Air Quality in 11 Chinese Cities

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Overview of Presentation

- General Information on urban AQM in China
- City AQ Summaries: Pollutants of Concern, APIs
- What are next steps of CAI-Asia China Project in working with the cities

General Information

- Cities are the center of politics, economy, culture, science and technology of the society. They usually face huge pressures on resources and environment:
  - By 2004, China had 661 cities, with a total urban population of 524 million (41.7% of the total population);
  - Urbanization increased from 28% in 1993 to 41.7% in 2004, and keeps growing;
  - In 2003, cities contributed 65.5% of the GDP;

API Grades and AAQS Classes

Functional zones	Category 1	Category 2	Category 3
Application areas	nature reserve, scenic areas, and areas that need special protection	residential areas, mixed commercial, traffic and residential areas, cultural areas, ordinary industrial areas, and rural areas	designated industrial areas
Applied standard values	Class 1	Class 2	Class 3

API Grades and AAQS Classes

Pollutant	Average time	Limit value ($mg/m^{3)}$ (ppm)		
		Class 1	Class 2	Class 3
SO_2	Annual	0.02 (0.007)	0.06 (0.021)	0.10 (0.035)
	Daily	0.05 (0.0175)	0.15 (0.0525)	0.25 (0.0875)
	Hourly	0.15 (0.0525)	0.50 (0.175)	0.70 (0.245)
NO_2	Annual	0.04 (0.02)	0.08 (0.04)	0.08 (0.04)
	Daily	0.08 (0.04)	0.12 (0.06)	0.12 (0.06)
	Hourly	0.12 (0.06)	0.24 (0.117)	0.24 (0.117)
PM_{10}	Annual	0.04	0.10	0.15
	Daily	0.05	0.15	0.25

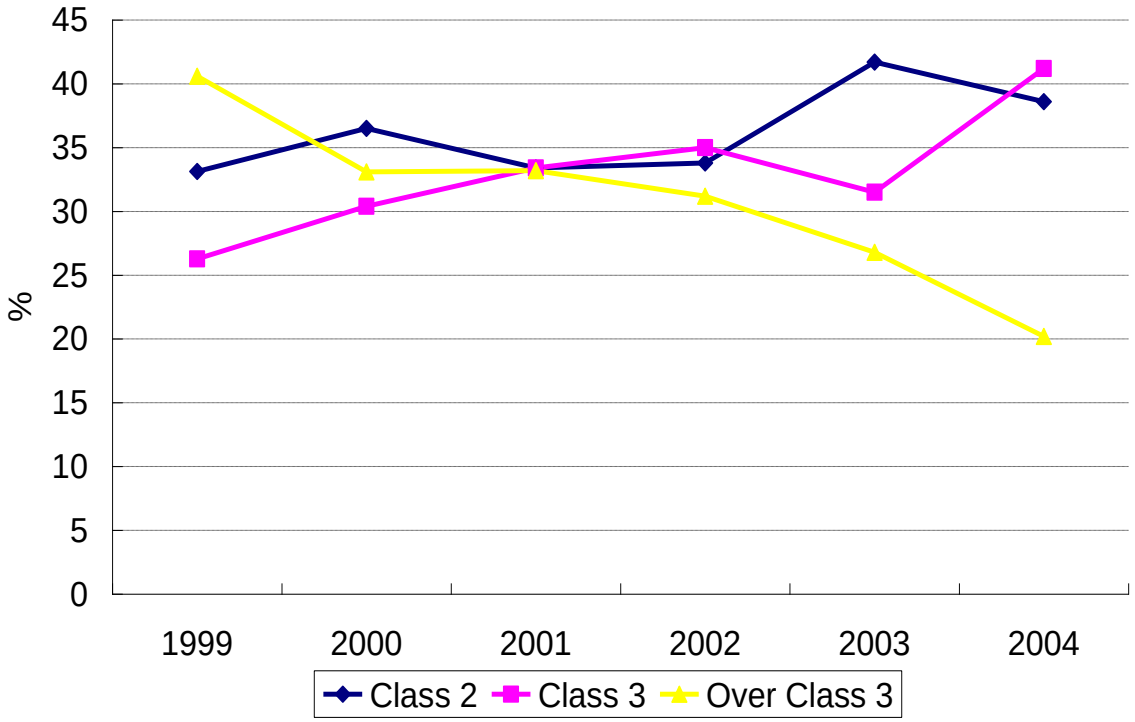
Air Pollution Indices

API	Air Quality Description	Grade	Effects to Health	Measures Suggested
0-50	Excellent	1	Daily Activities not affected	
51-100	Good	2		
101-150	Slightly Polluted	3A	The symptom of the susceptible is aggravated slightly, while the healthy people will show some symptoms	The cardiac and respiratory system patients should reduce strength draining and outdoor activities
151-200	Light Polluted	3B		
201-250	Moderate Polluted	4A	Cardiac symptoms of the lung disease patients aggravated	The aged, cardiac and lung disease patients should stay indoors and reduce physical activities
251-300	Moderate-heavy polluted	4B		
>300	Heavy Polluted	5	The exercise endurance of the healthy people drops down, some shows strong symptoms. Some diseases appear earlier.	The aged and patients should stay indoors and avoid strength draining; the ordinary should avoid outdoor activities.

API Grades and AAQS Classes

API grade	API			AAQS class	AAQS limit value mg/m^3 (ppm)			Average time
	SO_2	NO_2	PM_{10}		SO_2	NO_2	PM_{10}	
1	≤50			Class 1	0.05 (0.0175)	0.08 (0.04)	0.05	Daily
2	≤100			Class 2	0.15 (0.0525)	0.12 (0.06)	0.15	Daily
3	≤200			Class 3	0.25 (0.0875)	0.12 (0.06)	0.25	Daily
4	≤300			Rigid noncompliance				
5	>300			Rigid noncompliance				

Air quality compliance: overall

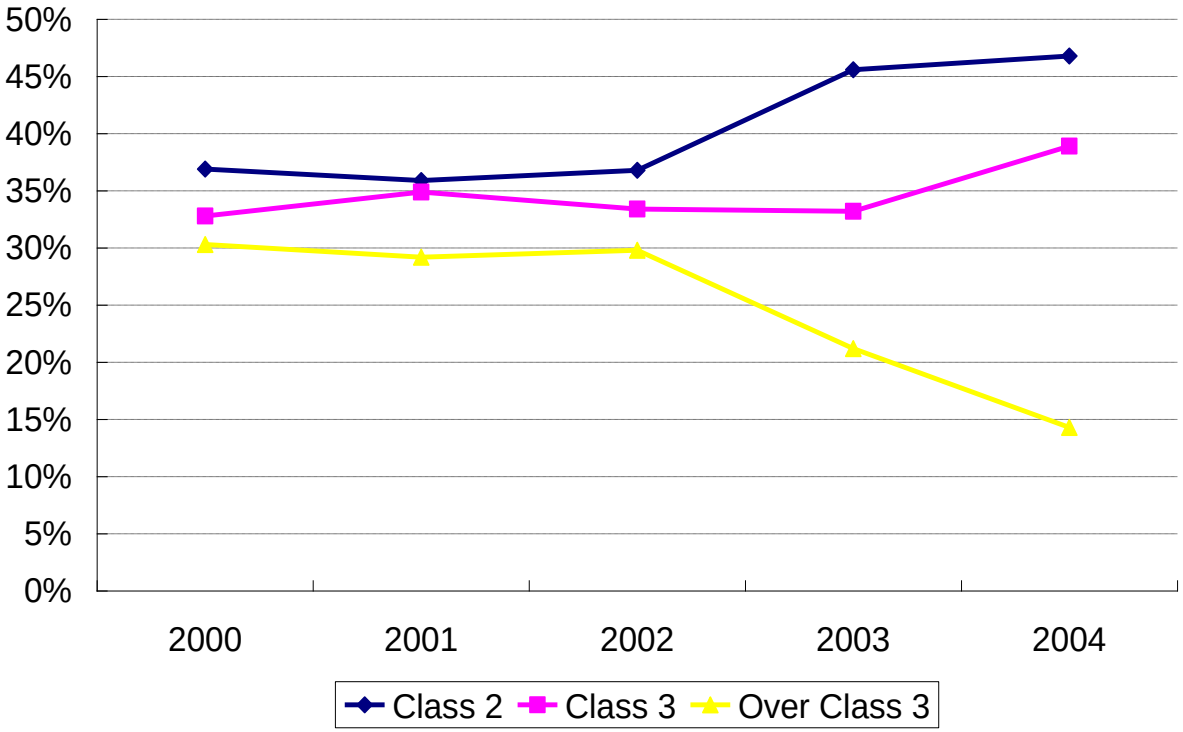


Air quality in Chinese cities is generally getting better

(sample size about 340 cities)

- Percent of cities with air quality complying with Class 2 of AAQS increased from 33.1% in 1999 to 38.6% in 2004;
- Percent of cities with air quality within Class 3 of AAQS also increased from 26.3% in 1999 to 41.2% in 2004;
- Percent of cities with air quality worse than Class 3 of AAQS dropped from 40.5% in 1999 to 20.3% in 2004;

Air Quality compliance: PM10

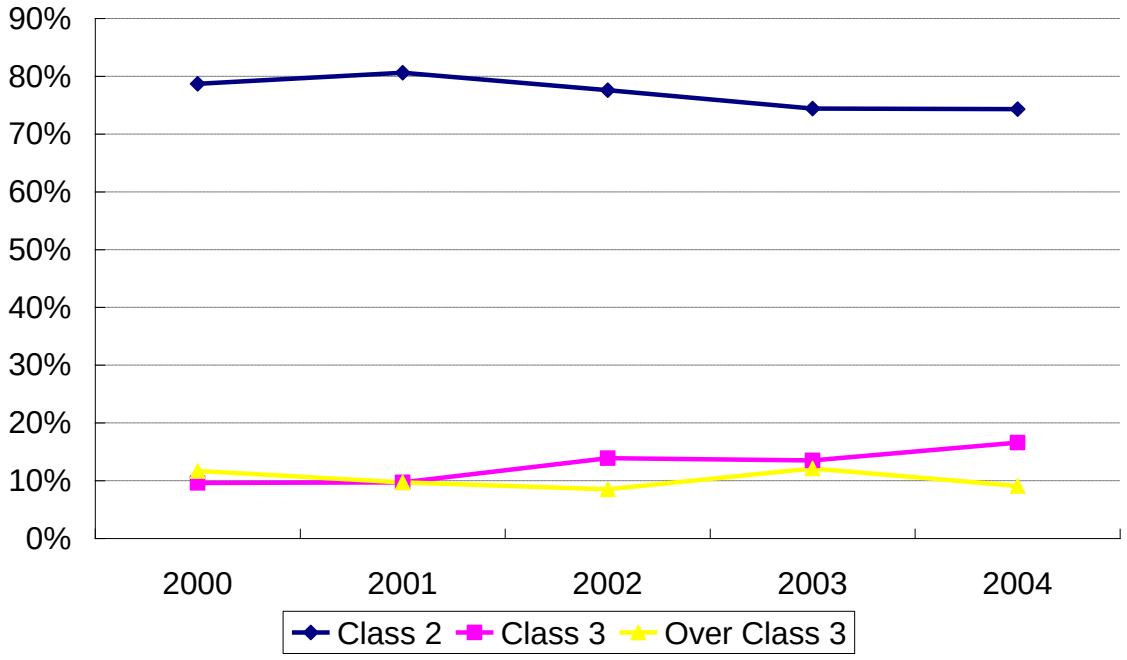


PM 10 levels in Chinese cities are improving

(sample size about 340 cities)

- PM10 in cities within Class 3 increased from 32.8% in 2000 to 38.9% in 2004;
- Those over Class 3 dropped from 30.3% in 2000 to 14.3% in 2004
- While those complying with Class 2 also increased from 36.9% in 2000 to 46.8% in 2004; and

Air Quality compliance: SO2



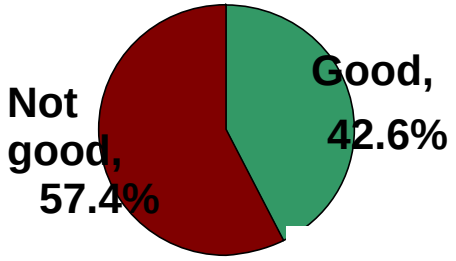
SO2shows a less clear (relatively stable) picture levels in Chinese cities are improving

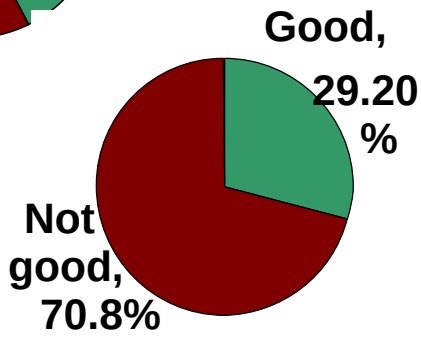
(sample size about 340 cities)

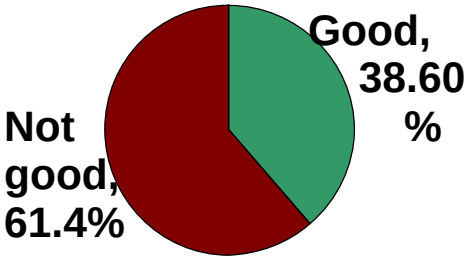
- Class 2 decreased slightly from 78.7% in 2000 to 74.3% in 2004;
- Class 3 increased slightly from 9.6% in 2000 to 16.6% in 2004;
- Over Class 3 decreased slightly from 11.7% in 2000 to 9.1% in 2004

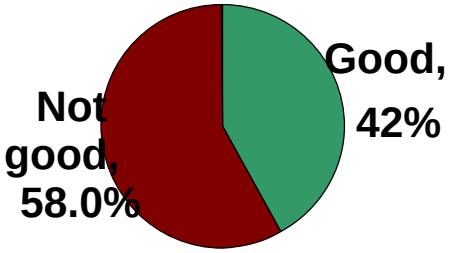
Conclusion Urban AQ

- Scope for further improvement:
  - Among the 47 national key cities on environmental protection, only 20 cities (42.6%) could meet Class 2 annual residential area standard of AAQS in 2004;
  - Among the 113 national key cities on environmental protection, only 33 cities (29.2%) could meet Class 2 of AAQS in 2004;
  - Among the 342 cities monitored in 2003, only 132 cities (38.6%) could meet Class 2 of AAQS;
  - Among the 500 cities participated in the Quantitative Examination System on Comprehensive Control of Urban Environment (QESCCUE), only 210 cities (42%) could meet Class 2 of AAQS in 2004;









City specific AQ information

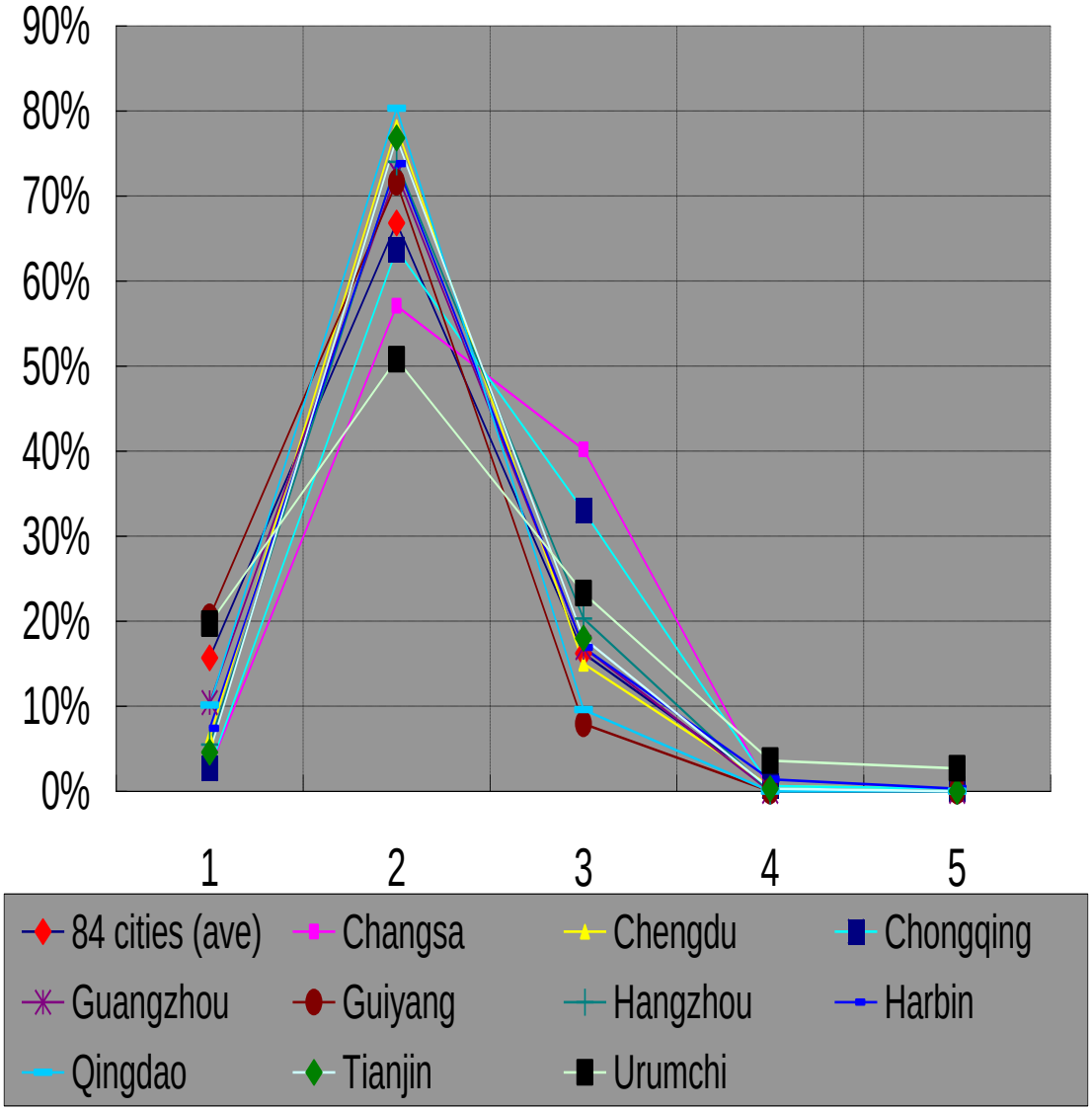
- CAI-Asia works on UAQM in cities at regional level;
- A phase approach will be adopted to deal with Chinese cities;
- Initial group of cities will be selected by SEPA and CAI-Asia
- Candidate cities include: Chengdu, Tianjin, Harbin, Hangzhou, Guangzhou, Chongqing,Urumchi, Guiyang, Luoyang, Changsha, Qingdao
- These will be selected according to SEPA's UAQM priorities;

General Information

AQ Monitoring Set-up

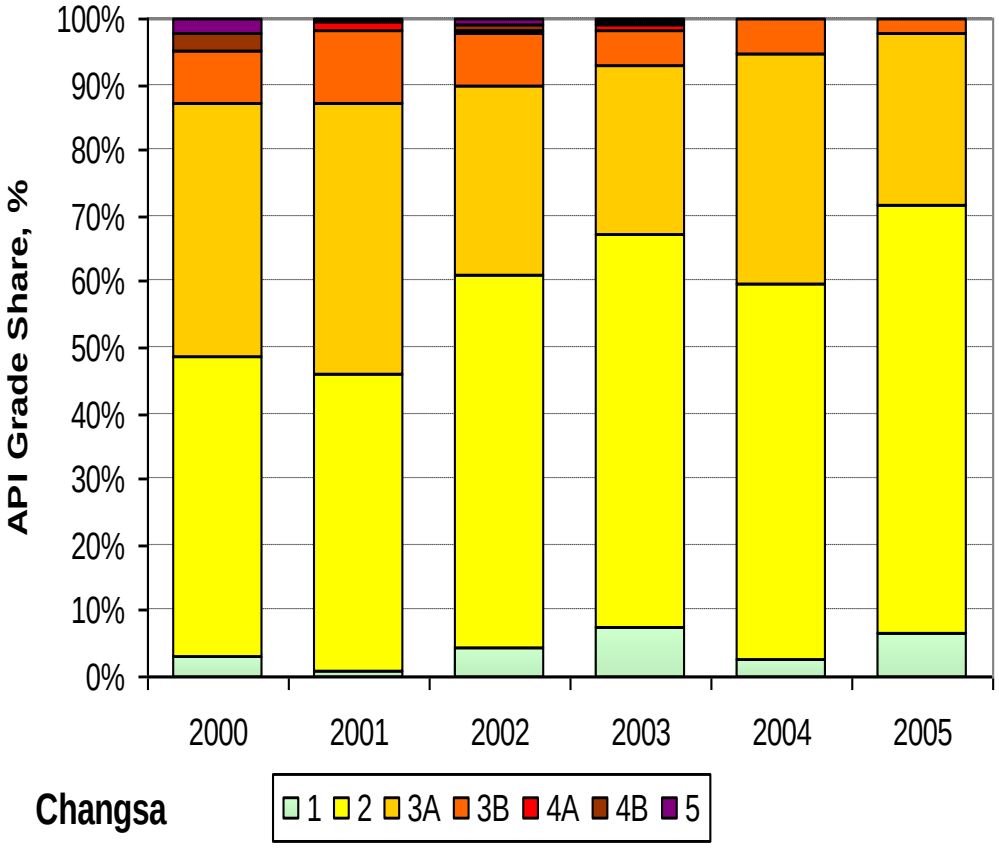
City	Area (km^2) Total/urban	Population (million) Total/urban	Number of Stations
Harbin	53200/1637/(220)	9.7/3.95	8
Tianjin	11300	10.1	22 ?
Hangzhou	16595/683(105.2)	6.5/4.0	9
Chengdu	12390/283	10.6/4.5	?
Chongqing	82403/600	31.4/12.1	11
Guangzhou	7434.4/266	942.6/852.6	9
Urumchi	12000/166.8	2.08/173.7	?
Qingdao	10654/1102	7.3/2.58	13
Luoyang	15208/544	6.4/1.4	?
Guiyang	8046/495	3.32/1.87	2?
Changsha	11819.5/556	6.1/2.02	6

API of Chinese cities



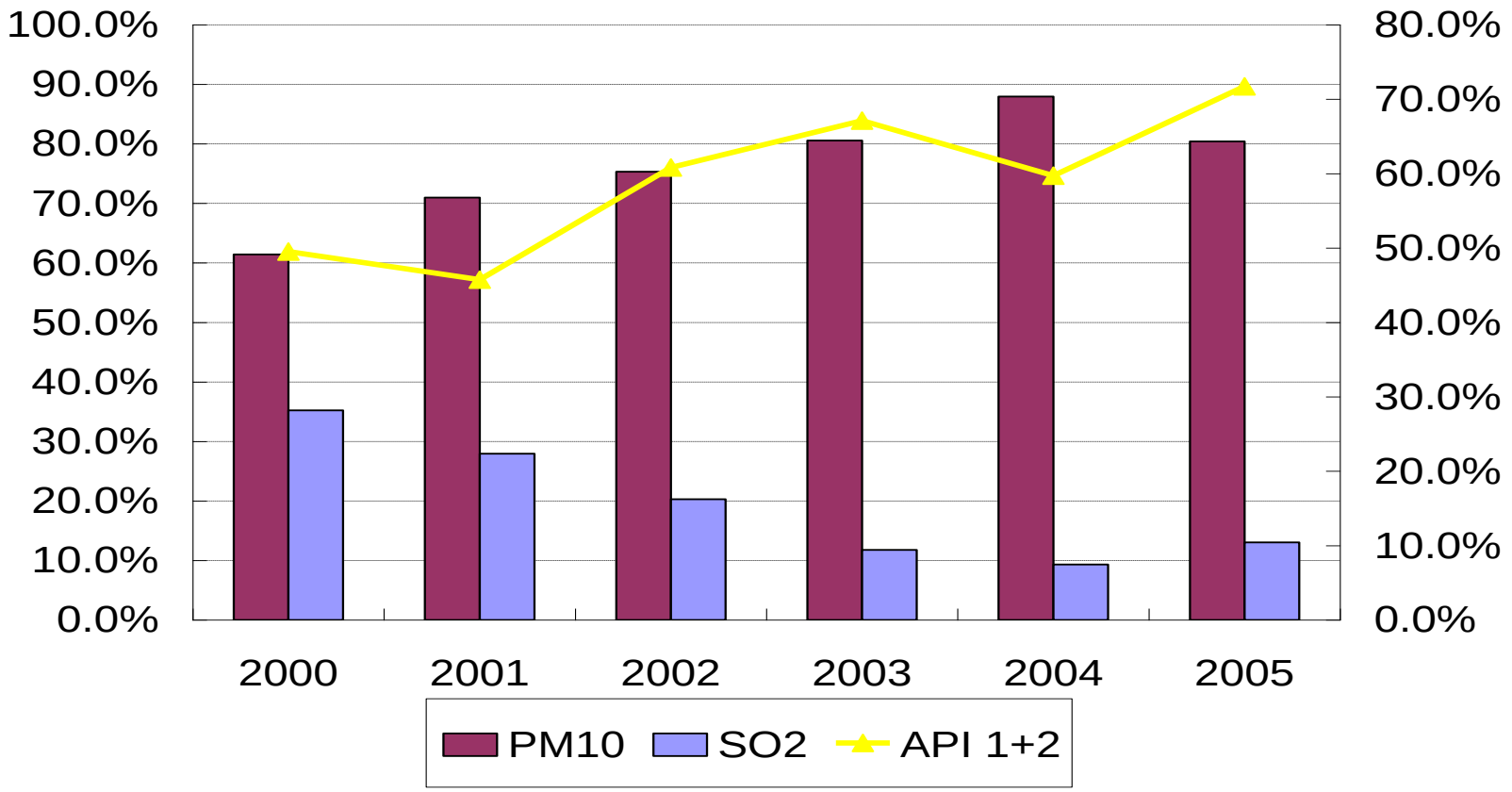
- Our cities API are around the average of 84 cities;
- Guiyang and Urumchi had more Grade 1;
- Changsha, Chongqing, Urmchi had less Grade 2;
- Guiyang, Chengdu, Qingdao had less Grade 3;
- All cities had similar amount of Grade 4 and 5

Changsa – Air Quality Summary (1)



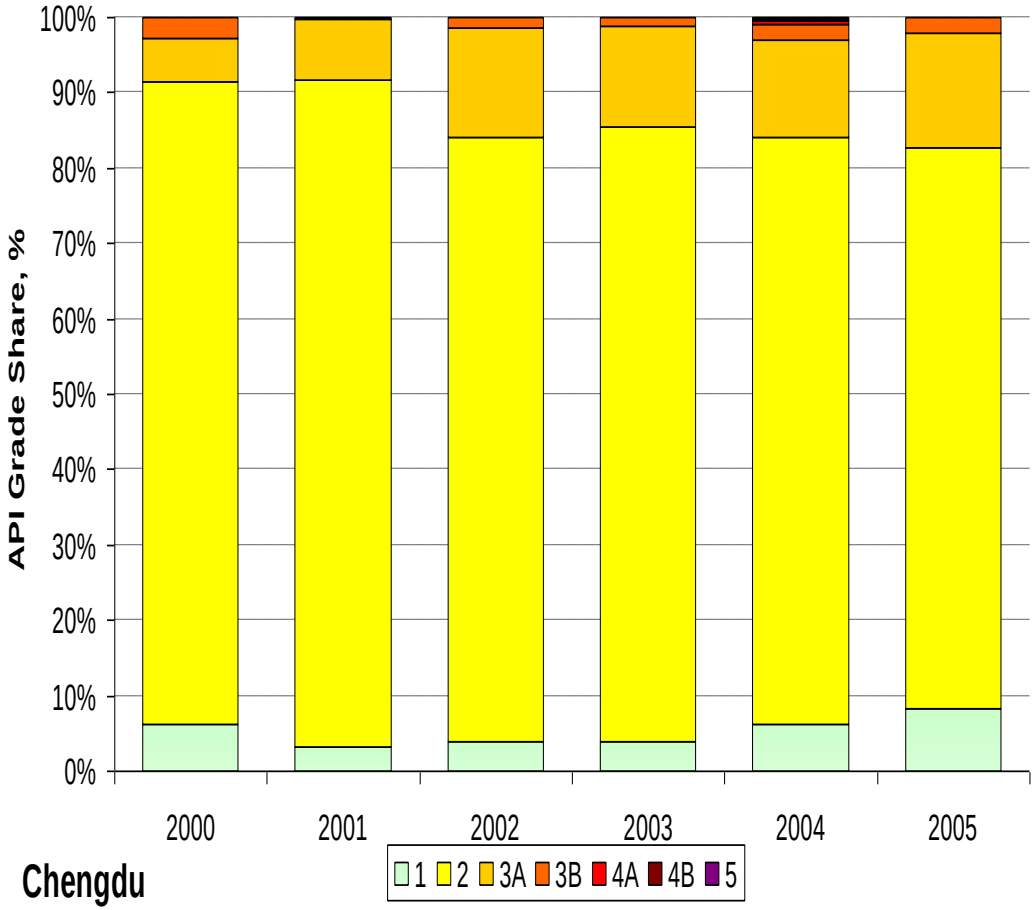
- General improvement
- Still more than 30% of days non compliance
- Grade 1 days below national average
- Grade 3B, 4 and 5 dropped continuously
- No Grade 4 since 2004

Changsha – Air Quality Summary (2)



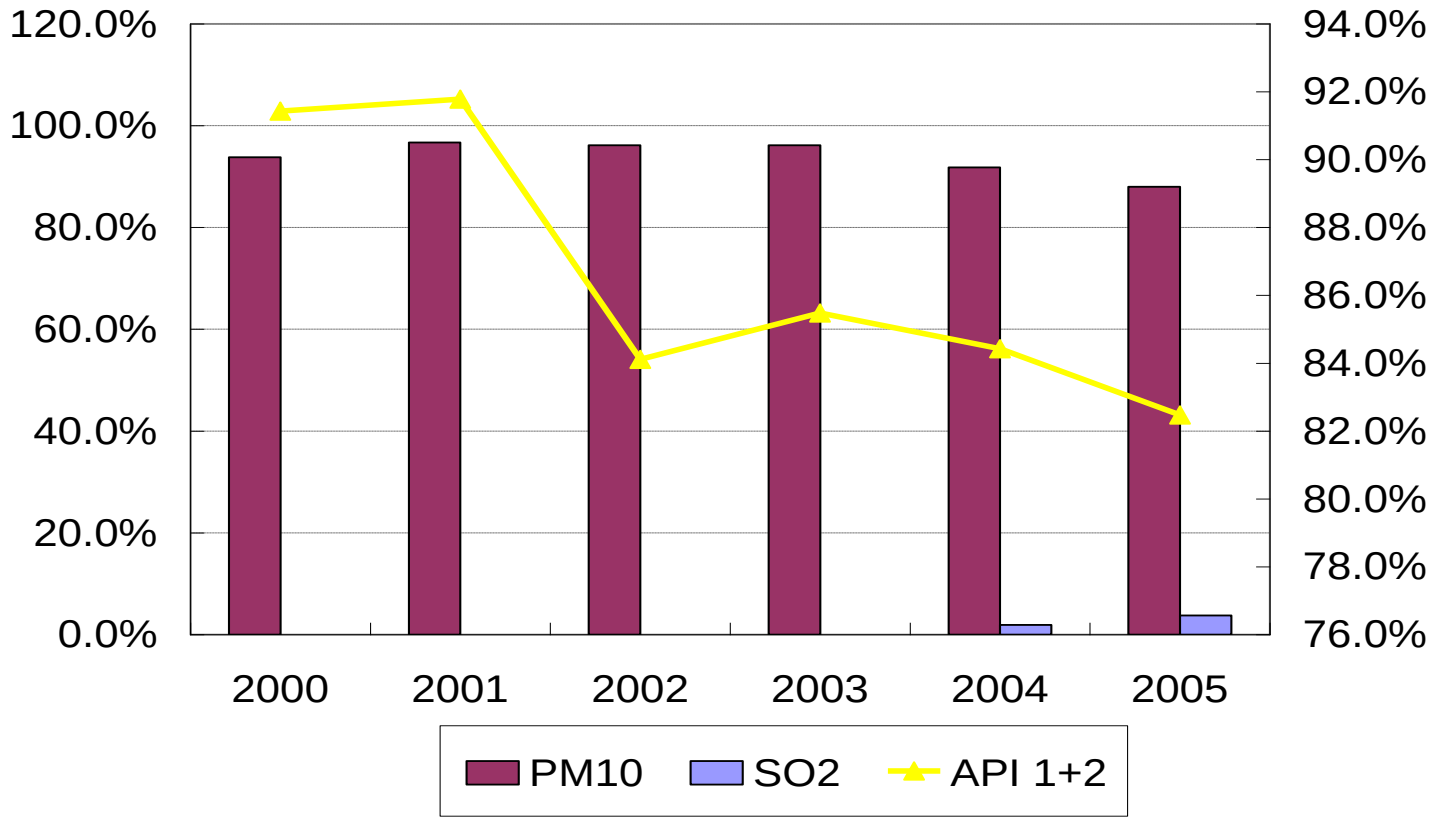
- PM10 continues to be pollutant of concern
- SO2 dropped to less than 10% as prominent pollutant in 2004
- Air quality generally improves, slight drop in 2004

Chengdu – Air Quality Summary (1)



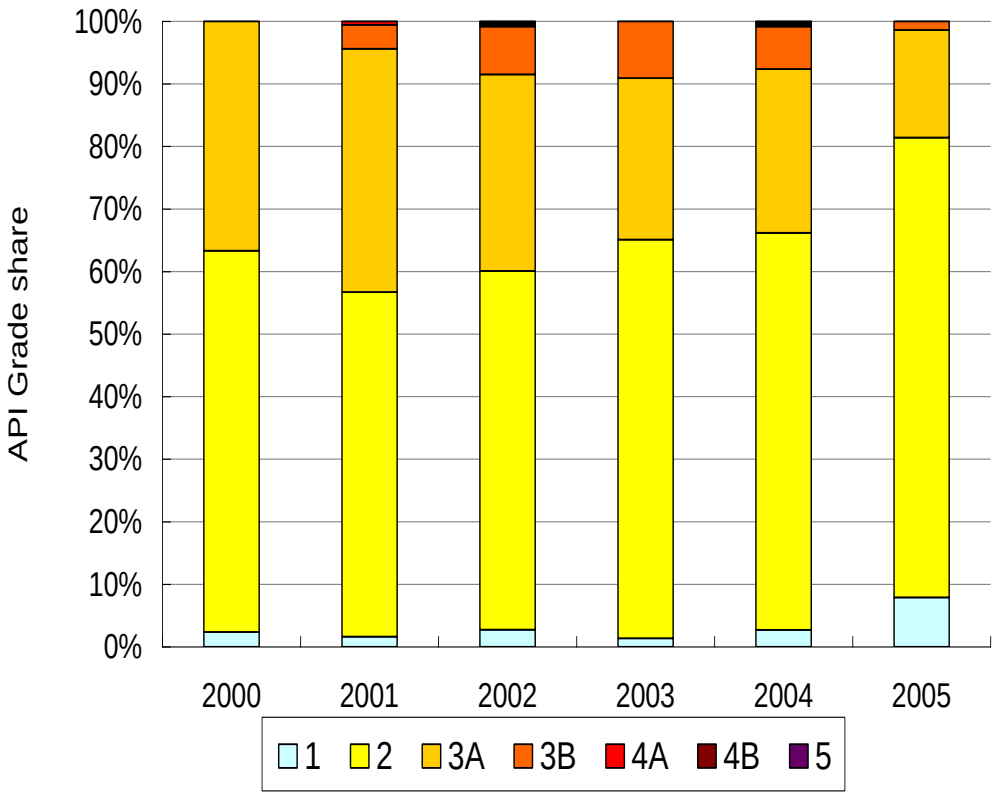
- Unique decrease of air quality over years, esp. in 2004, having Grade 4 and 5;
- Grade 1 less than average;

Chengdu – Air Quality Summary (2)



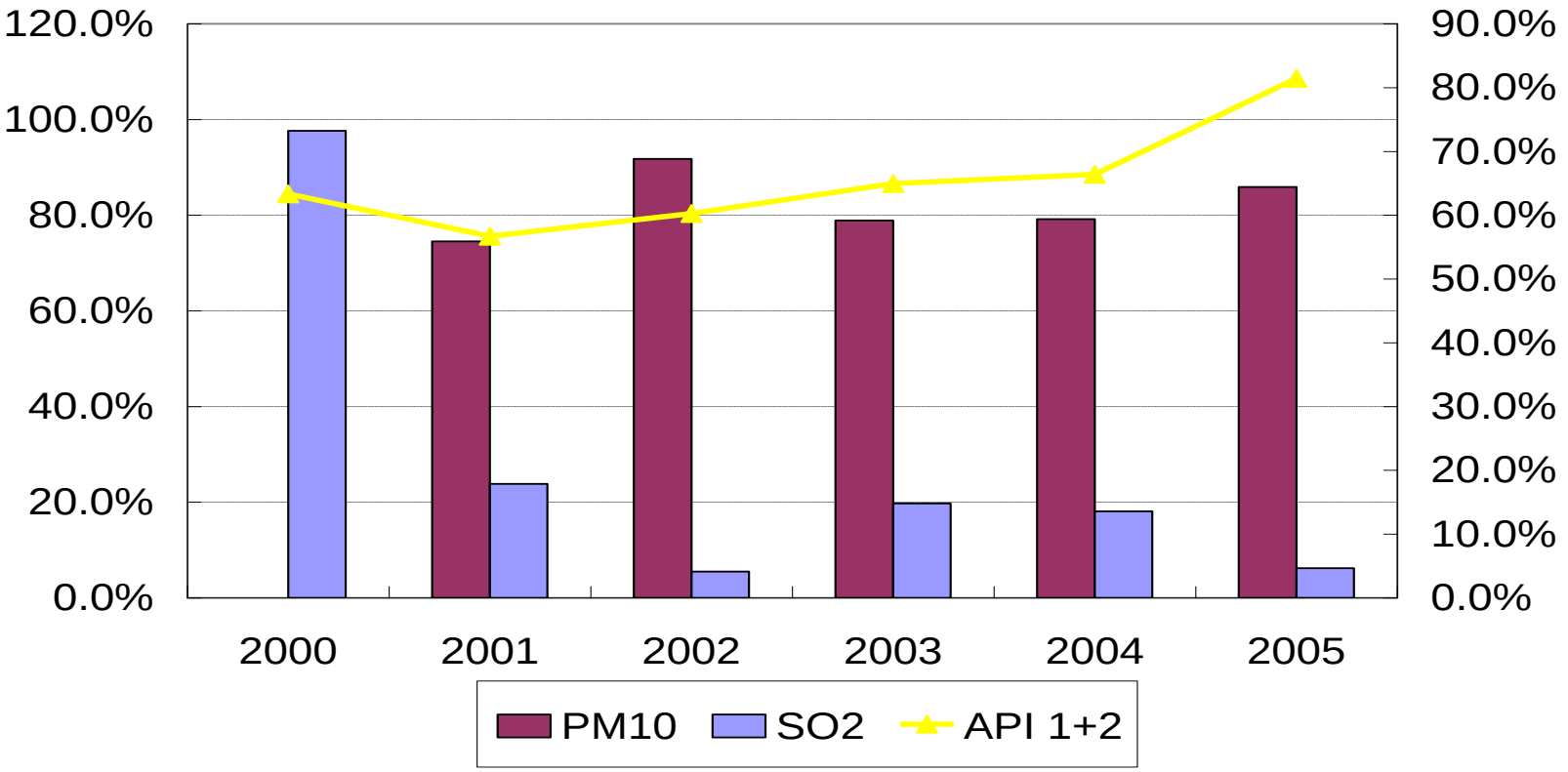
- National Model City for Environmental Protection (NMCEP) in 2005;
- PM10 as prominent pollutant, of decreasing concern
- SO2 rises in recent 2 years
- Air quality shows a decreasing trend

Chongqing – Air Quality Summary (1)



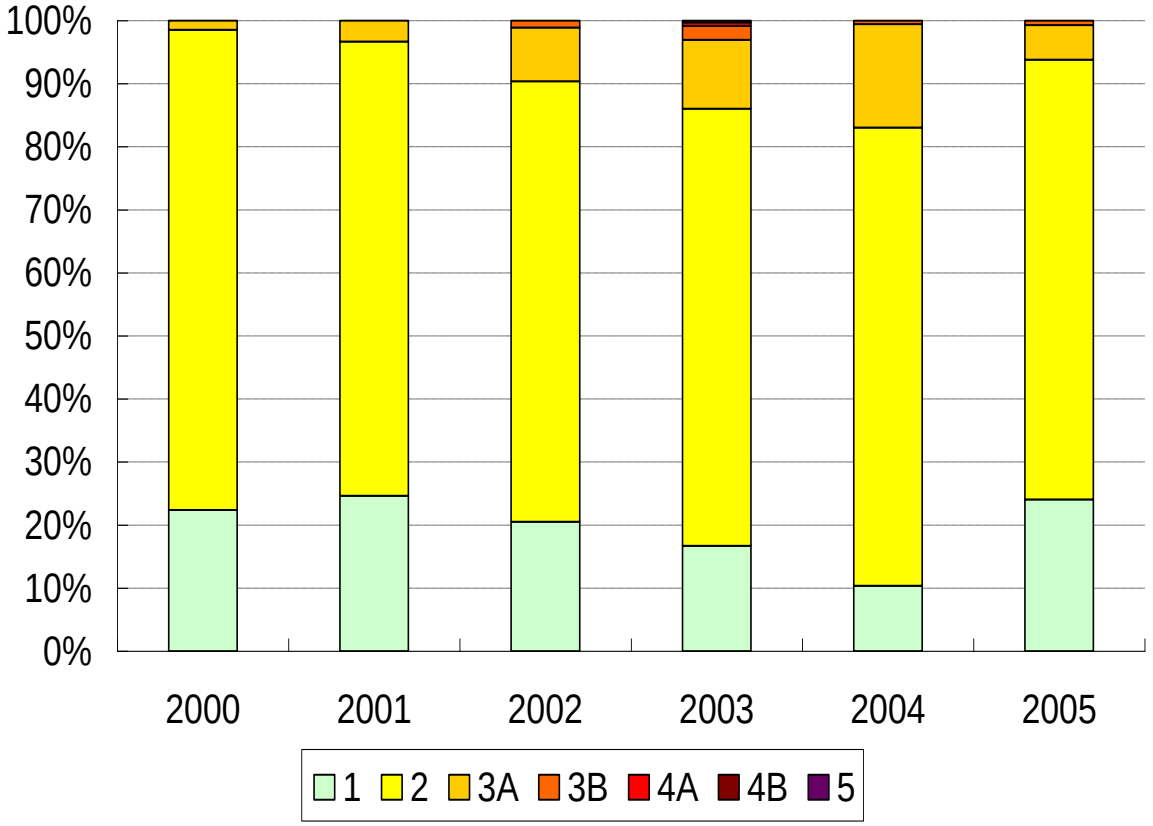
- Air quality generally improving;
- Grade 1 less than average;
- Grade 2 less than average
- Grade 3B and 4, 5 generally decreasing

Chongqing – Air Quality Summary (2)



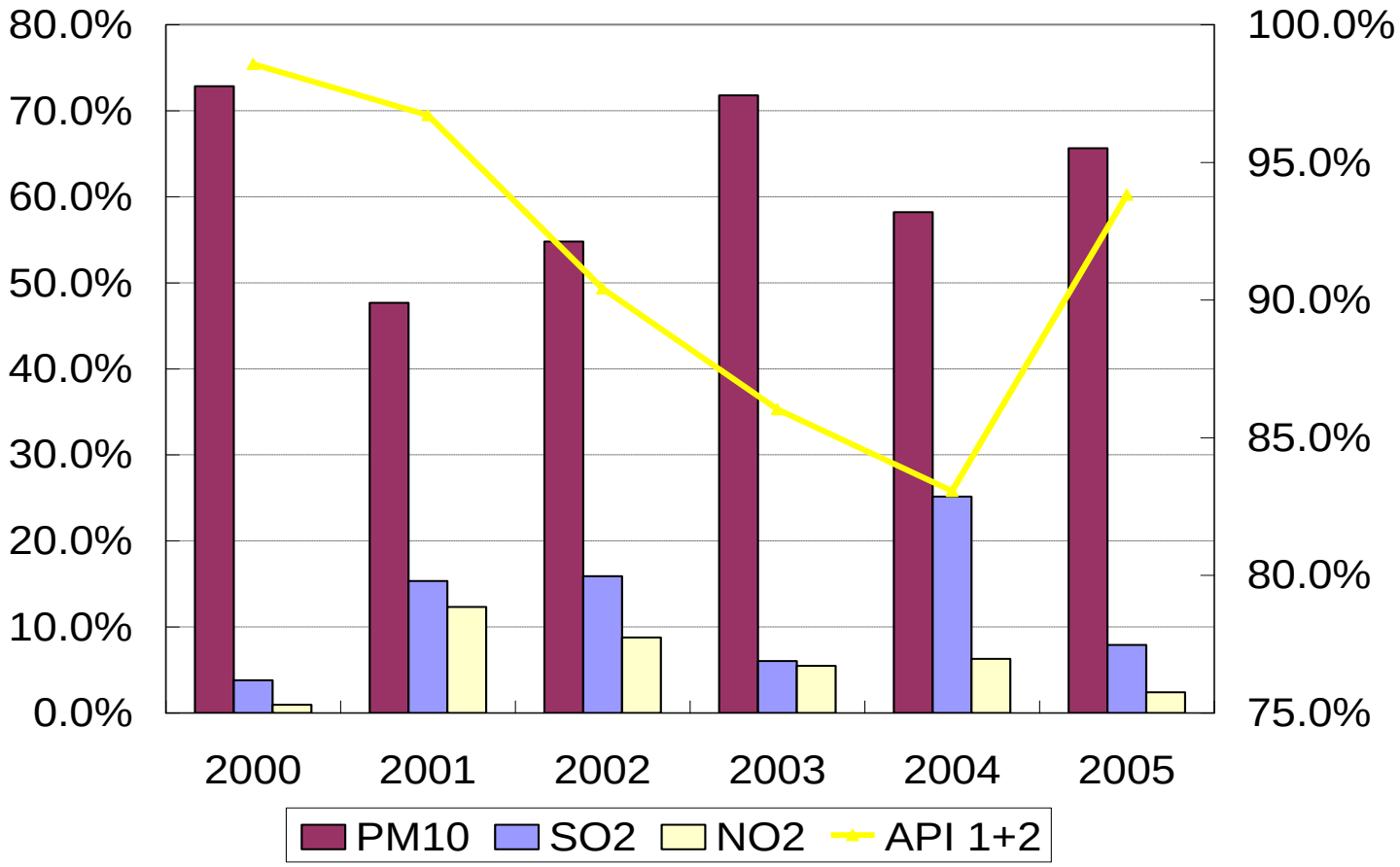
- Yubei District NMCEP (2004)
- PM10 as prominent pollutant of concern, while SO2 still plays an important role;
- Air quality keeps improving;

Guangzhou – Air Quality Summary (1)



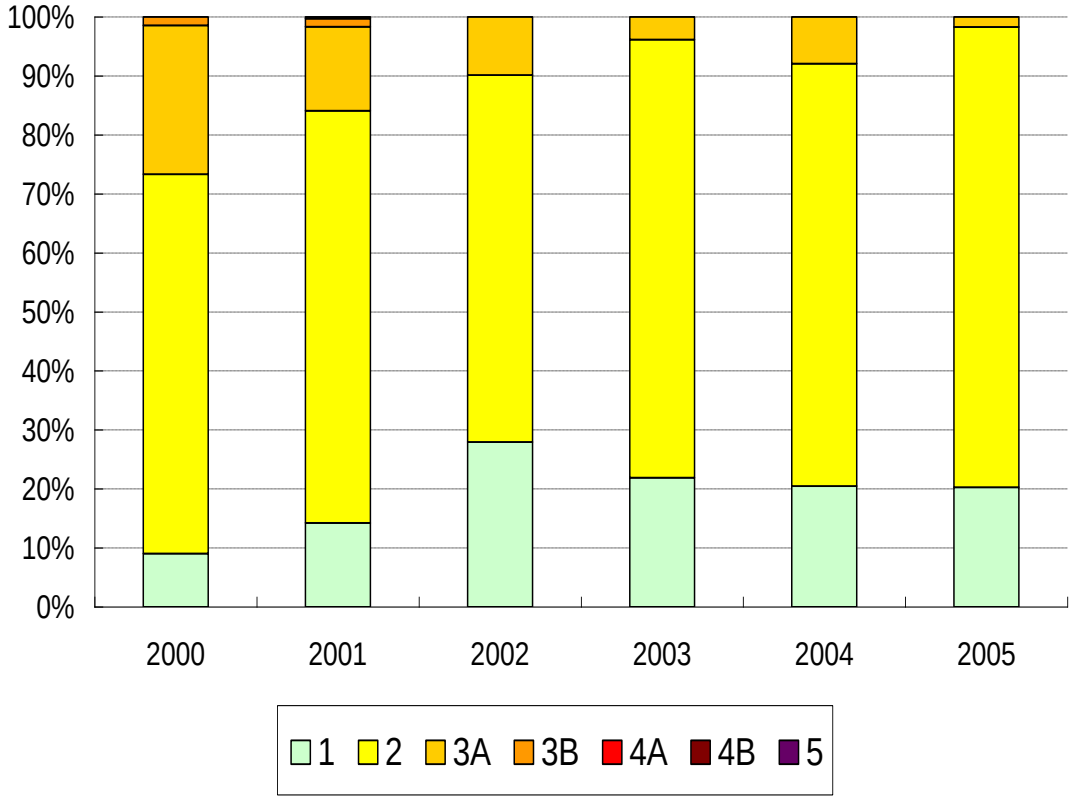
- Air quality generally drops;
- Grade 1 drops and Grade 3A increases;
- Grade 1 around the average level

Guangzhou – Air Quality Summary (2)



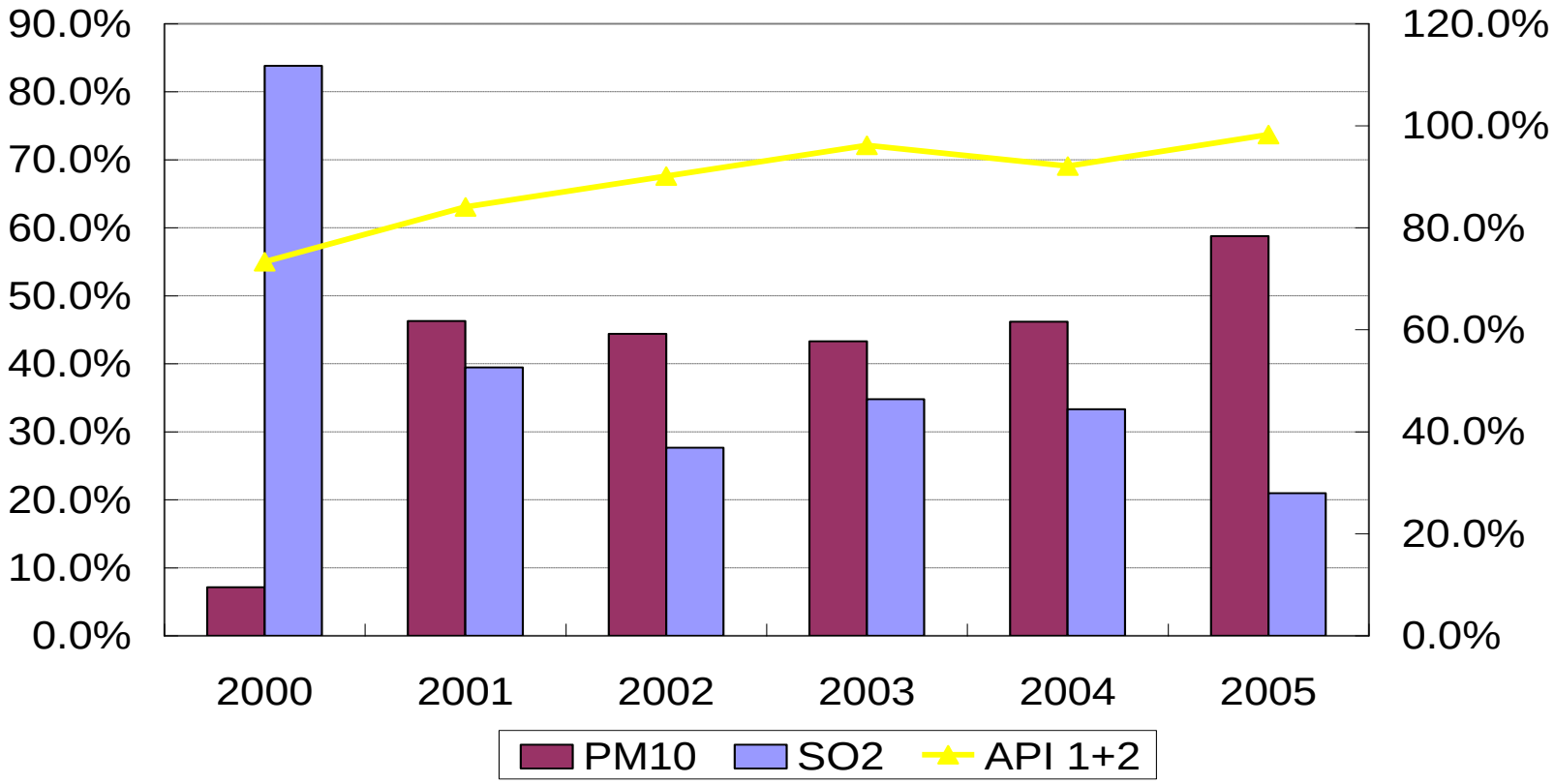
- PM10 as major pollutant of concern, SO2 still important and generally on increase, while NO2 on drop;
- Air quality compliance keeps dropping

Guiyang – Air Quality Summary (1)



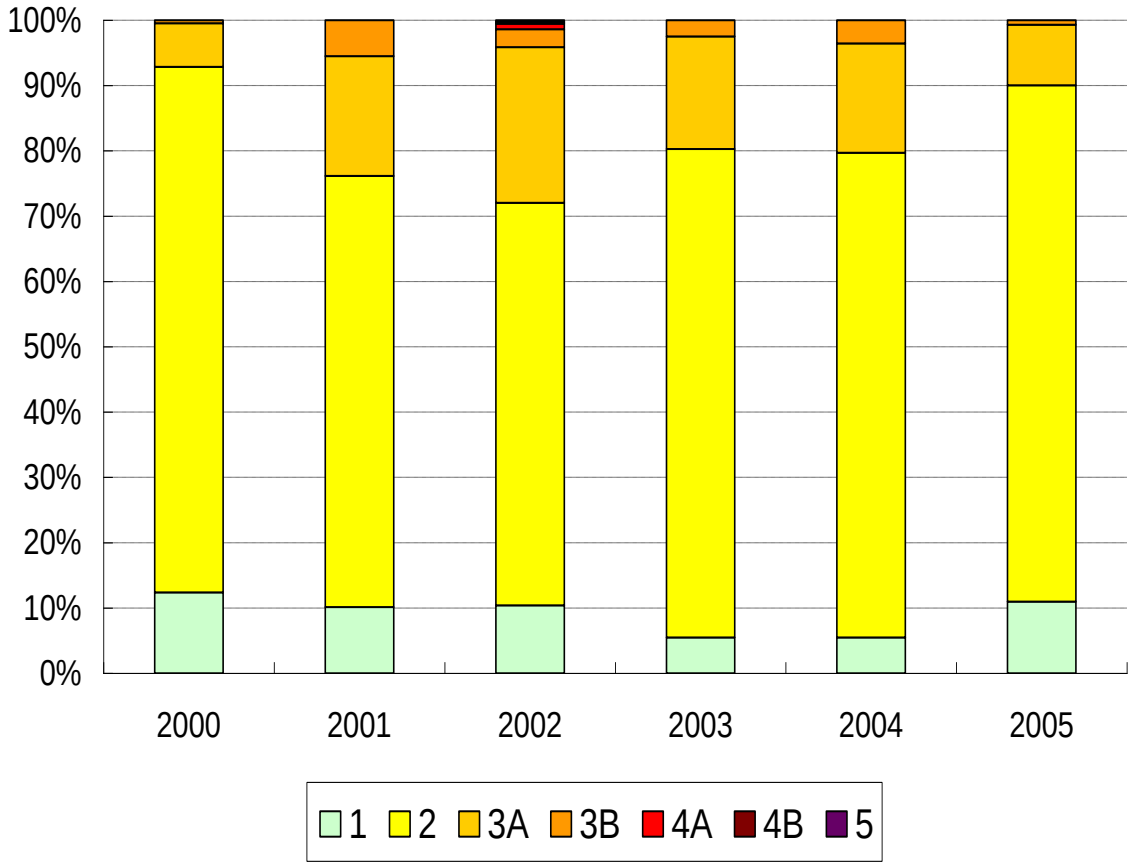
- Very good air quality in general, 98.3% compliance in 2004;
- Grade 1 more than average;
- No 3B, 4, 5 at all

Guiyang – Air Quality Summary (2)



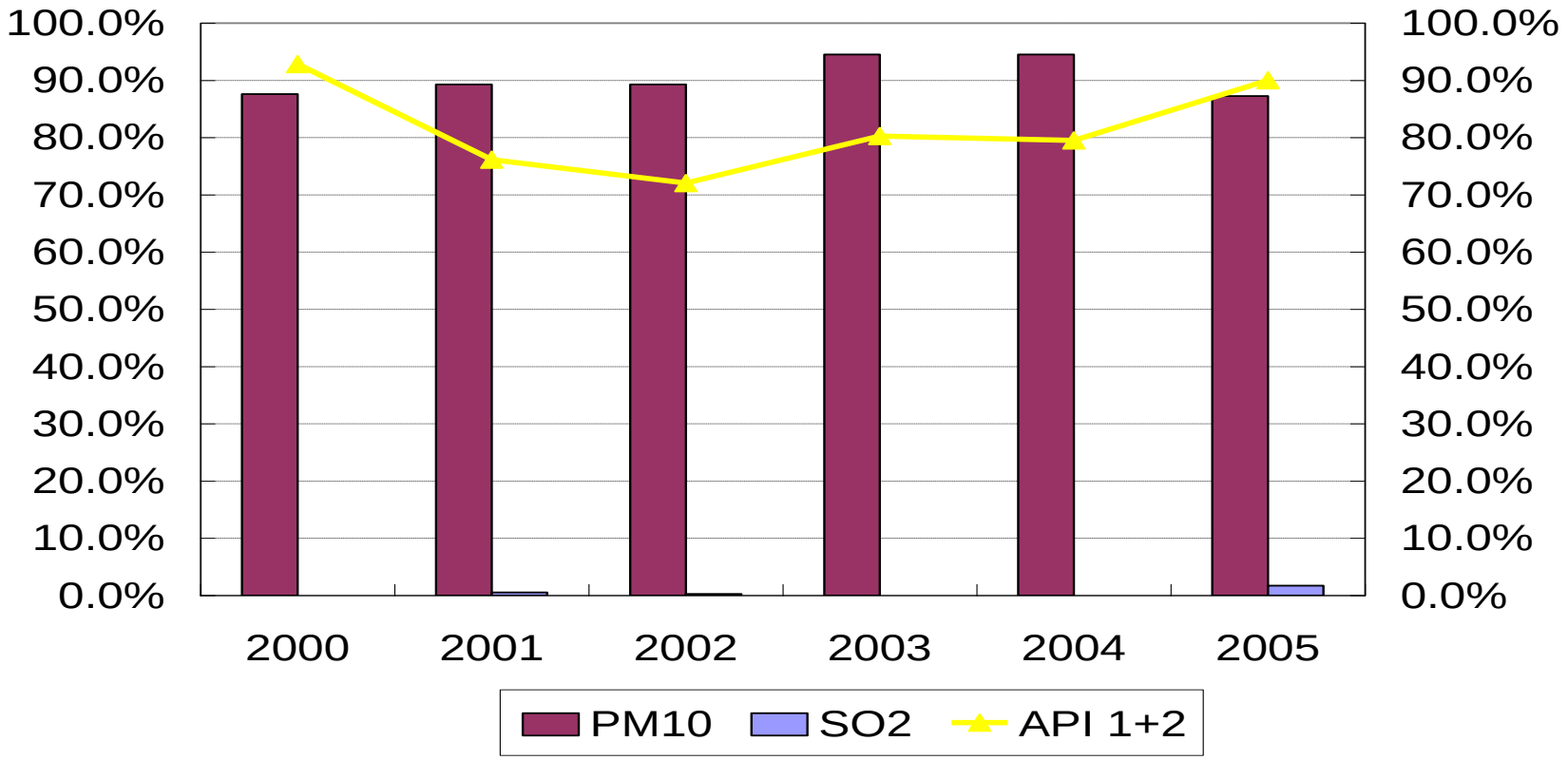
- PM10 as pollutant of concern and increasing, while SO2 still quite important;
- Air quality keeps improving and remains high compliance

Hangzhou- Air Quality Summary (1)



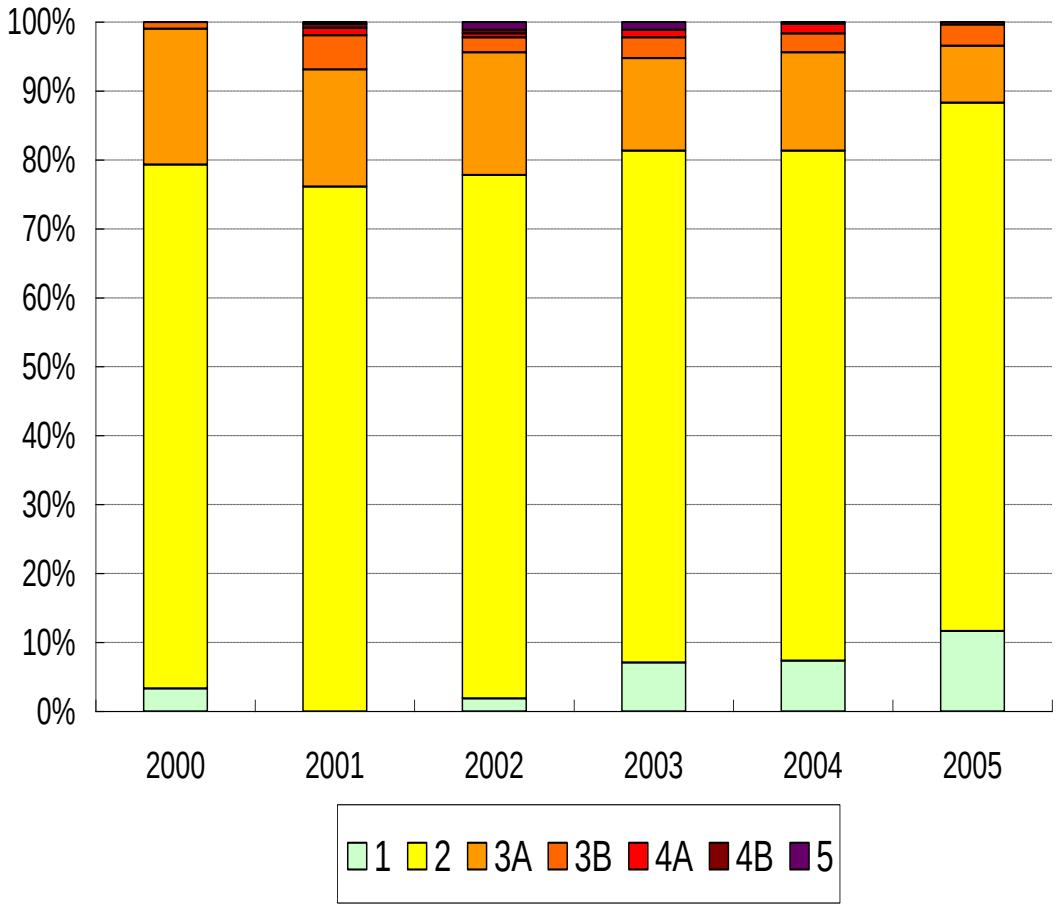
- Air quality steadily improves, Grade 2 keeps increasing, Grade 3 decreases;
- Grade 1 less than average

Hangzhou – Air Quality Summary (2)



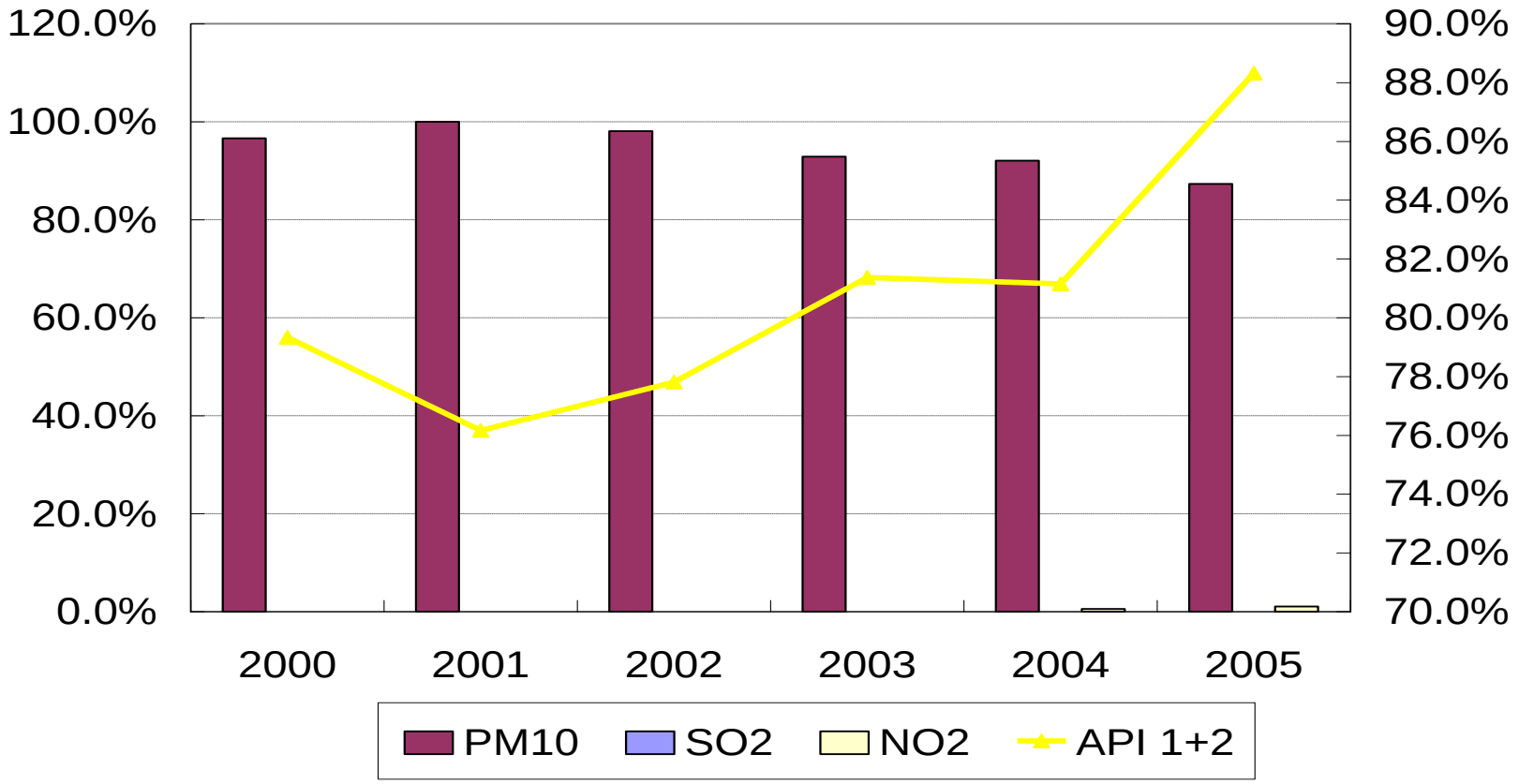
- NMCEP (2001)
- PM10 as pollutant of concern;
- SO2 not to be overlooked;
- AQ compliance is high and increasing

Harbin – Air Quality Summary (1)



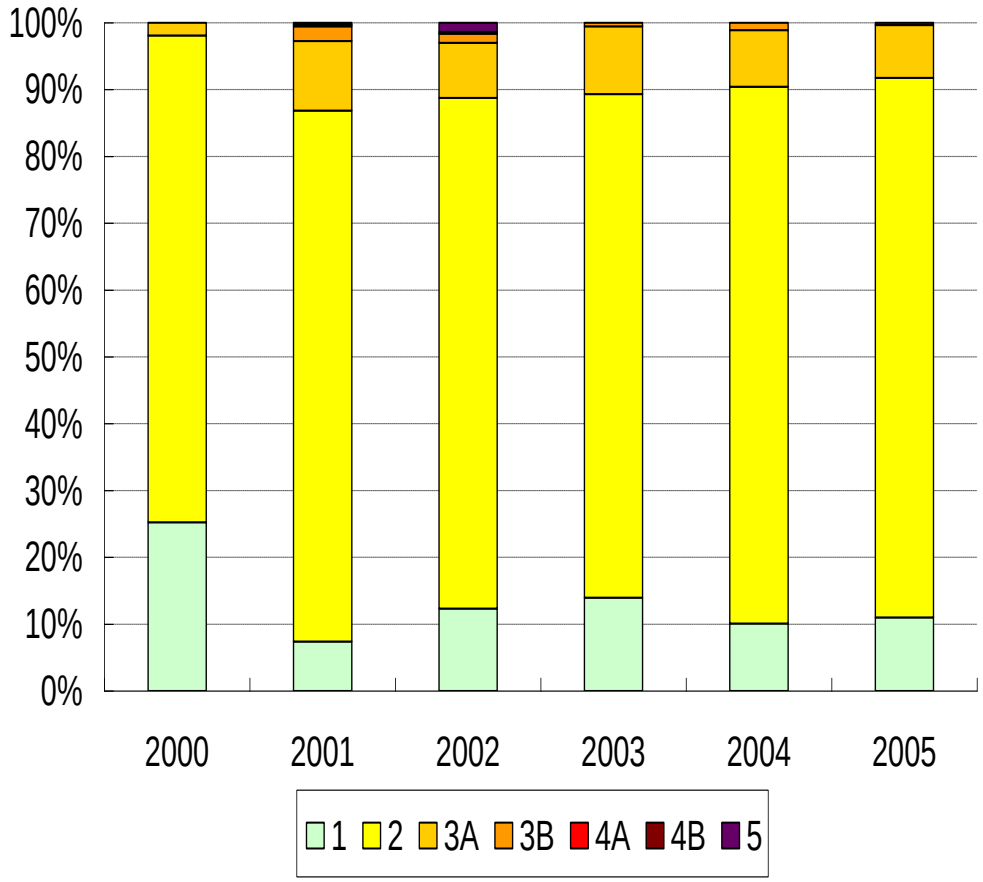
- Good days keep increasing;
- Used to have heavily polluted days;
- Grade 1 less than average

Harbin – Air Quality Summary (2)



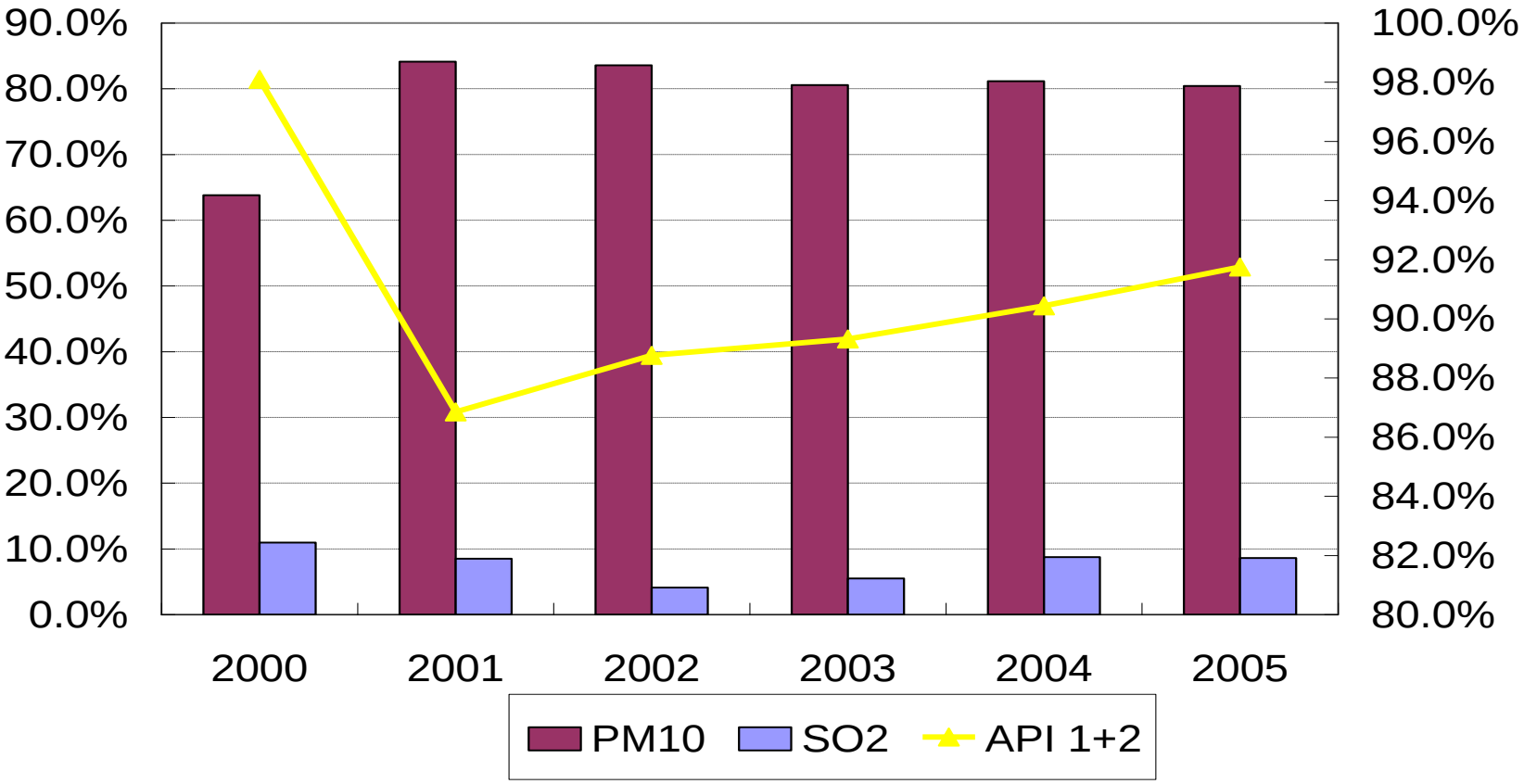
- PM10 as pollutant of concern, surprisingly no SO2 issue as Harbin is a northern city;
- NO2 emerges to be a pollutant of concern recently and is on rise;
- Overall air quality is improving

Qingdao – Air Quality Summary (1)



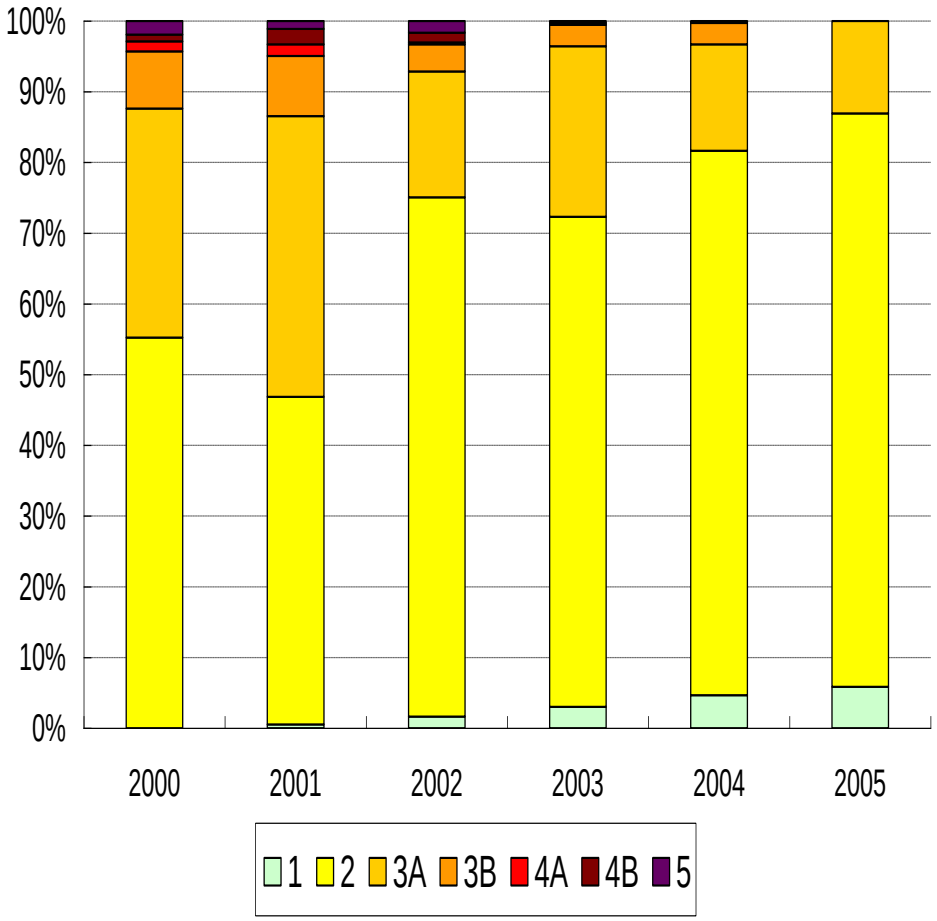
- Air quality generally improves ;
- High compliance rate;
- Less Grade 1 days than average;

Qingdao – Air Quality Summary (2)



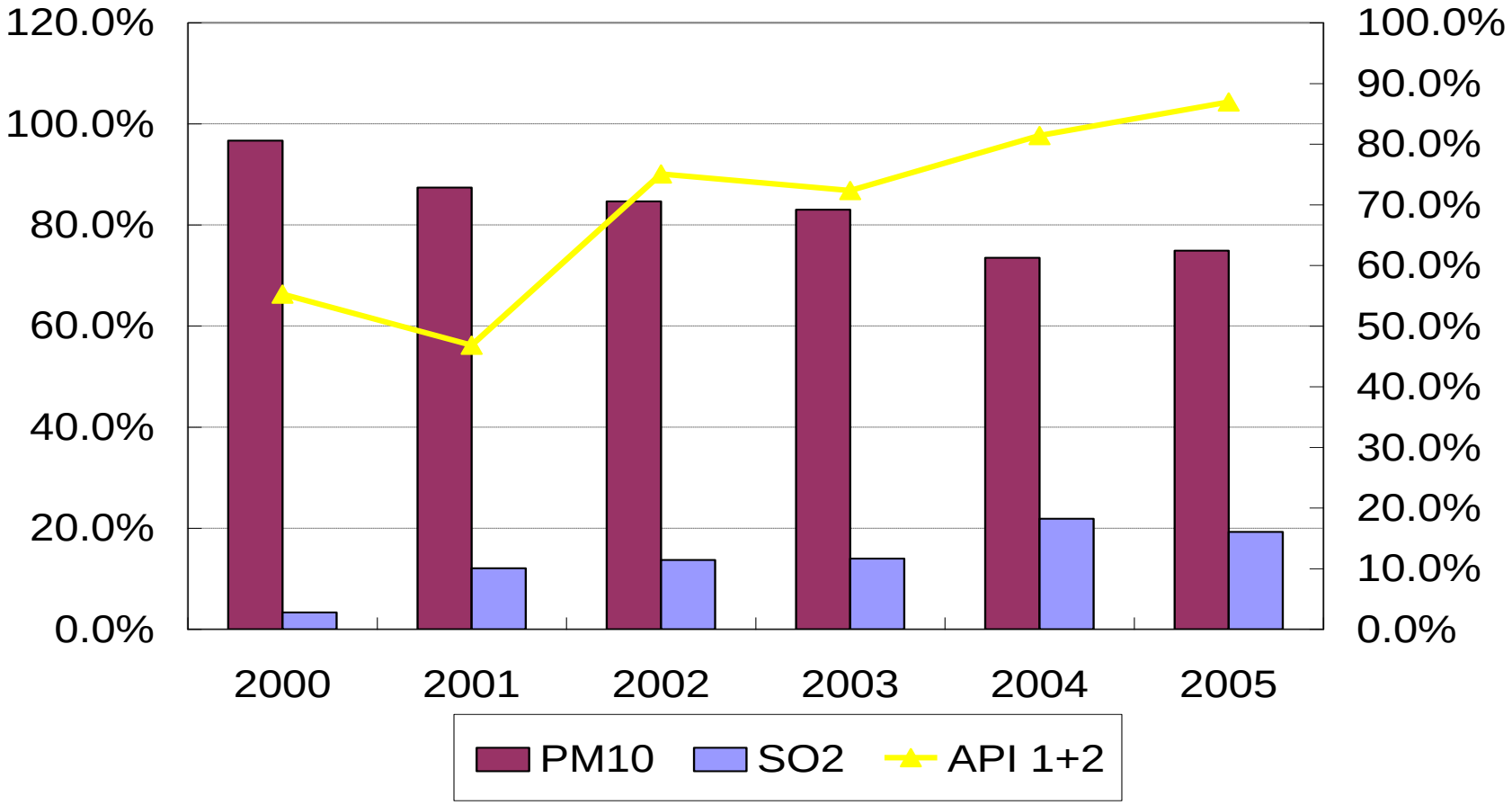
- NMCEP (2000)
- PM10 as pollutant of concern, SO2 re-increased in 2002
- Air quality keeps improving at high compliance rate

Tianjin- Air Quality Summary (1)



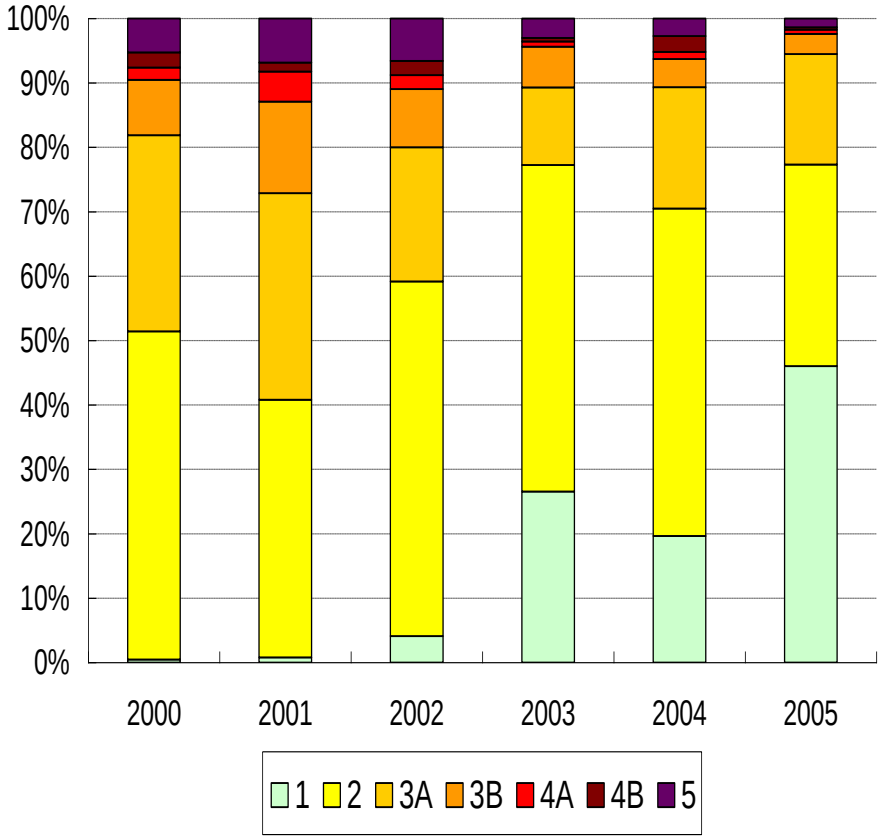
- Overall air quality is improving;
- Used to have seriously polluted days;
- Quite lower Grade 1 days than average;

Tianjin – Air Quality Summary (2)



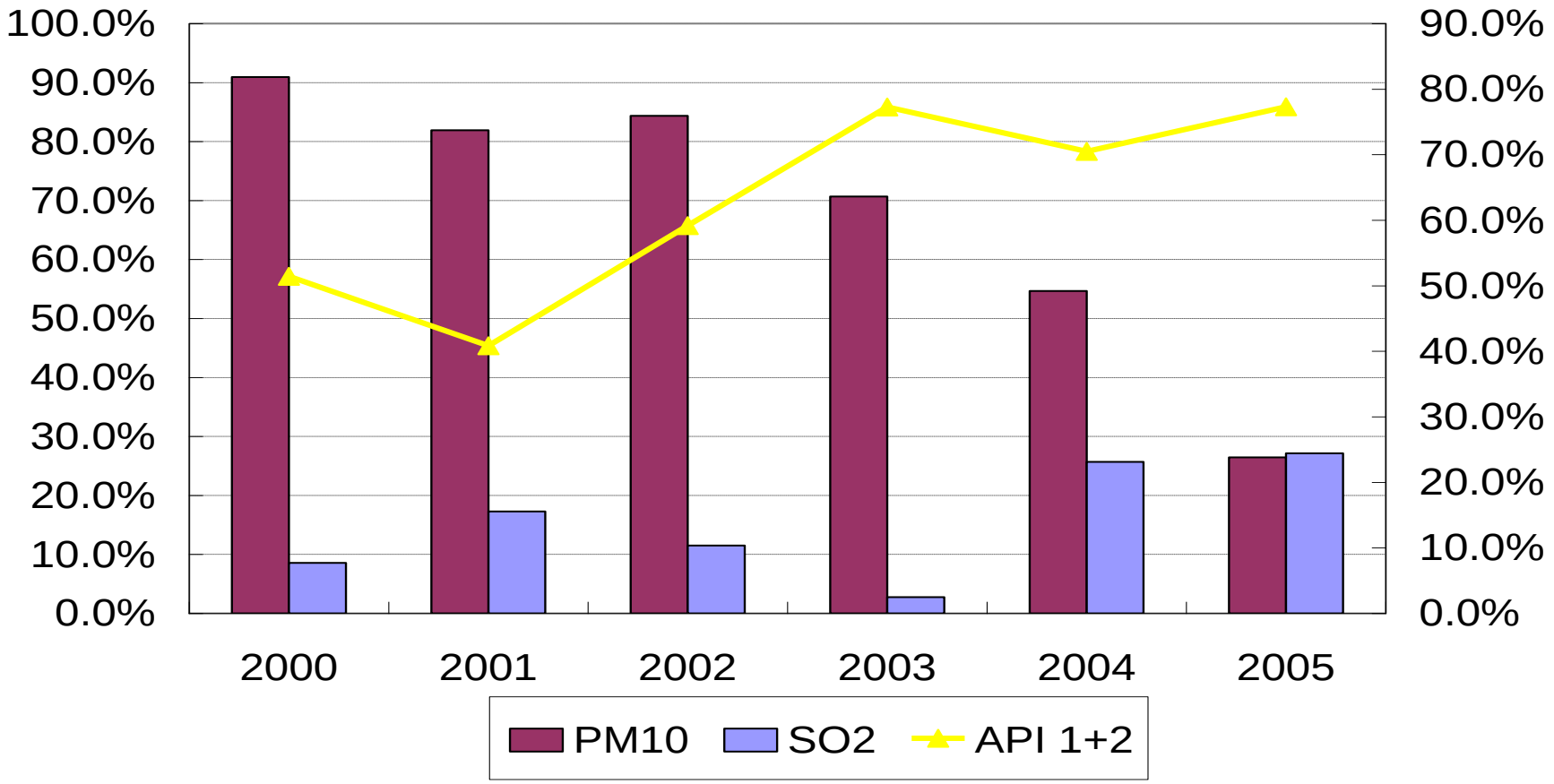
- Dagang District NMCEP (1999)
- PM10 as pollutant of concern, the percent as prominent pollutant is dropping;
- SO2 as prominent pollutant is increasing;
- Air quality keeps increasing at high speed

Urumchi- Air Quality Summary (1)



- Air quality improved fast;
- Used to have quite many seriously polluted days, still have Grade 5;
- Above average number of Grade 1 days in recent years

Urumchi – Air Quality Summary (2)



- PM10 as pollutant of concern, while the share as prominent is dropping;
- SO2 plays important role from time to time and increases in recent years
- Air quality generally is improving while slightly went down in 2004

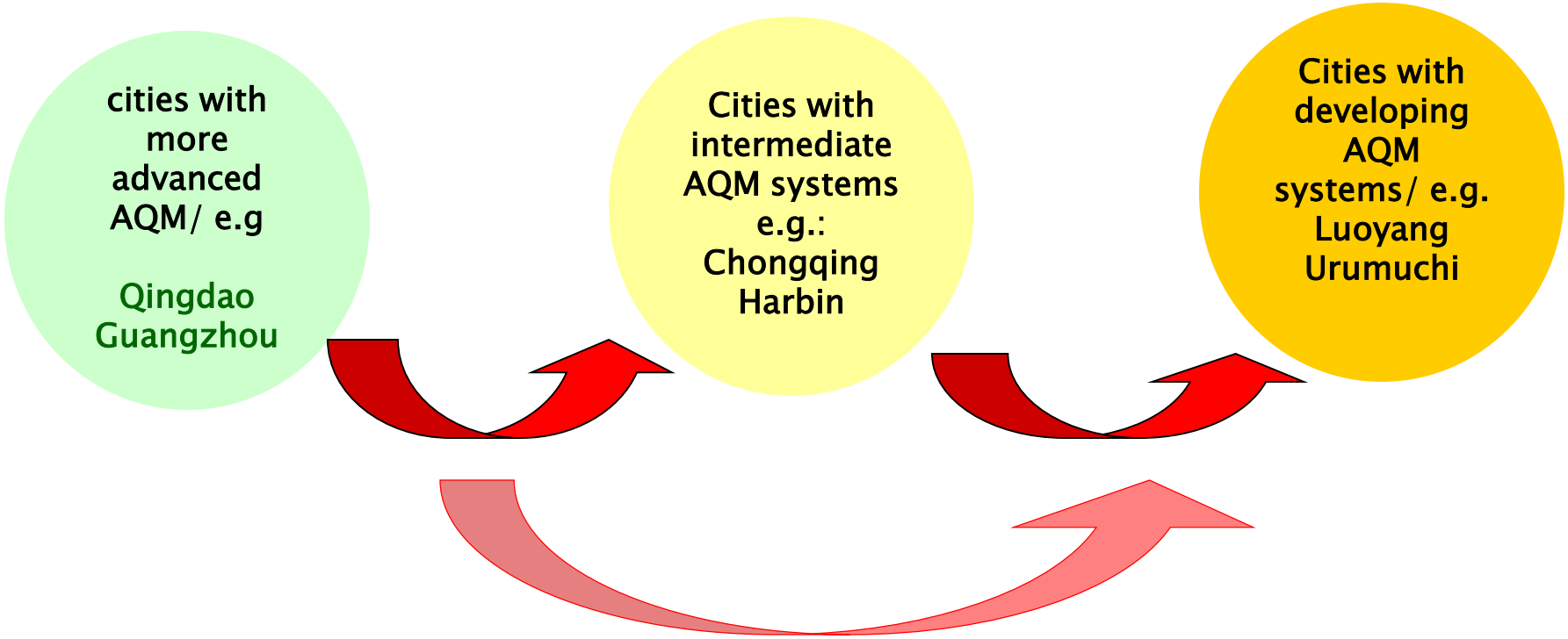
Luoyang – Air Quality Summary

- Very limited information available for Luoyang
- Luoyang has a history of serious air pollution over the past 10 years. In 2003, it was listed in the top 10 most polluted cities by SEPA; air quality in 2003 only 94 days complied with the NAAQS. From 1996 to 2003 particulate matters (TSP) daily averages in urban areas exceeded the NAAQS by 50% and during 2001 to 2003, the exceedance was over 68%.
- Though mitigation measures in 2004, the number of days that comply with the NAAQS reached 156 days. It was a great achievement, but still in very low number.
- Particulate matters and SO2 are the prominent air pollutants in Luoyang. The major sources of PM are coal-burning, industrial emissions, blown-up dusts and vehicle emission.
- Luoyang has set its air quality target in 2005 to be "have more than 220 days that comply with the NAAQS" and starts the application for the National Model City for Environmental Protection.

Conclusions on AQ levels

- Overall urban air quality in Chinese cities is improving but Air pollution levels continue to be higher than the Chinese AQ standards
- Chinese AQ standards are less strict than EU and USEPA standards
- SO2 levels were going down but are now increasing again.
- PM10 is the main pollutant of concern for all of the cities
- Cities are having similar AQ problems and all cities will have to deal with mobile, stationary and area sources to be successful in improving Air Quality
- Ozone is becoming more serious but is not studied in same level of detail.
- Local EPBs have played key role in improvements and are key to further improvements, as well as national campaigns

AQM Stages of Cities



- Cities have varying capacities in AQM and have different needs in improving their AQM
- Cities with more advanced AQM systems/capabilities have the potential to provide assistance to cities that have developing AQM capacities through sharing of experience, best practices, etc
- Intercity-cooperation can maximize international assistance

Next steps of CAI-Asia China Project

- Organize city visits to validate and complete information on AQ and AQM in participating cities
- Request SEPA and cities to make "raw" AQ data (daily, weekly and annual) available for management and research purpose
- Select priority actions for inclusion in CAI-Asia China work program 2006: knowledge management, capacity building, pilot projects
- Response will be different depending on needs of cities
- Fund raising to be able to carry out more activities.
- Organize city participation in BAQ 2006