - To ensure the effectiveness of the early warning system, the positioning of the monitoring sites need to be more representative and targeted. Forecasts and reports need to be disclosed more promptly. The comprehensiveness of information published needs to be increased and there also needs to be a more user-friendly and accessible type of disclosure.
- **Spread knowledge of the detrimental health effects of atmospheric air pollution to the public.**

[85] For instance, running and other outdoor winter sports for students are suspended on days when there is serious air pollution.

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