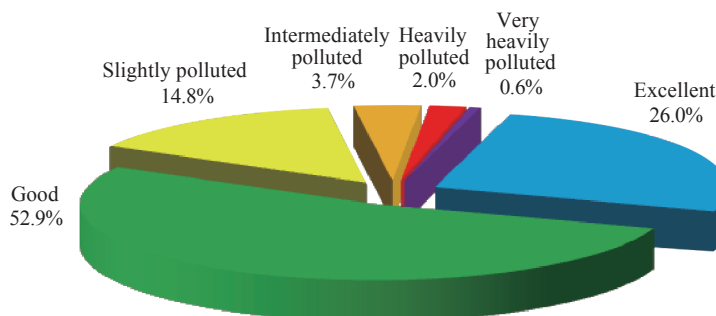


Atmospheric Environment

Air quality

Cities at or above prefecture level In 2016, all 338 APL cities* across the country conducted environmental monitoring. The monitoring results show that 84 cities met national air quality standard**, accounting for 24.9%; 254 cities failed to meet national air quality standard, taking up 75.1%.

The average percent of attainment days on air quality*** of the 338 cities was 78.8%, up by 2.1 percentage points compared with that of 2015. The amount of nonattainment days**** took up 21.2%. The percent of attainment days on air quality of 8 cities was 100%. The percent of attainment days on air quality of 169 cities was 80%~100%. The percent of attainment days on air quality of 137 cities was 50%~80% and the percent of attainment days on air quality of 24 cities was less than 50%.



The percentage of air quality standards of 338 cities in 2016

In 338 cities, 2,464 days were under heavy pollution and 784 days were under very heavy pollution. Among them, days with PM_{2.5} as the primary pollutant***** took up 80.3% and

those with PM₁₀ as the primary pollutant took up 20.4% and with O₃ as the primary pollutant took up 0.9%. There were 32 cities suffering from more than 30 days under heavy or very

*Cities at or above prefecture level (APL cities): including municipality, cities or regions at prefecture level, autonomous prefectures and league.

**Air quality meeting the standard: the ambient air quality meets the standard when the concentrations of all pollutants under assessment meet the standard.

***The amount of attainment days: It refers to the amount of days with AQI at 0~100.

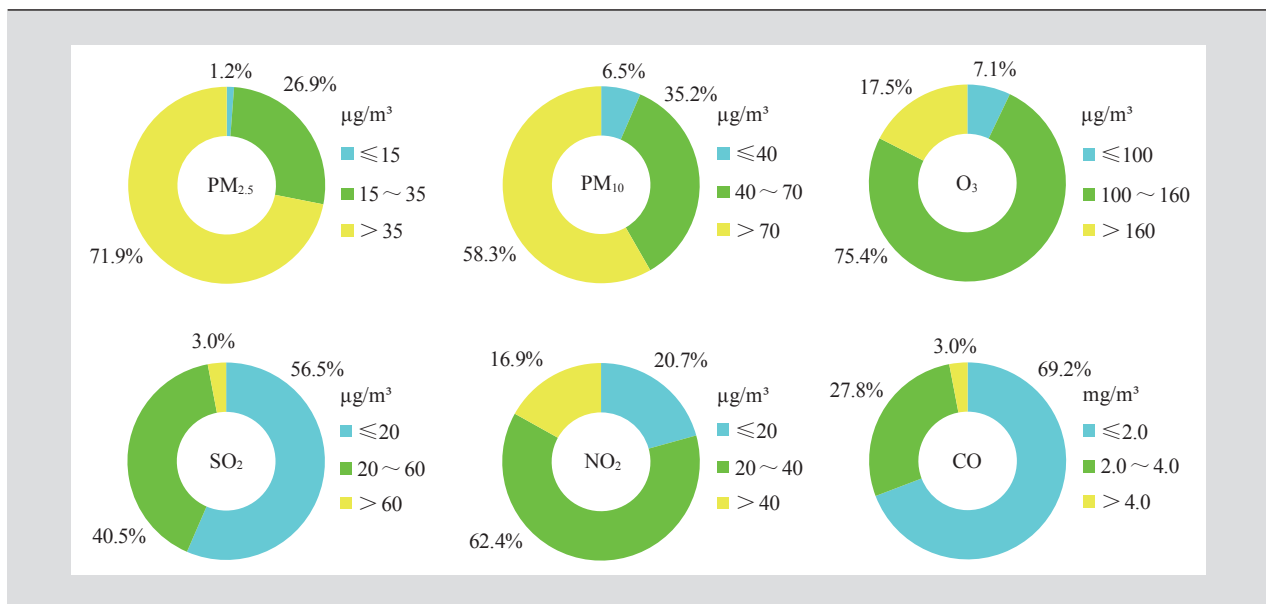
****The amount of non-attainment days: the amount of days with AQI >100. Among them, AQI =101~150 indicates slight pollution, 151~200 indicates intermediate pollution, 201~300 indicates heavy pollution and >300 very serious pollution.

*****Primary pollutant: When AQI >50, the pollutant with the biggest individual AQI is the primary pollutant.

heavy pollution, and they were distributed in Xinjiang (some cities here were influenced by sandstorm), Hebei, Shanxi, Shandong, Henan, Beijing and Shaanxi.

The indicator analysis results show that the range of annual average $PM_{2.5}$ concentration was 12~158 $\mu\text{g}/\text{m}^3$ with the average level of 47 $\mu\text{g}/\text{m}^3$, down by 6.0% compared with that of 2015. The amount of days with daily average concentration failing to meet relevant standard took up 14.7% of the total, down by 2.8 percentage points compared with that of 2015. The range of annual average PM_{10} concentration was 22~436 $\mu\text{g}/\text{m}^3$ with the average of 82 $\mu\text{g}/\text{m}^3$, down by 5.7% compared with that of 2015. The amount of days with daily average concentration failing to meet relevant standard took up 10.4% of the total, down by 1.7 percentage points compared with that of 2015. The range of 90th percentile concentration of O_3 daily maximum 8-hour average* was 73~200 $\mu\text{g}/\text{m}^3$ with the average at 138 $\mu\text{g}/\text{m}^3$, up by 3.0%

compared with that of 2015. The amount of days with daily average failing to meet the standard took up 5.2% of the total, up by 0.6 percentage point compared with that of 2015. The range of annual average SO_2 concentration was 3~88 $\mu\text{g}/\text{m}^3$ with the average at 22 $\mu\text{g}/\text{m}^3$, down by 12.0% compared with that of 2015. The amount of days with daily average failing to meet the standard took up 0.5% of the total, down by 0.2 percentage point compared with that of 2015. The range of annual average NO_2 concentration was 9~61 $\mu\text{g}/\text{m}^3$ with the average at 30 $\mu\text{g}/\text{m}^3$, same as that of 2015. The amount of days with daily average failing to meet the standard took up 1.6% of the total, same as that of 2015. The range of the 95th percentile concentration of daily CO average was 0.8~5.0 mg/m^3 with the average at 1.9 mg/m^3 , down by 9.5% compared with that of 2015. The amount of days with daily average failing to meet the standard took up 0.4% of the total, down by 0.1 percentage point compared with that of 2015.



Percent of 338 cities with different concentrations of six pollutants in 2016

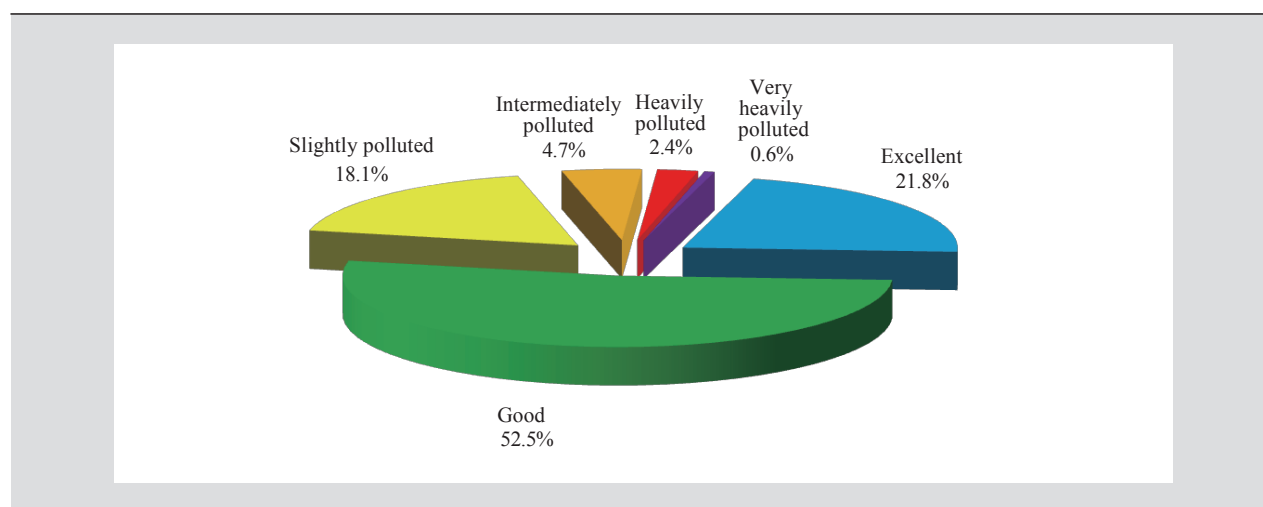
Cities under Stage I monitoring based on the newly amended ambient air quality standard In 2016, the

monitoring results of 74 cities under Stage I monitoring based on the newly amended ambient air quality standard (including

*Percentile concentration: Based on the Technical Regulation for Ambient Air Quality Assessment (Trial) (HJ 63-2013), effective daily maximum 8-hour average of O_3 concentrations in the calendar year are ranked from small to big, compare the percentile value at 90% with the daily maximum 8-hour average of O_3 concentration of national standard date to judge if O_3 concentration meets the standard. The assessment of CO follows the same principle.

APL cities in key regions such as Beijing-Tianjin-Hebei, the Yangtze River delta and Pearl River delta, municipalities, provincial capital cities and cities under separate plan of the State Council) (the 74 cities) show that the percentage of days of the 74 cities meeting air quality standard was 74.2%, up by 3.0 percentage points compared with that of 2015. The average amount of days failing to meet the standard took up 25.8%. The attainment rate was 80%~100% for 26 cities, 50%~

80% for 42 cities. The nonattainment percent of 6 cities was less than 50%. The amount of days with PM_{2.5} as the primary pollutant took up 57.5% of the total non-attainment days, the amount of days with O₃ as the primary pollutant took up 30.8%, the amount of days with PM₁₀ as the primary pollutant took up 10.5%, the amount of days with NO₂ as primary pollutant took up 1.6% and the amount of days with SO₂ as primary pollutant took up 0.1%.



Percent of air quality levels of 74 cities in 2016

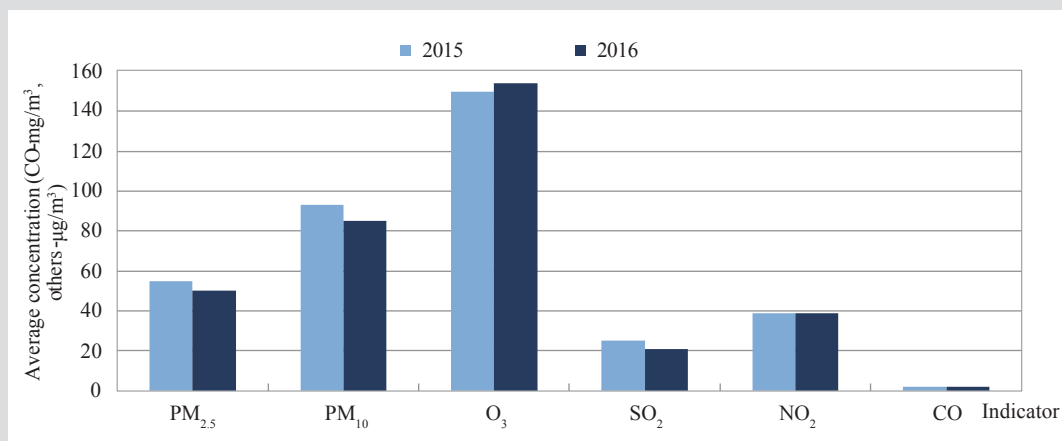
The analysis results of air quality comprehensive index* show that the top 10 cities with poor air quality (from No.74 to No. 65) in the 74 cities were Hengshui, Shijiazhuang, Baoding, Xingtai, Handan, Tangshan, Zhengzhou, Xi'an, Jinan

and TaiYuan. The top 10 cities with relatively good urban air quality (from No.1 to No.10) were Haikou, Zhoushan, Huizhou, Xiamen, Fuzhou, Shenzhen, Lishui, Zhuhai, Kunming and Taizhou.

*Air quality comprehensive index: The sum of the quotients of concentration of the 6 air pollutants against corresponding Grade II limit of assessment period is the air quality comprehensive index of the current city in that period, which is employed for ranking of urban air quality.

Air quality comprehensive index and primary pollutant of 74 cities in 2016

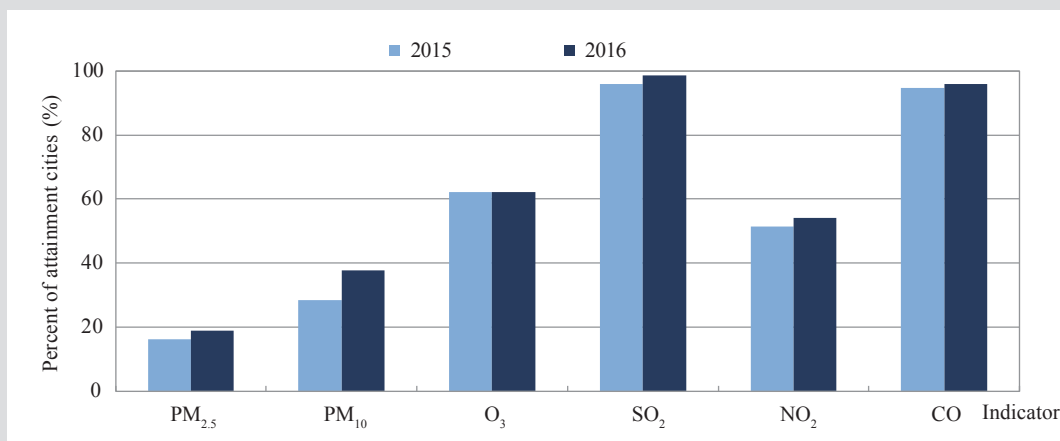
No.	City	Comprehensive index	The biggest index	Primary pollutant	No.	City	Comprehensive index	The biggest index	Primary pollutant
1	Haikou	2.55	0.67	O ₃	38	Harbin	5.22	1.49	PM _{2.5}
2	Zhoushan	3.05	0.86	O ₃	38	Huai'an	5.22	1.51	PM _{2.5}
3	Huizhou	3.25	0.83	O ₃	40	Chongqing	5.24	1.54	PM _{2.5}
4	Xiamen	3.29	0.80	PM _{2.5}	40	Hangzhou	5.24	1.40	PM _{2.5}
5	Fuzhou	3.35	0.77	PM _{2.5}	42	Zhenjiang	5.28	1.43	PM _{2.5}
6	Shenzhen	3.44	0.84	O ₃	43	Yangzhou	5.30	1.46	PM _{2.5}
7	Lishui	3.46	0.94	PM _{2.5}	44	Suzhou	5.32	1.31	PM _{2.5}
8	Zhuhai	3.47	0.90	O ₃	45	Taizhou	5.40	1.57	PM _{2.5}
9	Kunming	3.71	0.80	PM _{2.5}	46	Suqian	5.45	1.60	PM _{2.5}
10	Taizhou	3.81	1.03	PM _{2.5}	47	Hefei	5.56	1.63	PM _{2.5}
11	Zhongshan	3.83	0.96	O ₃	48	Nanjing	5.58	1.37	PM _{2.5}
12	Lasa	3.86	1.14	PM ₁₀	49	Hohhot	5.67	1.36	PM ₁₀
13	Nanning	3.95	1.03	PM _{2.5}	50	Wuhan	5.69	1.63	PM _{2.5}
14	Guiyang	4.00	1.06	PM _{2.5}	51	Changzhou	5.71	1.51	PM _{2.5}
15	Dongguan	4.09	1.04	O ₃	52	Wuxi	5.79	1.51	PM _{2.5}
16	Jiangmen	4.14	1.01	O ₃	53	Qinhuangdao	5.87	1.31	PM _{2.5}
17	Zhaoqing	4.23	1.06	PM _{2.5}	54	Shenyang	6.09	1.54	PM _{2.5}
18	Quzhou	4.35	1.20	PM _{2.5}	55	Xining	6.18	1.61	PM ₁₀
19	Ningbo	4.41	1.09	PM _{2.5}	56	Chengdu	6.38	1.80	PM _{2.5}
20	Foshan	4.45	1.09	PM _{2.5}	57	Xuzhou	6.54	1.71	PM _{2.5}
21	Guangzhou	4.47	1.15	NO ₂	58	Yinchuan	6.63	1.60	PM _{2.5}
22	Zhangjiakou	4.50	1.19	PM ₁₀	59	Tianjin	6.65	1.97	PM _{2.5}
23	Wenzhou	4.52	1.09	PM _{2.5}	60	Lanzhou	6.79	1.89	PM ₁₀
24	Yancheng	4.53	1.23	PM _{2.5}	61	Beijing	6.81	2.09	PM _{2.5}
25	Dalian	4.60	1.11	PM _{2.5}	62	Urumchi	6.95	2.11	PM _{2.5}
26	Jinhua	4.61	1.31	PM _{2.5}	63	Langfang	7.11	1.89	PM _{2.5}
27	Nanchang	4.70	1.23	PM _{2.5}	64	Cangzhou	7.13	1.97	PM _{2.5}
28	Shaoxing	4.76	1.31	PM _{2.5}	65	TaiYuan	7.66	1.89	PM _{2.5}
29	Shanghai	4.80	1.29	PM _{2.5}	66	Jinan	7.77	2.17	PM _{2.5}
30	Jiaxing	4.85	1.26	PM _{2.5}	67	Xi'an	7.82	2.17	PM _{2.5}
31	Huzhou	5.02	1.31	PM _{2.5}	68	Zhengzhou	7.96	2.23	PM _{2.5}
32	Nantong	5.04	1.31	PM _{2.5}	69	Tangshan	8.27	2.11	PM _{2.5}
33	Changsha	5.06	1.51	PM _{2.5}	70	Handan	8.56	2.34	PM _{2.5}
34	Qingdao	5.09	1.31	PM _{2.5}	71	Xingtai	8.85	2.49	PM _{2.5}
35	Lianyungang	5.11	1.31	PM _{2.5}	72	Baoding	9.05	2.66	PM _{2.5}
36	Changchun	5.17	1.31	PM _{2.5}	73	Shijiang-zhuang	9.30	2.83	PM _{2.5}
36	Chengde	5.17	1.16	PM ₁₀	74	Hengshui	10.44	3.43	PM _{2.5}



Year-on-year comparison of the average concentration of six pollutants of the 74 cities in 2016

The analysis results show that the average PM_{2.5} concentration was 21~99 µg/m³ with the average at 50 µg/m³, down by 9.1% compared with that of 2015. The percentage of days failing to meet national air quality standard was 16.7%, down by 4.1 percentage points compared with that of 2015. The average PM_{2.5} concentration of 2 cities reached Grade I national air quality standard, taking up 2.7%. 12 cities reached Grade II national air quality standard, taking up 16.2%. 60 cities failed to meet Grade II national air quality standard, taking up 81.1%. The range of average PM₁₀ concentration was 39~164 µg/m³ with the average at 85 µg/m³, down by 8.6% compared with that of 2015. The percent of days failing to meet national standard was 11.5%, down by 2.8 percentage points compared with that of 2015. The average PM₁₀ concentration of 1 city reached Grade I national air quality standard, taking up 1.4%. 27 cities reached Grade II national air quality standard, taking up 36.5%. 46 cities failed to meet Grade II national air quality standard, taking up 62.2%. The 90th percentile concentration of O₃ daily maximum 8-hour average was 102~199 µg/m³ with the average at 154 µg/m³, up by 2.7% compared with that of 2015. The percent of days failing to meet the standard was 8.6%, up by 0.4 percentage point compared with that of 2015. 46 cities reached Grade II national air quality standard, taking up 62.2%. 28 cities failed to meet Grade II national air quality standard, taking up

37.8%. The range of the average SO₂ concentration was 6~68 µg/m³ with the average at 21 µg/m³, down by 16.0% compared with that of 2015. The percent of days failing to attain the standard reached 0.3%, down by 0.6 percentage point than that of 2015. The average SO₂ concentration of 48 cities reached Grade I national air quality standard, taking up 64.9%. 25 cities reached Grade II national air quality standard, taking up 33.8%. 1 city failed to meet Grade II national air quality standard in terms of SO₂, taking up 1.4%. The range of annual average NO₂ concentration was 16~61 µg/m³ with the average at 39 µg/m³, same as that of 2015. The percent of days failing to meet the standard was 4.2%, up by 0.1 percentage point compared with that of 2015. The average NO₂ concentration of 40 cities reached Grade I national air quality standard (same as the value of Grade II national air quality standard), taking up 54.1%. 34 cities failed to meet Grade II national air quality standard in terms of NO₂, taking up 45.9%. The 95th percentile concentration of daily average CO was 0.9~4.4 mg/m³ with the average at 1.9 mg/m³, down by 9.5% compared with that of 2015. The percent of days failing to meet the national air quality standard was 0.6%, down by 0.2 percentage point compared with that of 2015. The average CO concentration of 71 cities reached Grade I national air quality standard (same as the value of Grade II national air quality standard), taking up 95.9%. 3 cities failed to meet Grade II national air quality standard, taking up 4.1%.



Year-on-year comparison of the percent of cities with attainment of the six pollutants meeting national air quality standard in 74 cities in 2016

Beijing-Tianjin-Hebei region In 2016, the percent of days of the whole year of 13 APL cities in Beijing-Tianjin-Hebei meeting air quality standard ranged from 35.8% to 78.7%, with the average at 56.8%, up by 4.3 percentage points compared with that of 2015. The average percent of nonattainment days was 43.2%, and 25.3%, 8.8%, 7.0% and 2.2% of which was under slight pollution, intermediate pollution, heavy pollution and very heavy pollution respectively. The percent of days meeting air quality standard was 50%~80% for 9 cities. The percent of days meeting air quality standard was less than 50% for 4 cities. Among the

nonattainment days, the amount of days with PM_{2.5}, O₃, PM₁₀, NO₂ and CO as the primary pollutant took up 63.1%, 26.3%, 10.8%, 0.3% and 0.1% respectively. There was no occurrence of nonattainment days with SO₂ as the primary pollutant.

For Beijing, the percent of days meeting air quality standard was 54.1%, up by 3.1 percentage points compared with that of 2015. There were 30 days under heavy pollution and 9 days under very heavy pollution, 7 days less than that of 2015. Among the nonattainment days, the amount of days with PM_{2.5} as the primary pollutant was the most, followed by O₃.

Change of average concentration of primary pollutants in Beijing-Tianjin-Hebei region in 2016

Region	Indicator	Average concentration (CO: mg/m ³ , others: µg/m ³)	Change compared with that of 2015
Beijing-Tianjin-Hebei	PM _{2.5}	71	-7.8%
	PM ₁₀	119	-9.8%
	O ₃	172	6.2%
	SO ₂	31	-18.4%
	NO ₂	49	6.5%
	CO	3.2	-13.5%
Beijing	PM _{2.5}	73	-9.9%
	PM ₁₀	92	-9.8%
	O ₃	199	-2.0%
	SO ₂	10	-28.6%
	NO ₂	48	-4.0%
	CO	3.2	-11.1%

The Yangtze River delta In 2016, 65.0%~95.4% of the total days of 25 APL cities met national air quality standard with the average at 76.1%, up by 4.0 percentage points compared with that of 2015. The average of days failing to meet air quality standard took up 23.9%; the percent of days with slight pollution was 19.0%, the percent of days with intermediate pollution was 3.9%, the percent of days with heavy pollution was 0.9%, and there was no days under very heavy pollution. The attainment rate was 80%~100% for 7 out of the 25 cities and 50%~80% for the rest 18 cities. In all the days failing to meet national air quality standard, the amount

of days with PM_{2.5}, O₃, PM₁₀ and NO₂ as the primary pollutant took up 55.3%, 39.8%, 3.4% and 2.1% respectively. There was no occurrence of nonattainment days with SO₂ and CO as the primary pollutants.

The percent of Shanghai's number of days meeting air quality standard was 75.4% around the year, up by 5.2 percentage points compared with that of 2015. There were 2 days under heavy pollution and no days under very heavy pollution, 6 days less than that of 2015. Among the nonattainment days, the amount of days with PM_{2.5} as the primary pollutant was the most, followed by O₃.

Change of average concentration of primary pollutants in the Yangtze River delta in 2016

Region	Indicator	Average concentration (CO: mg/m ³ , others: µg/m ³)	Change compared with that of 2015
The Yangtze River delta	PM _{2.5}	46	-13.2%
	PM ₁₀	75	-9.6%
	O ₃	159	-2.5%
	SO ₂	17	-19.0%
	NO ₂	36	-2.7%
	CO	1.5	0
Shanghai	PM _{2.5}	45	-15.1%
	PM ₁₀	59	-14.5%
	O ₃	164	1.9%
	SO ₂	15	-11.8%
	NO ₂	43	-6.5%
	CO	1.3	-13.3%

The Pearl River delta The percent of days of 9 APL cities in the Pearl River delta meeting air quality standard ranged from 84.4% to 96.7% with the average at 89.5%, up by 0.3 percentage point compared with that of 2015. The average percent of nonattainment days was 10.5%, with 8.9% of which under slight pollution, 1.4% under intermediate pollution and 0.2% under heavy pollution. There was no occurrence of very serious pollution. All the 9 cities had 80%~100% of the days of the year enjoying good or excellent air quality. Among

the nonattainment days, the amount of days with O₃, PM_{2.5} and NO₂ as the primary pollutants took up 70.3%, 19.6% and 10.4% respectively. There was no occurrence of nonattainment days with PM₁₀, SO₂ and CO as the primary pollutant.

The percent of Guangzhou's days meeting air quality standard was 84.7%, down by 0.8 percentage point compared with that of 2015. There was 1 day under heavy pollution and no occurrence of very heavy pollution, 1 day more than that of 2015.

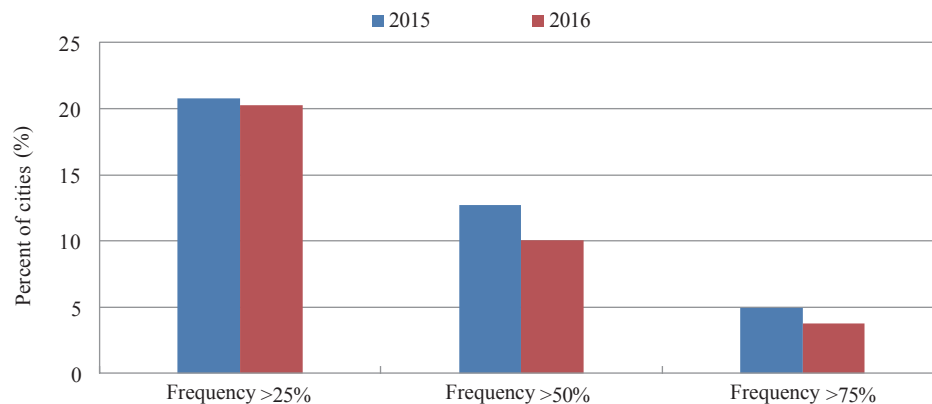
Change of average concentration of primary pollutants in the Pearl River delta in 2016

Region	Indicator	Average concentration (CO: mg/m ³ , others: μg/m ³)	Change compared with that of 2015
The Pearl River delta	PM _{2.5}	32	-5.9%
	PM ₁₀	49	-7.5%
	O ₃	151	4.1%
	SO ₂	11	-15.4%
	NO ₂	35	6.1%
	CO	1.3	-7.1%
Guangzhou	PM _{2.5}	36	-7.7%
	PM ₁₀	56	-5.1%
	O ₃	155	6.9%
	SO ₂	12	-7.7%
	NO ₂	46	-2.1%
	CO	1.3	-7.1%

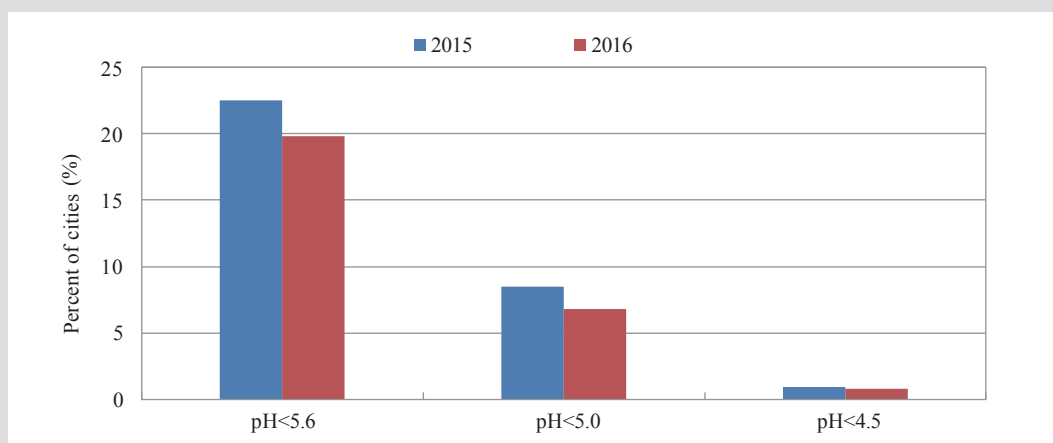
Acid Rain

Acid rain frequency In 2016 the average acid rain frequency of 474 cities (districts or counties) under precipitation monitoring was 12.7%. The percent of cities with acid rain was 38.8%, down by 1.6 percentage points

compared with that of 2015. Among them, 20.3% of the cities had acid rain frequency over 25%, down by 0.5 percentage point compared with that of 2015. 10.1% cities had acid rain frequency over 50%, down by 2.6 percentage points compared with that of 2015. 3.8% cities had acid rain frequency over 75%, down by 1.2 percentage points compared with that of 2015.



Year-on-year comparison of the percent of cities with different acid rain frequency in 2016

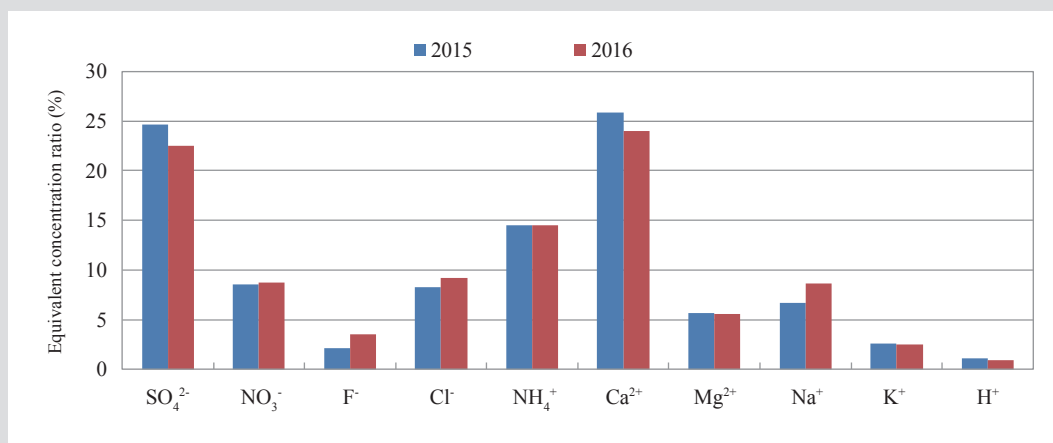


Annual comparison of the percent of cities with different annual pH of precipitation in 2016

Precipitation acidity In 2016, the annual average pH of precipitation across the country was 4.1 (Zhuzhou in Hunan Province) ~8.1 (Korla in Xinjiang). Among them, the percent of cities with acid rain (annual average pH of precipitation < 5.6), relatively serious acid rain (annual average pH of precipitation < 5.0) and serious acid rain (annual average pH of precipitation < 4.5) was 19.8%, 6.8% and 0.8% respectively, down by 2.7, 1.7 and 0.2 percentage points respectively compared with that of 2015.

Chemical composition In 2016, the main cations in

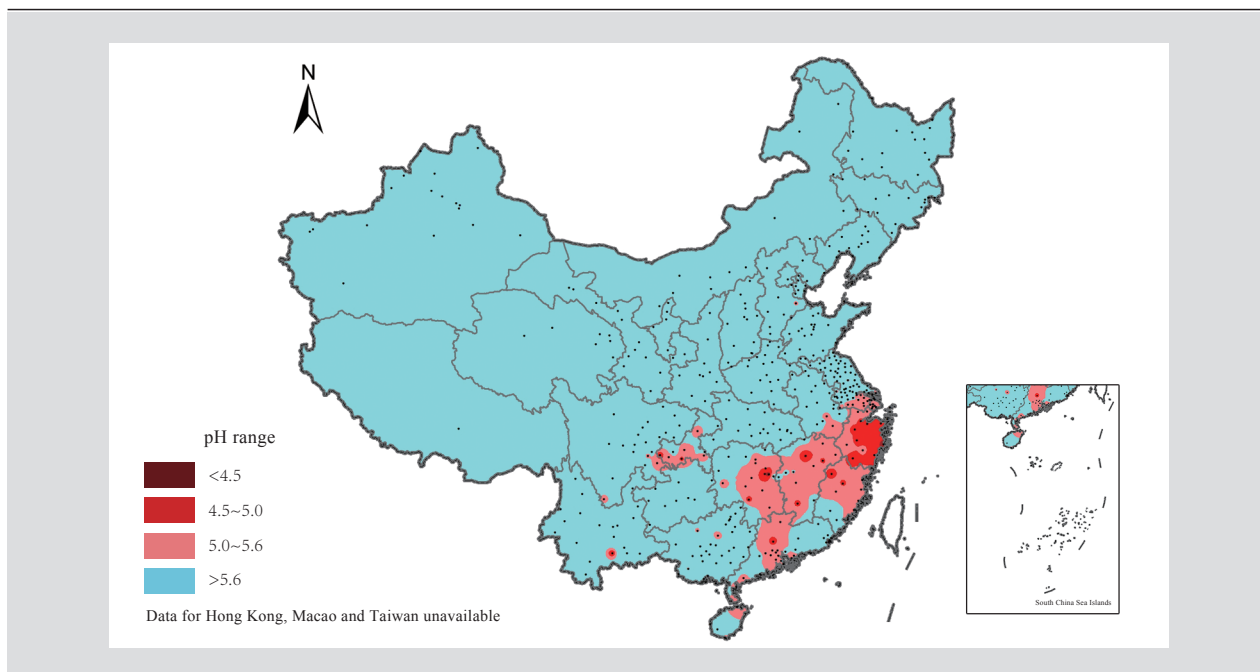
precipitation were calcium and ammonium, taking up 24.0% and 14.5% respectively of the total ion equivalent. The key anion was sulfate radical, taking up 22.5% of the total ion equivalent, while nitrate radical took up 8.7% of the total ion equivalent. In general, the type of acid rain still was sulphuric acid. Compared with that of 2015, both the percent of concentration of sulfate radical and chlorine ion went down, the percent of concentration of fluoride ions, chloride ion and Sodium chloride went up a bit, and the percent of concentration of other ion equivalents kept at a stable level.



Year-on-year comparison of main ion equivalent concentration ratio of precipitation in 2016

Acid rain distribution The total area of acid rain region was about 690,000 km², taking up 7.2% of total land area, down by 0.4 percentage point compared with that of 2015. Among them, the percent of land area with relatively serious acid rain or serious acid rain was 1.0% and 0.03% respectively of the total. Acid rain was mainly distributed in

the region south to the Yangtze River and east to Yunnan-Guizhou Plateau, mainly including most of Zhejiang, Shanghai, Jiangxi and Fujian, central and eastern part of Hunan, central part of Guangdong, some areas of southern part of Chongqing, southern part of Jiangsu and southern part of Anhui.



The isoline of annual pH of precipitation in China in 2016