

State of the Environment in China 2006

1 Ambient Air Quality

1.1 Ambient Air Quality of the Cities

1.1.1 General Situation

Of the 559 cities under the air quality monitoring network of 2006, 322 were at or above prefecture level, and 237 were of county level. The network covered above 350 million urban people (88.5% of them in prefectures and 11.5% in counties) and 27,000 square kilometers of built-up areas (85.2% of them at prefecture level and 14.8% at county level). 24 cities met Grade I of National Ambient Air Quality Standard (NAAQS), accounting for 4.3%; 325 met Grade II, taking up 58.1%; 159 met Grade III, taking up 28.5%, and 51 failed to meet Grade III, accounting for 9.1%.

Table1-1 Grade Distribution of Chinese Urban Air Quality

	Cities at county level	Cities at prefecture level or above	Cities Nationwide
% of Grade I cities	7.2	2.2	4.3
% of Grade II cities	65.0	53.1	58.1
% of Grade III cities	18.6	35.7	28.5
% of cities below Grade III	9.2	9.0	9.1

Compared with the last year, the proportion of cities with air quality at or better than Grade II of NAAQS increased by 4.7% and the proportion of cities with air quality worse than Grade III dropped by 2.1%. (Figure 1-1)

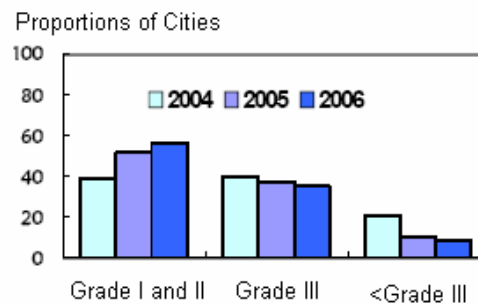


Figure 1-1 Proportion of Cities with Varied Level of Air Quality

1.1.2 Proportion of People Affected by Air Pollution

As of 2006, 52.4% of urban people lived in the cities meeting Grade II of NAAQS or above. The large cities tended to have comparatively bad air quality. For the cities with populations of below 100,000, 100,000~500,000, 500,000~1,000,000 and above 1,000,000, the proportions of people living in the up-to-standard cities were declining, respectively 72.4%, 63.1%, 54.3% and 48.0%. (Figure 1-2)

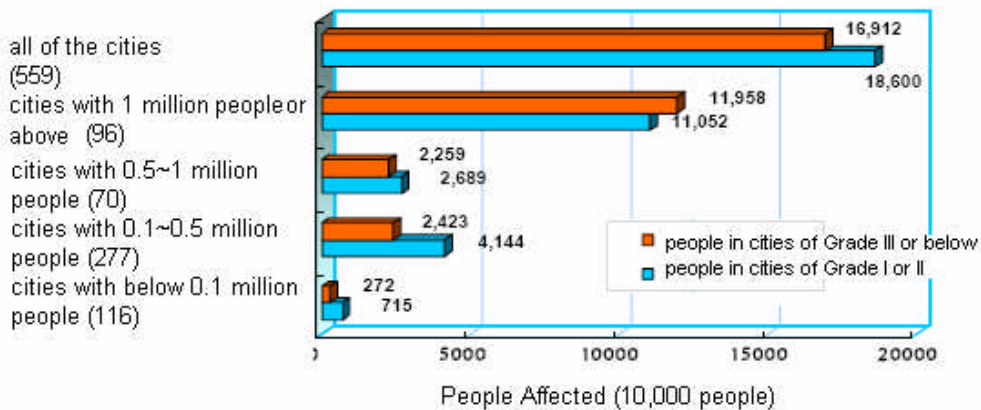


Figure 1-2 Proportion of People Living in Up-To-Standard Air at Different City Sizes

Compared with the last two years, the proportion of people in up-to-standard cities had steadily increased from 1/3 of the year 2004 to 50.3% of the year 2006. (Figure 1-3)

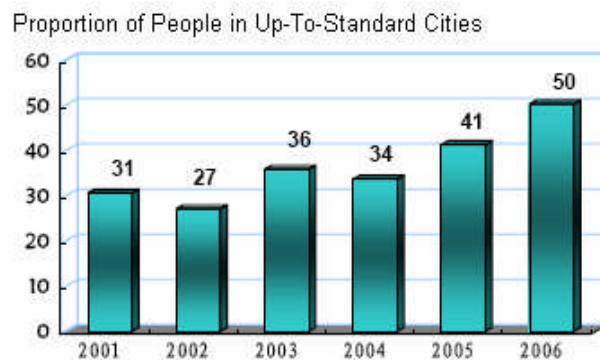


Figure 1-3 Change of Proportion of People in Up-To-Standard Cities

1.1.3 Major Pollutants in the Air

Among the cities under monitoring, 33.5% had annual particulate concentration exceeding Grade II standard and 7.0% exceeding Grade III standard. 13.2% failed to meet SO₂ Grade II standard and 3.6% failed SO₂ Grade III. For all of the cities monitored, annual NO₂ concentrations met Grade II standard. (Table 1-2) Particulate matter was still the primary air pollutant while SO₂ pollution remained a problem.

Cities with heavy particulate pollution were mainly distributed in provinces (autonomous regions, or municipalities directly under the Central Government) such as Shanxi, Xinjiang, Gansu, Beijing, Shaanxi, Ningxia, Sichuan, Inner Mongolia, Hebei, Hunan, Liaoning, Henan, Chongqing, Tianjin, and Jiangsu. Cities suffering from heavy SO₂ pollution mainly distributed in Shanxi, Inner Mongolia, Yunan, Xinjiang, Guizhou, Gansu, Hebei, Hubei, Guangxi, Hunan, Sichuan, Liaoning, Henan, Chongqing, and Tianjin. Some large cities like Urumuqi, Guangzhou, Lanzhou, Beijing, Shenzhen, Guiyang, and Hohhot observed relatively higher NO₂ level.

The national annual PM₁₀ concentration barely met Grade II of NAAQS. (Figure 1-4) Compared with last year, the proportion of cities with noncompliant PM level decreased 3.3% while the proportion of cities below Grade III basically remained the same. The national annual SO₂ concentration met Grade II of NAAQS. (Figure 1-5) Compared with last year, the proportion of cities with noncompliant SO₂ level decreased 4.3% and the proportion of cities below Grade III decreased 2.0%. The grade distribution had little

change for NO₂.

Table 1-2 Proportions of Cities with Different Grades of PM, SO₂ and NO₂ Levels

Grades of Annual Concentration of Major Air Pollutants		Cities at county level	Cities at prefecture level or above	Cities Nationwide
PM	% of Grade I cities (PM ₁₀ ≤0.04mg/m ³)and(TSP≤0.08mg/m ³)	8.6	3.8	5.7
	% of Grade II cities (0.04mg/m ³ <PM ₁₀ ≤0.1mg/m ³) or (0.08mg/m ³ <TSP≤0.2mg/m ³)	65.1	58.3	60.8
	% of Grade III cities (0.1mg/m ³ <PM ₁₀ ≤0.15mg/m ³) or 0.2mg/m ³ <TSP≤0.3mg/m ³)	17.3	32.5	26.5
SO ₂	% of Grade I cities (SO ₂ ≤0.02mg/m ³)	38.5	20.9	28.3
	% of Grade II cities (0.02mg/m ³ <SO ₂ ≤0.06mg/m ³)	56.4	60.0	58.5
	% of Grade III cities (0.06mg/m ³ <SO ₂ ≤0.1mg/m ³)	3.0	14.4	9.6
	% of cities below Grade III (SO ₂ >0.1mg/m ³)	2.1	4.7	3.6
NO ₂	% of Grade I cities (NO ₂ ≤0.04mg/m ³)	88.1	86.6	87.4
	% of Grade II cities (0.04mg/m ³ <NO ₂ ≤0.08mg/m ³)	11.6	13.3	12.6

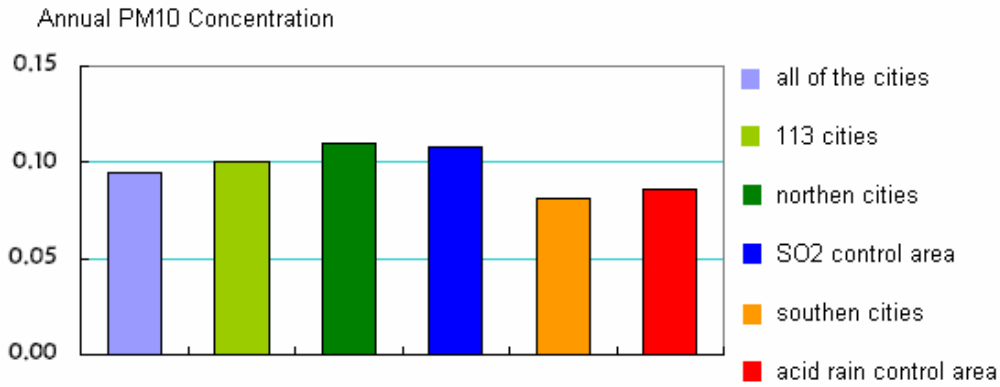


Figure 1-4 Comparison of PM10 Concentration Levels (mg/m³)

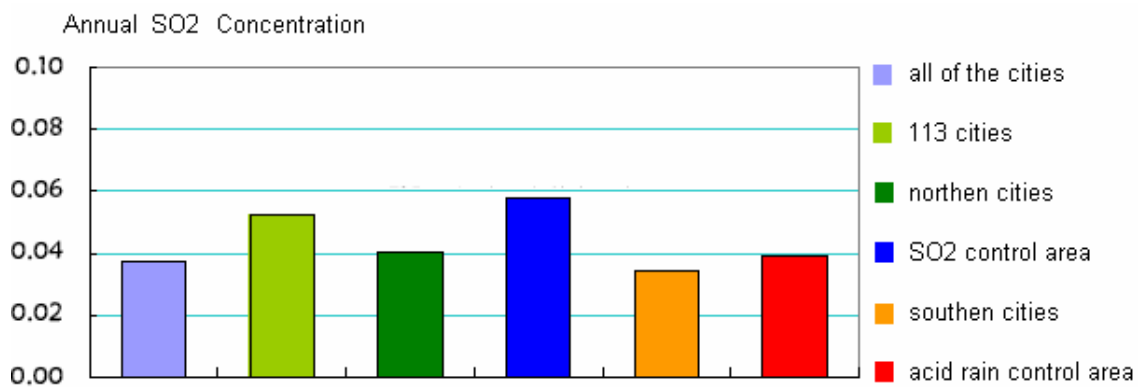


Figure 1-5 Comparison of SO₂ Concentration Levels (mg/m³)

1.1.4 SO₂ Pollution in the Two Controlled Zones

Among the 63 comparable cities in the SO₂ controlled zone, 51.6% had the annual average SO₂ levels meeting Grade II standard, an increase of 7.2% compared with that of the last year. 48.4% failed to meet Grade II standard; and 16.1% surpassed Grade III standard, down by 4.5%. (Figure 1-6). Of the 115 comparable cities in acid rain controlled zones, 79.2% had annual average SO₂ levels meeting Grade II standard, up by 4.4%; and 3.3% failed to meet Grade III standard, down by 1.0% compared with that of the last year. (Figure 1-7)

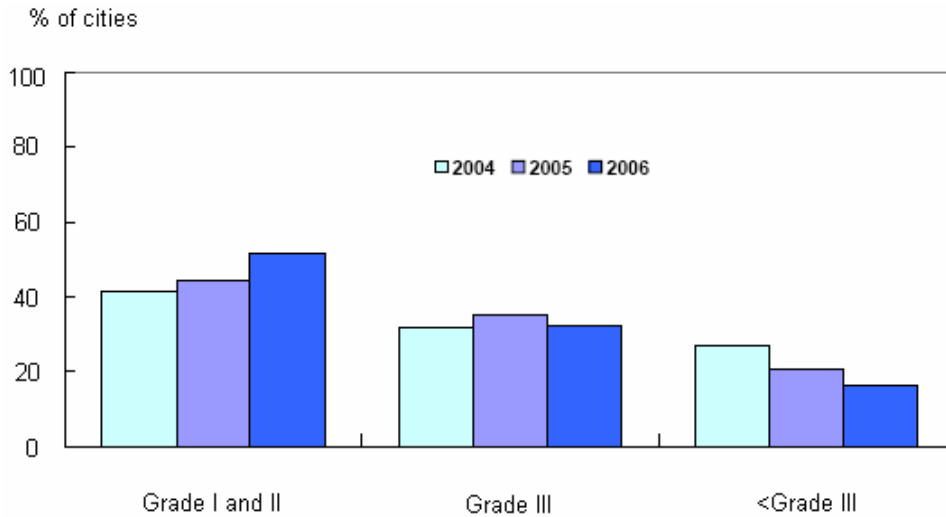


Figure 1-6 Comparison of Annual SO2 Level in SO2 Controlled Zone

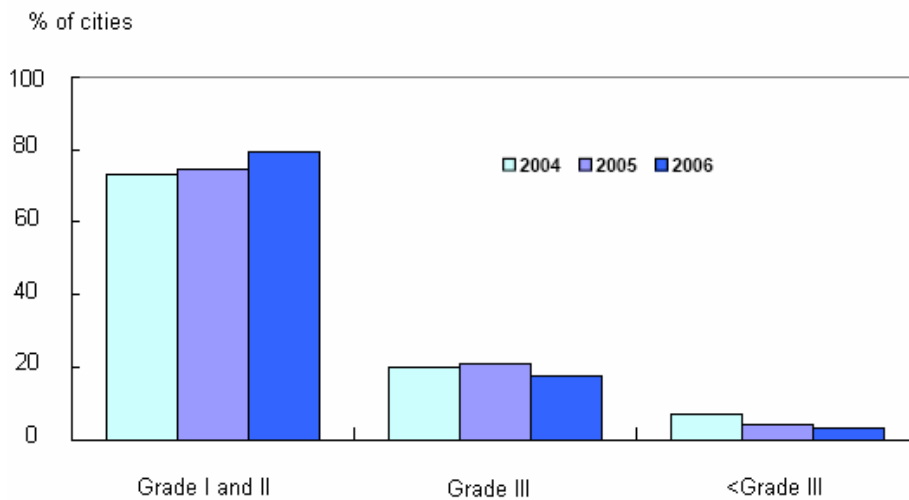


Figure 1-7 Comparison of Annual SO2 Level in Acid Rain Controlled Zone

Among the comparable cities in the SO2 controlled zone, the annual SO2 level had decreased since 2003 (from 2003~2006 they were 0.097mg/m³, 0.089mg/m³, and 0.069mg/m³). For the 115 comparable cities in the acid rain controlled zone, the annual SO2 level tended to decrease since 2004 but the trend was not prominent. (Figure 1-8)

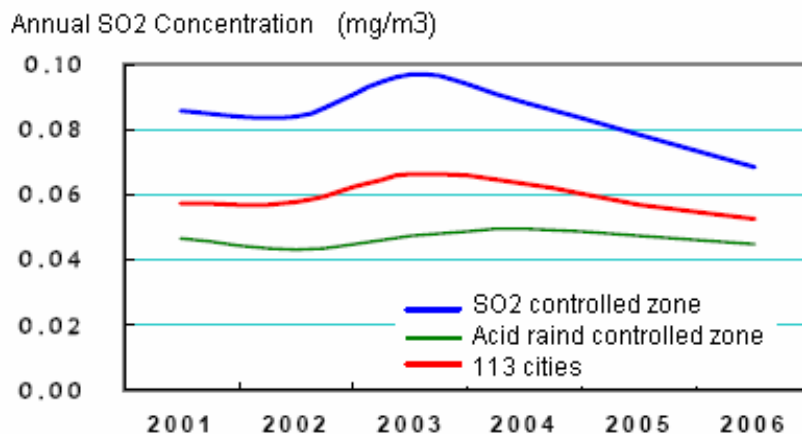


Figure 1-8 Change of SO₂ Concentrations of Comparable Cities in TCZs

1.1.5 Distribution of Heavily Polluted Cities at or above Prefecture Level

There were 15 provinces (autonomous regions, or municipalities directly under the Central Government) where above 50% of the cities failed to meet Grade II of NAAQS. (Table 1-3)

Table 1-3 Air Quality Levels of the Cities in Different Provinces

Province	I	II	III	<III	% of <II	Province	I	II	III	<III	% of <II
Shanxi			4	7	100	Guizhou		5	2	2	44.4
Gansu		2	9	3	85.7	Jilin		5	4		44.4
Hebei		2	7	2	81.8	Hunan		9	5		35.7
Ningxia		1	1	3	80	Yunnan	1	10	4	1	31.3
Shaanxi		2	7	1	80	Guangxi		10	3	1	28.6
Inner Mongolia		3	8	1	75	Fujian		7	2		22.2
Xinjiang	1	3	4	6	71.4	Heilongjiang	1	7	2		20.0
Henan		6	11		64.7	Zhejiang		9	2		18.2
Jiangsu		5	8		61.5	Shandong		14	3		17.6
Liaoning		6	8		57.1	Jiangxi		10	1		9.1
Sichuan	1	9	10	1	52.4	Anhui		16	1		5.9
Beijing				1		Shanghai		1			
Tianjin			1			Guangdong	2	19			0
Chongqing			1			Hainan	1	1			0
Qinghai			1			Tibet		2			0
Hubei		7	6		46.2	Total	7	171	115	29	

Among the cities that failed to meet Grade III of NAAQS, there were 15 cities with SO₂ level noncompliant with Grade II, 18 cities with PM level noncompliant with Grade II and 40 cities with both of SO₂ and PM levels noncompliant with Grade II. Some provinces (autonomous regions, or municipalities directly under the Central Government) such as Shanxi had a mixed heavy pollution caused by both SO₂ and PM. Sand and dust weather had strong impact on air quality of the northwest region. (Figure 1-9)

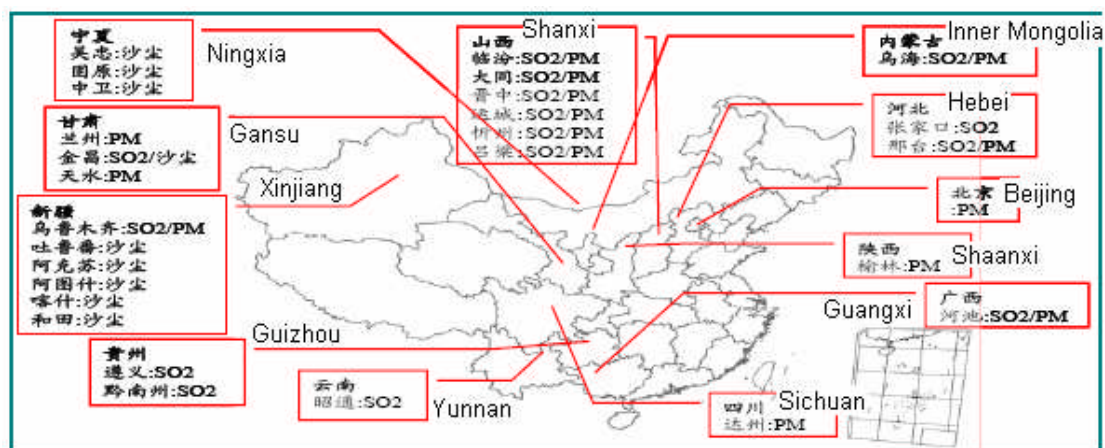


Figure 1-9 Geographical Distribution and Major Pollutants of Heavily Polluted Cities

1.2 Air Quality of 113 Major Cities

1.2.1 General Situation

Evaluated by annual concentration of major pollutants, of the 113 major cities for air pollution prevention and control, no city could meet Grade I of NAAQS; 50 cities experienced Grade II, accounting for 44%; 63 ones met with Grade III, taking up 51.3%; and 8 ones failed to meet with Grade III, accounting for 7%. (Figure 1-10)

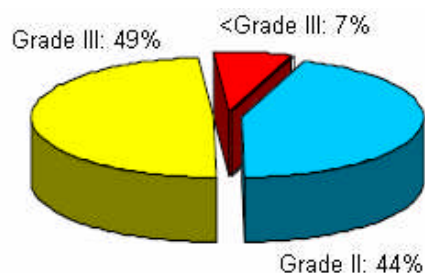


Figure 1-10 Distribution of Air Quality Grades of Major Cities

1.2.2 Pollution Features

1.2.2.1 Pollution Frequency

As of 2006, the 113 major cities had a total of 5615 days (or time) of air pollution, on average accounting for 14% of the total.

1.2.2.1 Pollution Features and Time Distribution

The cities experienced much more polluted air in January, March, April and December due to local emissions and weather factors. (Figure 1-11)

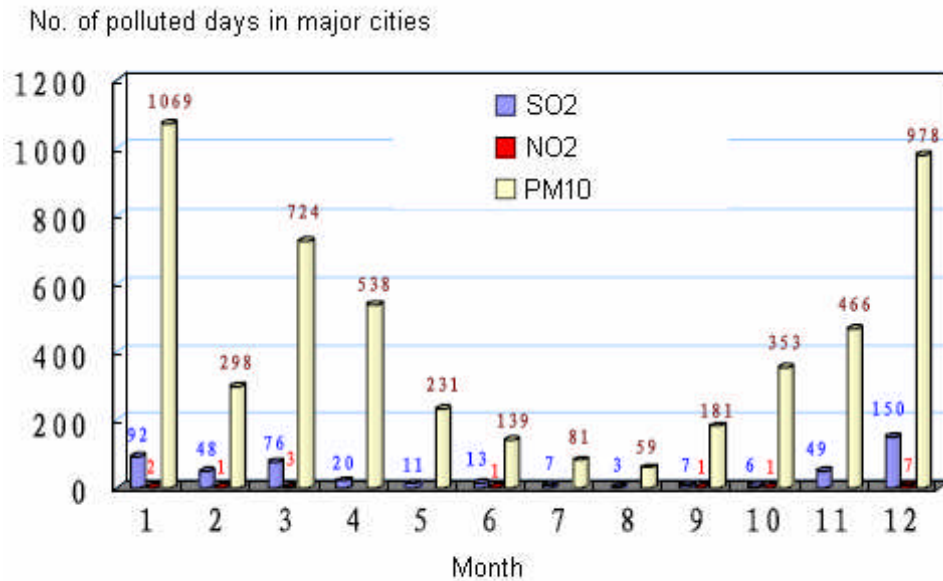


Figure 1-11 Distribution of Air Pollution of the Major Cities by Month

1.2.2.3 Major Pollutants and Pollution Level

Of the 113 major cities, the proportions of the cities meeting Grade I, II, III and below III of PM₁₀ standard were 1%, 53%, 42% and 4% respectively; the proportions of the cities meeting Grade I, II, III and below III of SO₂ standard were 9%, 60%, 27% and 4%; and the proportions of the cities meeting Grade I and II of NO₂ standard were 73% and 27%. The average SO₂ concentration of the major cities decreased 8% compared with that of the last year while the levels of NO₂ and PM₁₀ had little change. (Figure 1-12)

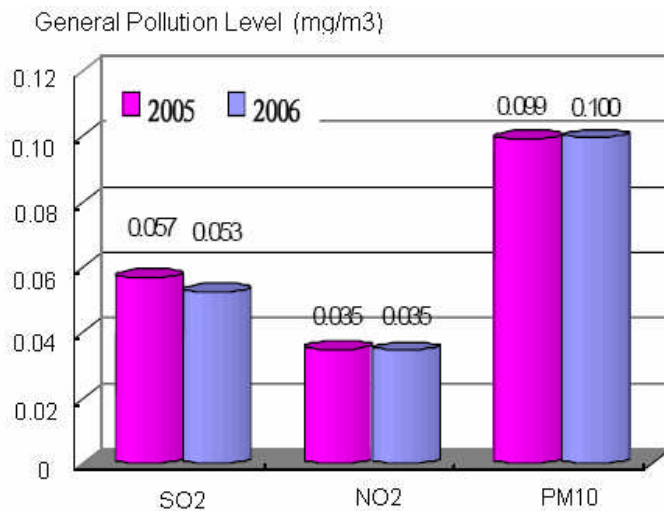


Figure 1-12 Annual Concentrations of Major Pollutants of the Major Cities

The primary air pollutant was PM₁₀ for 91.1% of the major cities. The days with SO₂ and NO₂ as primary pollutants accounted for 8.6% and 0.3%. Lanzhou, Linfen, Beijing, Datong and Urumuqi had rather high PM₁₀ levels, as annual PM₁₀ concentrations exceeded 0.15mg/m³, the Grade III limit of NAAQS. (Figure 1-13)

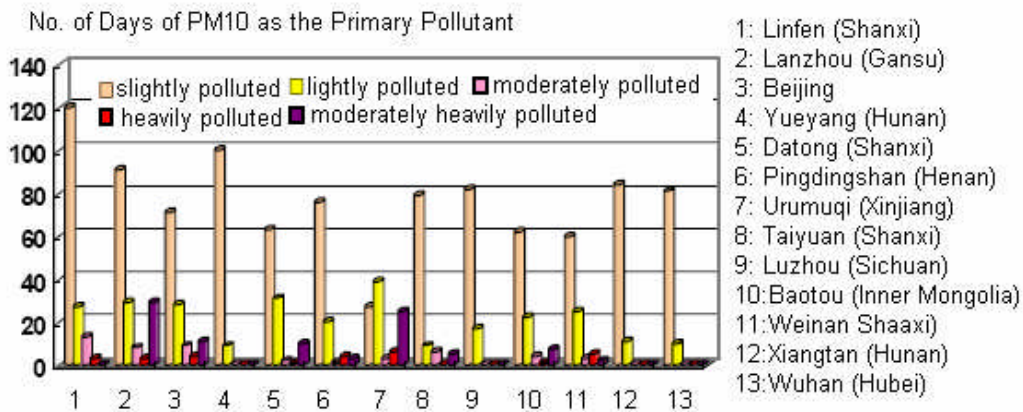


Figure 1-13 The Cities with above 90 days of PM10 as the Primary Pollutant

Few of the major cities had SO₂ as the primary air pollutant. Urumuqi, Linfen, Zunyi, Jinchang and Yangquan, however, had rather high SO₂ levels, as the annual SO₂ concentrations exceeded 0.10mg/m³, the Grade III limit of NAAQS. (Figure 1-14)

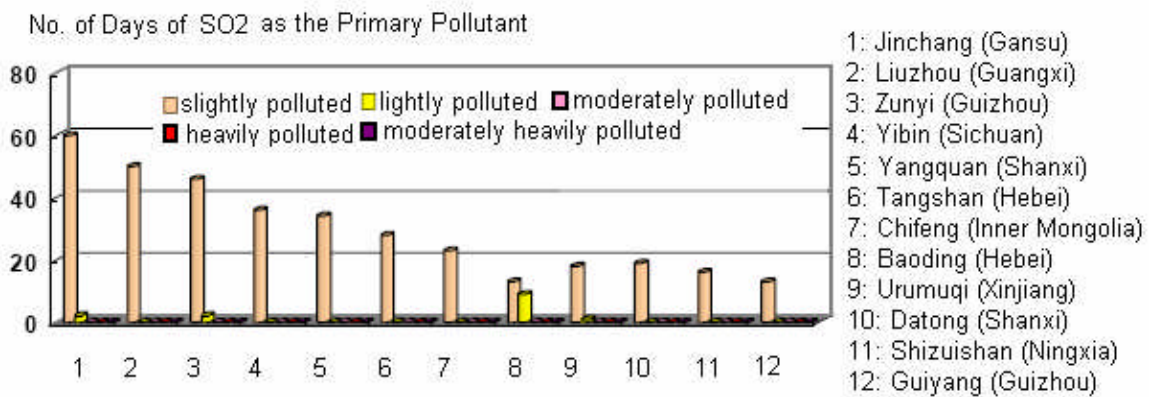


Figure 1-14 The Cities with above 10 Days of SO2 as the Primary Pollutant

1.2.2.4 Comparison with the last year

Compared with the last year, there were 62 cities with more days of Grade I or II while 39 cities with lower days of Grade I or II. Generally on average, the proportion of Grade I or II days increased 1%. The total frequency of polluted days slightly decreased while the frequency of heavily or moderately heavily polluted days had obvious increase.

1.3 Impact of Sand and Dust Weather on Urban Air Quality

1.3.1 General Situation

In 2006, the northern cities were on a large scale suffered from sand and dust weather, which affected the air quality of these cities by 12 times in 32 days. Particularly on April 9-11, the sand and dust weather swept along 40 cities, covering 2.5 million square kilometers and more than 200 million people; the PM₁₀ concentration of Lanzhou was as high as 1.86 mg/m³, more than 11 times of Grade II of NAAQS. Another sand and dust

weather, which occurred on April 22-26, lasted as long as 5 days. The heavily polluted days caused by sand and dust weather totaled 60, by far more than 14 day of the last year.

1.3.2 Impact of Sand and Dust Weather on Beijing

Sand and dust weathers, which occurred to Beijing by 17 times in 2006, seriously affected the air quality of the capital. There were 13 times that dominant cause of the sand-and-dust weather was flying dust transported from outside of Beijing. (Figure 1-15) The flying dust had geographically large impact, usually covering nearly the whole Beijing city; the highest PM₁₀ concentration monitored in an environmental monitoring point exceeded 1mg/m³.

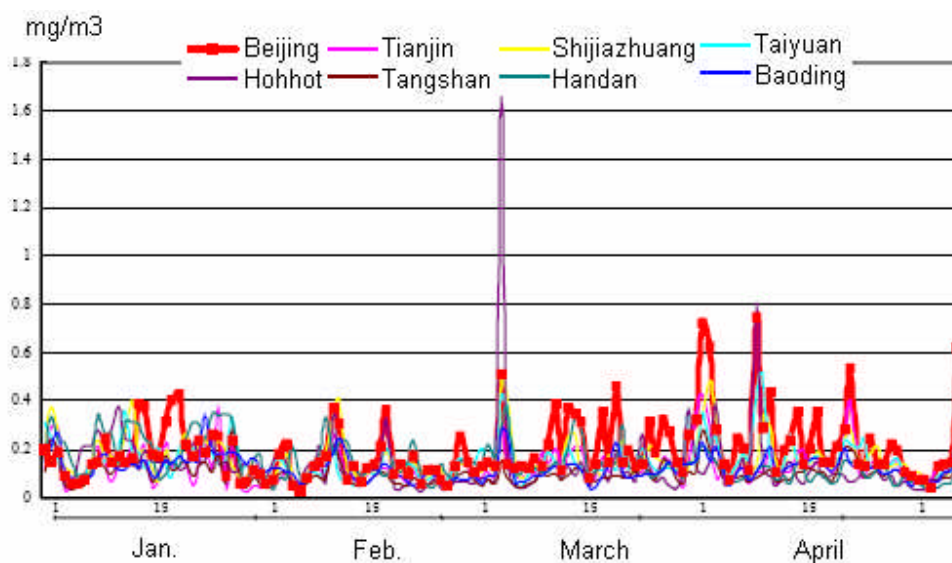


Figure 1-15 Daily PM10 Concentration of Beijing and Neighboring Cities

2. Acid Rain

2.1 Proportion of Cities Suffered from Acid Rain

283 out of 524 cities (counties) under national acid rain monitoring program experienced acid rain in 2006, taking up 54.0%. Among them, the acid rain occurrence was 100% in 6 cities (counties), namely Jiande, Xiangshan, Huzhou, Anji and Chengsi of Zhejiang Province and Jiangjin of Chongqing Province.

Compared with the last year, the proportion of cities experiencing acid rain decreased 3.1%; the proportion of cities experiencing



Figure 2-1 Proportions of Cities with Different Precipitation Acidity

moderate acid rain pollution (average pH of precipitation <5.0) slightly increased; the proportion of cities experiencing heavy acid pollution (average pH of precipitation <4.5) slightly decreased. (Figure 2-1)

2.2 Nationwide Distribution of Acid Rain Occurrences

In 2006, the area with above 5% of acid rain occurrences accounted for 32.6% of the total national area and the area with above 25% of acid rain occurrences accounted for 15.4%. (Figure 2-2) Compared with the last year, Ruichang City of Jiangxi Province, Luzhou City of Sichuan Province and Qingzhen City of Guiyang Province had above 50% increase of acid rain occurrences.

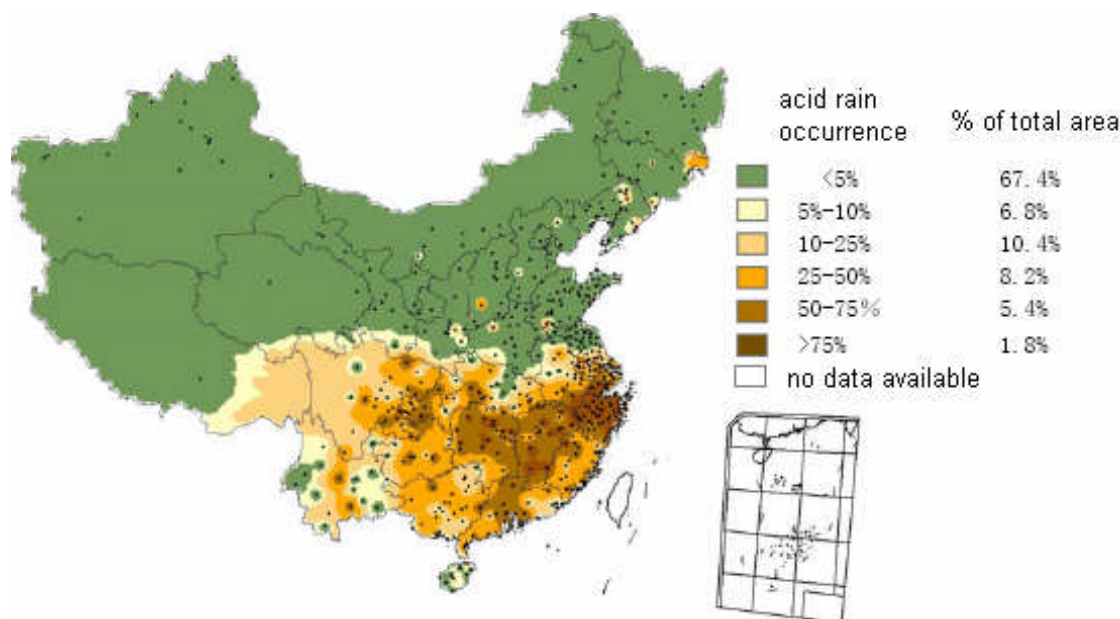


Figure 2-2 Distribution of Acid Rain Occurrence Nationwide in 2006

2.3 National Geographical Distribution of Acid Rain

The acid rain areas distributed mainly south of Yangtze River and east of Sichuan and Yunan Provinces, covering most areas of Zhejiang, Jiangxi, Hunan, Fujian, Guizhou, Chongqing, Yangtze River Delta and Pearl River Delta. (Figure 2-3) Compared with the last year, the geographical distribution of acid rain remained stable.

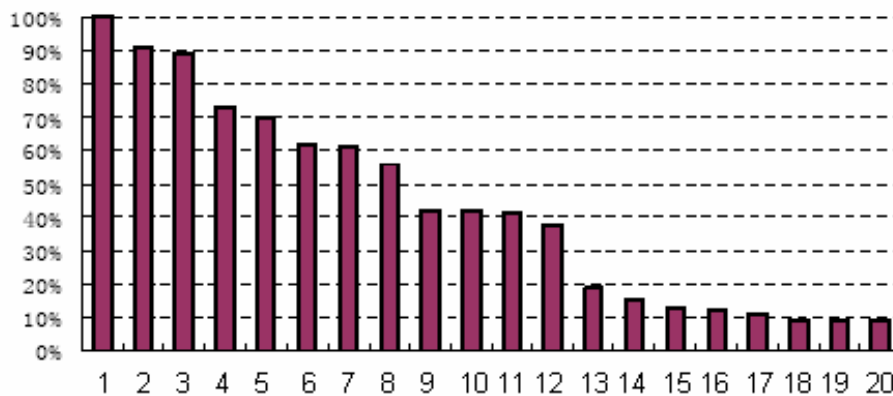


Figure 2-3 Distribution of Precipitation Acidity Nationwide in 2006

2.4 Comparison of Precipitation Acidity of Varied Regions

2.4.1 pH Value of Precipitation

In 2006, 22 provinces (autonomous regions, or municipalities directly under the Central Government) suffered from acid rain. As for Zhejiang, Hunan, Jiangxi, Chongqing, and Sichuan Province, above 70% of the cities experienced acid rain. (Figure 2-4)

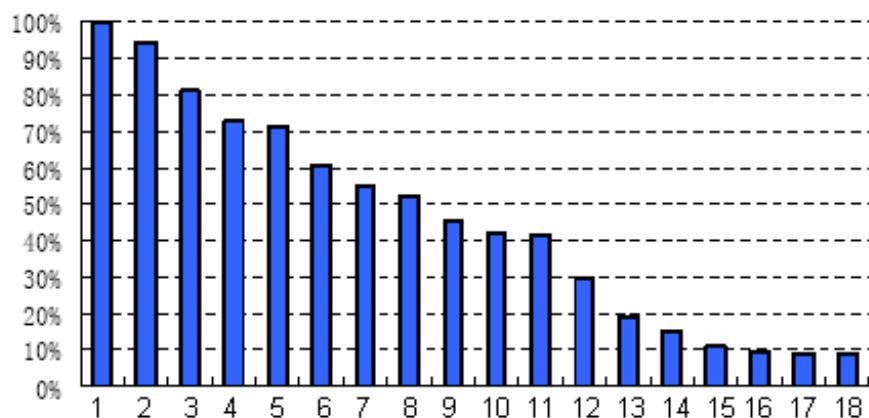


1: Zhejiang; 2: Hunan; 3: Jiangxi; 4: Chongqing; 5: Sichuan; 6: Guangdong; 7: Fujian
 8: Guangxi; 9: Jiangsu; 10: Guizhou; 11: Anhui; 12: Hubei; 13: Jilin; 14: Yunan;
 15: Liaoning; 16: Henan; 17: Hainan; 18: Hebei; 19: Shanxi; 20: Shaanxi

Figure 2-4 Proportion of Cities With Annual pH Mean of Precipitation Below 5.6

2.4.2 Acid Rain Occurrences

Zhejiang, Jiangxi, Hunan, Chongqing, Guangdong and Fujian had very high acid rain occurrences while the situation in Sichuan and Guangxi were serious too. (Figure 2-5)



1: Zhejiang; 2: Jiangxi; 3: Hunan; 4: Chongqing; 5: Guangdong; 6: Fujian; 7: Sichuan
 8: Guangxi; 9: Hubei; 10: Jiangsu; 11: Guizhou; 12: Anhui; 13: Jilin; 14: Yunnan;
 15: Hainan; 16: Liaoning; 17: Hebei; 18: Shanxi

Figure 2-5 Proportion of Cities with Acid Rain Occurrences above 25% in Varied Provinces