3.4 Chongqing

Situational Analysis and Urban Air Quality Trends

Chongqing municipality is one of four directly administered by the Central Government of China and is presently China's biggest municipality in terms of area and population. It covers 82,000 square kilometres in the southwest of China and includes 43 districts, cities and counties. The Chongqing urban area totals 190 square kilometres with a population of about 2, 500,000. In 2000, its GDP was 159,000 million Yuan and per capita income for the total city was 5,157 Yuan (US $621). The urban area lies between two large mountains, Tongke Shan and Zhongliang Shan. The relative humidity is about 80 per cent and the annual average wind speed is 1.1-1.7 m/s. Both topography and climate hinder pollutant diffusion. The urban area is divided into three parts by two rivers and the west is higher than the east. Traffic congestion is made worse by the many bends and slopes along the city's narrow roads which are often only seven to ten metres wide. The vehicle fleet has recently increased by 10-15 per cent and, as these vehicles are poorly maintained, their contribution to air pollution is substantial.

Chongqing is an industrial city and its main metallurgical and chemical industries have yet to control their emissions. The gases they emit constitute a large proportion of the city's total pollution load and mobile sources of pollution have remained comparatively low. In some areas of the city however, the contribution from mobile sources has reached a very high level. The data on contribution of vehicle emissions to air pollution (Table 3.4.1) indicate that vehicle emissions in Chongqing are a serious pollution issue.

The National Environmental Air Quality Standard (GB 3095-1996) requires normal urban and rural areas to conform to the Class II limited values (see Table 3. 4.2).

The rate of exceedence of urban air quality Class II national daily standards was 46 per cent in 1999 and increased to 51 per cent in 2000. Trends in concentrations of several pollutants in the urban area

Table 3.4.1 Percentage contribution of vehicle emissions to air pollution in Chongqing

District	(%)CO	(%) NO_x
Yu Zhong District	74	61
Jiang Bei District	45	53
Nan An District	32	44
Sha Ping Ba District	38	41
Jiu Long Po District	23	36
Da Du Kou District	27	47

Source: Chongqing Environmental Protection Bureau, (…….. .)

Table 3.4.2 National Air Quality Standards – Class II

Item	SO_2	NO_x	TSP*
Annual average limit	60 ì g/m^3	50 ì g/m^3	200 ì g/m^3
Daily average limit	150 ì g/m^3	100 ì g/m^3	300 ì g/m^3

* Total suspended particulates

Table 3.4.3 SO_2 Concentrations

Year	Range of daily average (ì g/m^3)	Annual average (ì g/m^3)	Unattain-ment rate for daily average (%)	Maximum daily average expressed as multiple of standard (x standard)
1996	16-1711	321	79.5	11.4
1997	9-900	207	67.3	6.0
1998	16-576	183	53.9	3.8
1999	16-752	171	48.6	5.0
2000	1-613	156	46.4	4.1

Table 3.4.4 TSP Concentrations

Year	Range of daily average (ì g/m^3)	Annual average (ì g/m^3)	Unattainment rate for daily average (%)	Maximum daily average expressed as multiple of standard (x standard)
1996	31-838	181	11.1	2.8
1997	030-890	199	16.0	3.0
1998	37-842	234	25.6	2.8
1999	31-688	204	18.1	2.3
2000	30-814	248	31.0	2.7

Table 3.4.5 NO_x Concentrations

Year	Range of daily average (ì g/m^3)	Annual average (ì g/m^3)	Unattainment rate for daily average (%)	Maximum daily average expressed as multiple of standard (x standard)
1996	4-262	41	3.1	2.6
1997	9-239	66	17.9	2.4
1998	6-247	56	9.8	2.5
1999	9-317	62	16.3	3.2
2000	3-368	68	19.6	3.7

Source: Chongqing Environment Scientific Research Institute (2001)

are listed in Tables 3.4.3 to 3.4.5.

Historically, the dominant source of pollution in Chongqing has been from coal burning. In recent years, the government succeeded in promoting conversion from coal to natural gas as an energy source resulting in a decrease in SO_2 levels. However as of 2000, the average annual concentration of SO_2 still exceeded the standard and remained the area's major pollutant. To further reduce SO_2, at the beginning of 2000, the Chongqing government decided to replace 1,153 coal-fuelled boilers and 1,500 water boilers with cleaner fuels such as natural gas, oil, and electricity. This was completed in 2001 and the quantity of coal burnt has been reduced by about 1.36 million tons per year with SO_2 emissions reducing by about 760,000 tons per year.

The construction industry developed rapidly in Chongqing from 1997–2000 and this aggravated dust pollution in the urban area. As a result, the TSP pollution levels have remained high. Although it is likely that when construction slows down, TSP pollution will also decline.

NO_x emissions in Chongqing have increased rapidly in recent years. NO_x exceeded the national standard on 72 days in 2000, an indication that this pollutant has become more of a problem with the recent high vehicle growth rate. In the ninth five-year plan period, the daily average concentration of NO_x was 61µg/m^3; 14 per cent higher than the standard. Daily average values peaked in 2000. Compared with average level during the previous five-year plan period, the average NO_x concentration has doubled as a result of growth in the vehicle fleet.

In May 1998 and May 1999, the Environment Protection Bureau (EPB) tested air quality at a few main roads in the Chongqing urban area and the results are listed in Table 3.4.6 Comparisons reveal that NO_x and TSP concentrations are much higher near main roads than elsewhere in urban Chongqing**.** These results indicate that roadside pollutants are a significant threat to those living or working near main roads .

Table 3.4.6 Air Quality Test Results from Main Roads (mg/m^3: Pb, µg/m^3)

Pollutant	Daily concentration			
	Range		Average	
	May 1998	May 1999	May 1998	May 1999
CO	3.12 - 19.0	0.62 - 27.1	9.70	6.59
NO_x	0.03 - 3.74	0.10 - 1.94	0.67	0.54
TSP	0.29 - 2.49	0.17 - 2.08	0.86	0.97
Pb	0.13 - 1.92	0.10 - 1.86	0.99	0.83

Air Quality Monitoring

The air quality monitoring system in Chongqing is managed by the national China Environmental Monitoring Centre and Chongqing Environmental Protection Bureau. The details of the monitoring system were unobtainable for this report.

Impacts of Air Pollution

Studies on health or economic impacts of air pollution in Chongqing were unobtainable for this report.

Enforcement and Control Strategies

All air quality policies and strategies are determined by the national government and the State Environmental Protection Administration (SEPA).

China's newly revised Air Law (2000) promotes the production of clean vehicles which consume clean fuel. The Chinese government is making a great effort to develop such vehicles, important for adjusting energy structure, improving air quality in urban areas, and developing China's sustainable auto industry. Liquefied petroleum gas (LPG) and compressed natural gas (CNG) vehicles have been developed in many cities and by the end of 2000, there were more than 80,000 gas vehicles and 228 gas stations to serve them. Both hybrid electric and fuel cell technology vehicles have been encouraged and are developing quickly.

Ethanol is also being promoted as a fuel source in China, a major agricultural country with an overproduction of grain in some areas. To make use of this overproduction and increase farmers' incomes, ethanol production from grain will be promoted. As an alternative fuel, ethanol will be added to gasoline in small quantities (5–15 per cent) to help save fuel oil resources and reduce CO and hydrocarbon (HC) vehicle emissions. Related feasibility research on ethanol gasoline application and demonstration programmes is underway. During its tenth five-year plan, the Chinese government will continue to support the Clean Vehicle Action Program to promote the sustainable development of China's auto industry.

China has also introduced emission standards for the three different categories of in-use vehicles (gas vehicles, diesel vehicles, and motorcycles) and these are shown in Tables 3.4.7 to 3.4.9 below.

Table 3.4.7 Emission Standards for In-Use Gasoline Vehicles*

Gasoline Vehicles			
In-use heavy duty vehicles made before 95.7.1	5.0	2000	9000
In-use light duty vehicles made after 95.7.1	4.5	900	7500
In-use heavy duty vehicles made after 95.7.1	4.5	1200	8000

*Date of effect: 94.5.1
Note: Light Duty Vehicles: d”3500kg; Heavy Duty Vehicle: >3500 kg

Table 3.4.8 Emission Standards for In-Use Diesel Vehicles*

Diesel Vehicles	
	Standard Limit
	Smoke (FSN)
In-use vehicles made before 95.7.1	5.0
In-use vehicles made after 95.7.1	4.5

*Date of effect: 94.5.1

Table 3.4.9 Emission Standards for In-Use Motorcycles

Motorcycles			
Vehicle Type	Standard Limit		
	Idle Speed		
	CO (%)	HC (ppm)	
		4-stroke	2-stroke
In-use motorcycles made before 96.1.1	5.0	2500	9000
In-use motorcycles made after 96.1.1	4.5	2200	8000

*Date of effect: 94.5.1

Conclusions

In Chongqing city as a whole, the industrial sector constitutes the dominant source of air pollutants (especially SO_2) although in some areas, mobile sources are becoming increasingly problematic (particularly for CO and NO_x emissions). Conversion from coal to natural gas has resulted in decreased SO_2 levels over recent years although in 2000 the average annual concentration of SO_2 still exceeded the standard and remained the area's major pollutant. Further reductions in SO_2 emissions were achieved in 2001 after the Chongqing government decided to replace coal-fuelled boilers with others fuelled by cleaner fuels.

Exceedance of urban air quality daily standards increased from 46 per cent in 1999 to 51 per cent in 2000. This was mainly as a result of increases in TSP and NO_x emissions from vehicles although rapid development in the construction industry from 1997–2000 has also aggravated dust pollution in the city. Average NO_x concentrations during 1996–2000 were double those in the previous five-year period due to growth in the vehicle fleet. It remains to be seen whether improvements stemming from the Chinese government's Clean Vehicle Action Program and legislation on higher emission standards for vehicles can keep pace with the increasing vehicle numbers.