AIR QUALITY IN HONG KONG

1997

Air Services Group
Environmental Protection Department
The Government of the Hong Kong
Special Administrative Region

Air Quality in Hong Kong
1997

Report Number	:	EPD/TR1/98
Report Prepared by	:	Alick Chang
Work Done by	:	Air Services Group
Approved by	:	PANG Sik-wing
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Summary

In 1997, ambient concentrations of nitrogen dioxide, total suspended particulates and respirable suspended particulates remained the greatest air pollution concern in Hong Kong although a slight decrease in particulates concentration was observed. The increasing ozone trend and frequent violations of the hourly ozone limit at new monitoring sites suggest that photochemical oxidation may become more and more active in Hong Kong. In contrast, sulphur dioxide levels were all well below the limits and further reduction is expected in the next few years. Lead and carbon monoxide levels also remained low.

Preliminary analysis of the monitoring results of 1,3-butadiene and formaldehyde in 1997 indicates that vehicle emission may be a major source of toxic air pollutants in Hong Kong. The ambient levels of benzene and perchloroethylene were also relatively high implying that petrol filling stations and dry cleaning facilities may also be important stationary sources of toxic air pollutants. However, more data are required to determine the health significance of these toxic air pollutants in Hong Kong.

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1. Introduction

The Environmental Protection Department (EPD) operated in 1997 a network of nine air quality monitoring stations for measuring major air pollutants. It aims to understand the air pollution problems of Hong Kong, assess how far the air quality objectives are being achieved and provide public information on the current and forecast air quality.

Additional monitoring facilities specifically designed to collect Toxic Air Pollutants (TAPs) samples were added to the Tsuen Wan and Central/Western monitoring stations in July 1997. The main objective is to measure the current ambient levels of potentially important TAPs in Hong Kong.

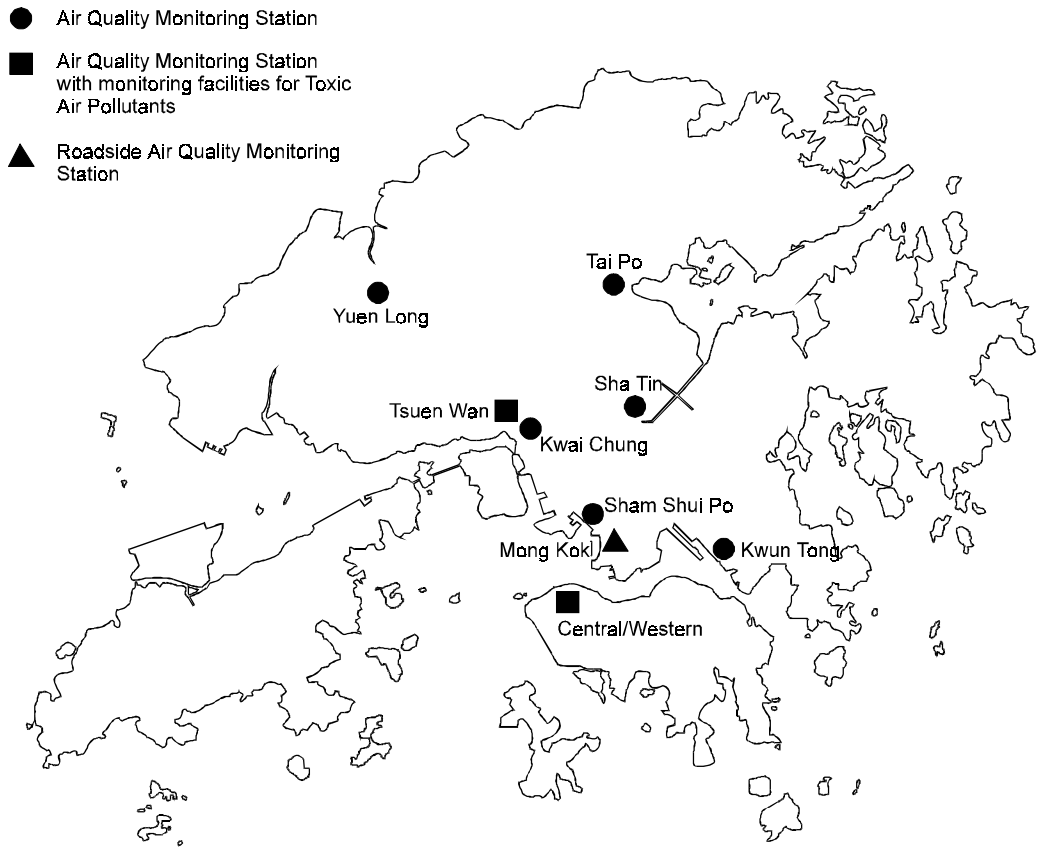


FIGURE 1 LOCATION OF EPD's AIR QUALITY MONITORING STATIONS

Other than EPD's monitoring network, The Hongkong Electric Co. Ltd. (HEC) and China Light & Power Co. Ltd. (CLP) also operated a number of monitoring stations in 1997 to assess the ambient levels of sulphur dioxide and nitrogen dioxide in the vicinity of their power generating stations. The locations of these monitoring stations are shown in Figure A1 of Appendix A.

2. Air Quality Objectives and their Compliance Status

The Hong Kong Air Quality Objectives (HKAQO) are established to protect public health. Violations of some of these objectives in 1997 were seen at some EPD monitoring stations. Similar to previous years, particulate pollution remains the greatest concern among all major air pollutants. Six out of the nine EPD monitoring stations recorded annual averages of both total and respirable suspended particulates higher than the respective Air Quality Objectives.

Table 1 Hong Kong Air Quality Objectives

Concentration in micrograms per cubic metre [1]

	Averaging Time				
Pollutant	**1 hr** [2]	**8 hr** [3]	**24 hr** [3]	**3 mon** [4]	**1 yr** [4]
Sulphur dioxide	800		350		80
Total suspended particulates			260		80
Respirable suspended particulates [5]			180		55
Nitrogen dioxide	300		150		80
Carbon monoxide	30000	10000			
Photochemical oxidants (as Ozone [6])	240				
Lead				1.5	

[1] Measured at 298K (25°C) and 101.325 kPa (one atmosphere).
[2] Not to be exceeded more than three times per year.
[3] Not to be exceeded more than once per year.
[4] Arithmetic means.
[5] Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 micrometres or smaller.
[6] Photochemical oxidants are determined by measurement of ozone only.

Table 2 Air Quality Objectives Compliance Status for 1997

Station	Ozone	Nitrogen Dioxide			Total Suspended Particulates		Respirable Suspended Particulates	
	1-hour	1-hour	24-hour	1-year	24-hour	1-year	24-hour	1-year
Kwun Tong	√	√	X	√	√	X	√	X
Sha Tin	√	√	√	√	√	√	√	√
Tai Po	√	√	√	√	√	√	√	√
Yuen Long	√	√	√	√	√	X	√	X
Sham Shui Po	--	√	X	√	√	X	√	X
Central/Western	√	√	√	√	√	X	√	X
Tsuen Wan	--	√	√	√	√	X	√	X
Kwai Chung	√	√	√	√	√	√	√	√
Mong Kok	--	X	X	X	√	X	√	X

Notes: "X" *violated the AQO* "--" *not measured*
"√" *complied with the AQO*
Sulphur dioxide, carbon monoxide and ozone all complied with the HKAQO

Nitrogen dioxide was the only gaseous air pollutant with measured concentrations violating the HKAQO in 1997. The 24-hour AQO for nitrogen dioxide was violated at both Kwun Tong and Sham Shui Po sites. As for the Mong Kok site, non-compliance of all three AQO established for nitrogen dioxide, viz. 1-hour, 24-hour and 1-year had been observed.

In 1997, no exceedance of the relevant AQO for sulphur dioxide and nitrogen dioxide had been recorded at any of the HEC and CLP air quality monitoring stations.

3. Gaseous Pollutants

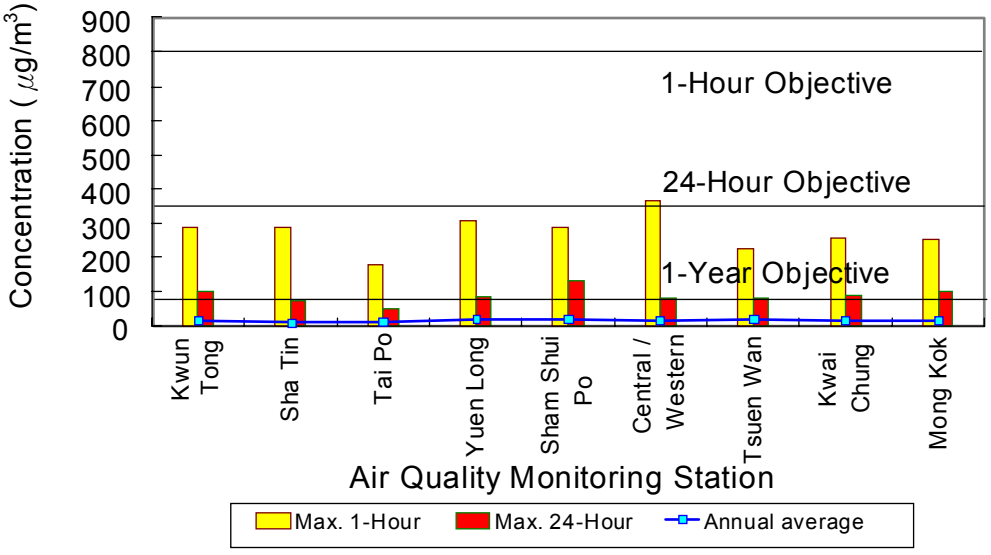
3.1 Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) is formed primarily from combustion of fossil fuels containing sulphur. Diesel vehicles and industrial emissions are the more important sources in urban areas because of their proximity to the receptors.

Exposure to high levels of SO_2 may cause impairment of respiratory function and aggravate existing respiratory and cardiac illnesses. Prolonged exposure at lower levels may also increase the risk of developing chronic respiratory disease.

Due to the past control efforts, the SO_2 concentrations in 1997 were maintaining at very low levels and none of the monitoring stations recorded violation of any relevant HKAQO. Even for the Mong Kok station, which has the closest proximity to the sources, the highest readings for all different averaging time were less than half of the respective permissible limits.

Figure 2: Sulphur Dioxide Monitoring 1997



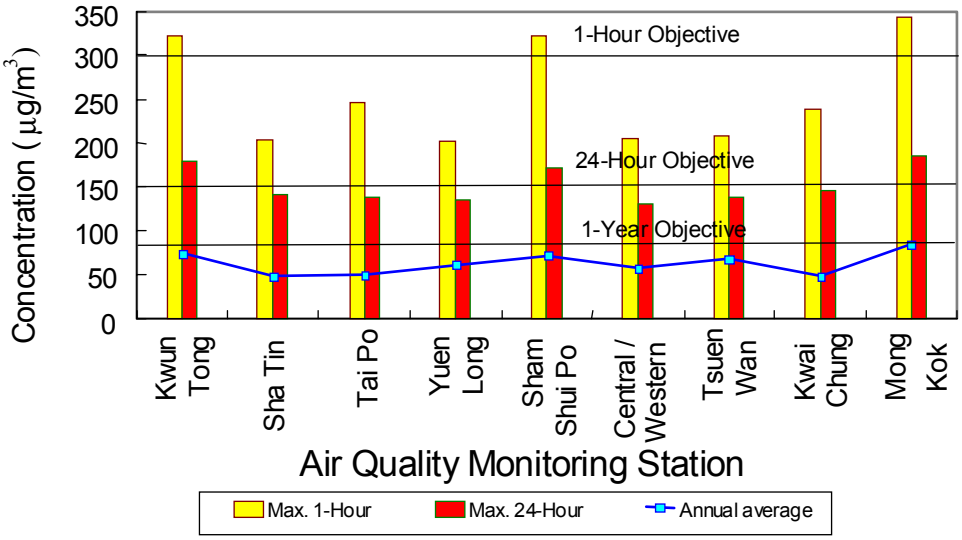
3.2 Nitrogen Dioxide (NO_2)

Nitrogen dioxide (NO_2) is formed by oxidation of nitric oxide emitted from fuel combustion from vehicles, power plants, incineration and aircraft. In urban areas, vehicles, especially diesel vehicles, are the most important sources due to the proximity to the receptors. NO_2 can aggravate the acute and chronic respiratory diseases.

The NO_2 concentrations were fairly high in Hong Kong. The accumulation and photochemical oxidation of the emissions from vehicles under calm wind conditions led to violation of the 24-hour AQO for NO_2 at the Kwun Tong, Sham Shui Po and Mong Kok stations in 1997. Violation of the 1-hour and 1-year AQO was also observed at the Mong Kok station.

The maximum 24-hour concentration for NO_2 recorded at the Mong Kok station was about 24% above the permissible limit. It amounts to an increase of 9% when compared with last year's maximum value, which was also recorded at the Mong Kok station. The annual average concentrations for all nine monitoring stations in 1997, with values ranging from 61 to 106% of the HKAQO, were slightly higher than their corresponding values in 1996. The percentage increase ranges from 9% at the Sha Tin site to 19% at the Central/Western site.

Figure 3: Nitrogen Dioxide Monitoring 1997



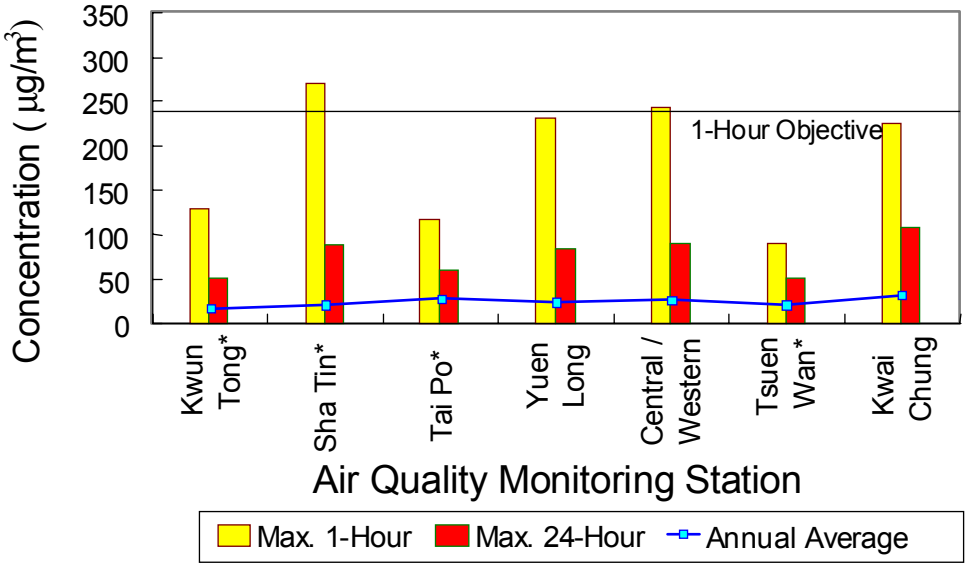
3.3 Ozone (O_3)

Ozone (O_3) is formed by a series of complicated photochemical reactions of oxygen, nitrogen oxides and reactive hydrocarbons in the presence of sunlight. It is used to represent the photochemical oxidants which can irritate eye, nose and throat and increase susceptibility to respiratory infections at elevated levels.

In 1997, ambient level of ozone was measured at seven monitoring stations. The Kwun Tong and Sha Tin stations started measuring ozone in June 1997 while the Tai Po and Tsuen Wan stations started in November 1997. In general, the annual averages of ozone at the Yuen Long, Central/Western and Kwai Chung stations in 1997 were comparable to their 1996 values.

Although all monitoring stations complied with the hourly AQO for ozone, the maximum concentrations had reached the AQO limit. Similar to previous cases of ozone pollution, all these incidences of high ozone level could be directly related to photochemical reactions triggered by bright sunlight under calm wind conditions.

Figure 4: Ozone Monitoring 1997



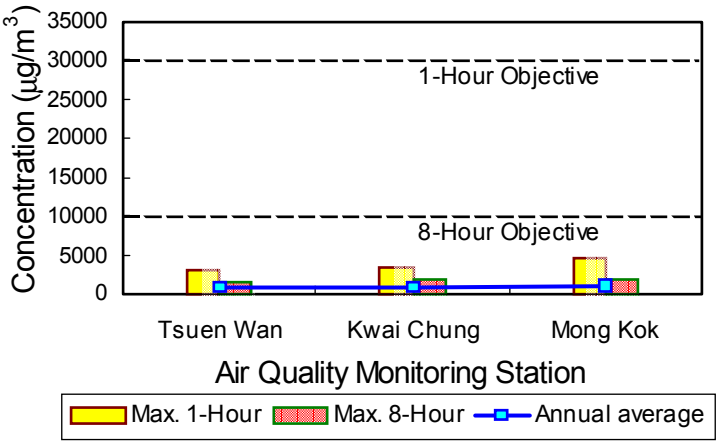
* Minimum annual data requirement not satisfied.

3.4 Carbon Monoxide (CO)

Carbon monoxide (CO) comes mainly from vehicular emissions although small amount of which may also be arisen from incomplete combustion of fuels from factories and power stations. It can reduce oxygen delivery to the body's organs and tissues when it enters the bloodstream. The health threat from CO is more important for those who suffer from heart disease.

In 1997, both the ambient and roadside concentrations of CO remained at low levels. Even the maximum 1-hour concentration, recorded at the Mong Kok site, was less than one fifth of the permissible value.

Figure 5: Carbon Monoxide Monitoring 1997



4. Particles

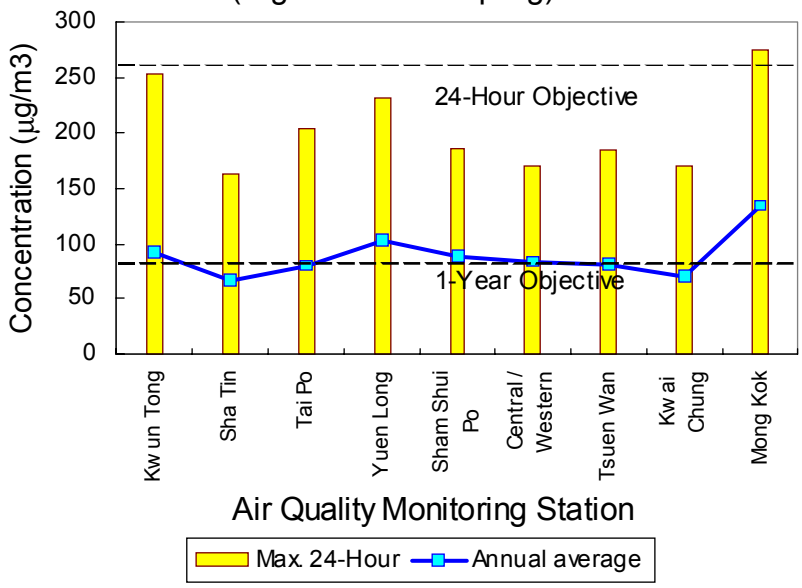
4.1 Total Suspended Particulates (TSP)

Total suspended particulates (TSP) are small airborne particles such as dust, fume and smoke with diameters less than 100 micrometres. They are emitted from various sources including power stations, construction activities, incineration and vehicles.

The fine portion, which are known as the respirable suspended particulates below, are of greater health concern. The coarse particles are mainly related to soiling and dust nuisance.

Levels of TSP in 1997 remained high throughout the territory although a slight decrease in the overall concentration was noted when compared with the figures of 1996. Six out of the nine monitoring stations recorded violation of the annual AQO. The highest annual level at the street site of Mong Kok was almost 68% above the limit. Due to closer proximity to emissions from vehicles and surrounding construction activities, it also recorded one violation of the 24-hour AQO limit. Same as previous years, Sha Tin recorded the lowest annual level of TSP which was about 83% of the permissible limit.

Figure 6: TSP Monitoring 1997
(High volume sampling)

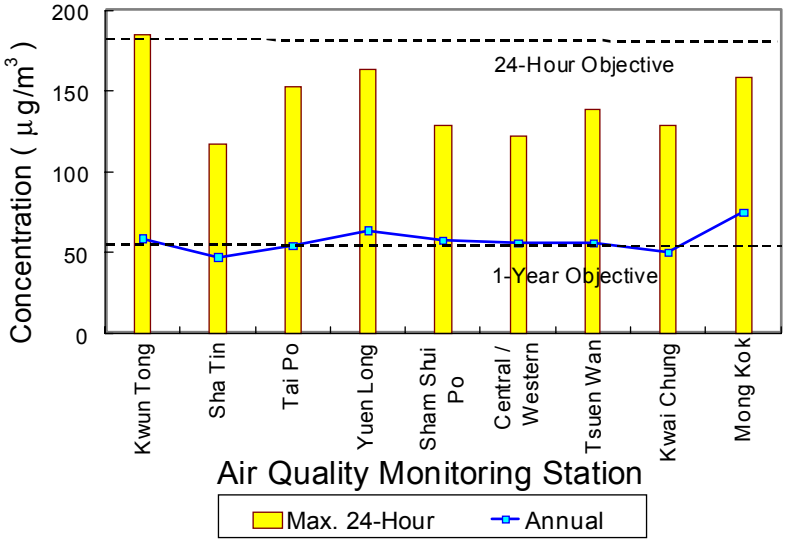


4.2 Respirable Suspended Particulates (RSP)

Respirable suspended particulates (RSP) are airborne particles with diameters of 10 micrometres or less. Apart from combustion sources, in particular diesel vehicles, atmospheric oxidation of sulphur dioxide and nitrogen oxides and to a less extent, the crustal dust and marine aerosols are also significant sources of RSP.

RSP at high level may cause chronic and acute effects on human health, particularly the pulmonary function, as they can penetrate deep into the lungs and cause respiratory problems.

Figure 7: RSP Monitoring 1997
(High volume sampling)



These effects are enhanced if high RSP levels are associated with higher levels of other pollutants, such as SO_2. Smaller particles in RSP will also have a major impact on visibility.

The annual RSP levels were high in 1997. Six sites, viz., Kwun Tong, Yuen Long, Sham Shui Po, Central/Western, Tsuen Wan and Mong Kok, violated the annual AQO for RSP. The highest annual level at the street site of Mong Kok was almost 36% above the permissible limit. Diesel vehicle emissions were the major cause of the high RSP concentrations. As in the case of TSP, Sha Tin recorded the lowest annual level of about 85% of the permissible limit.

4.3 Lead

Among various TAPs, lead is the one with the AQO established in Hong Kong. It comes mainly from combustion of leaded petrol. Due to the reduction of lead in petrol programme, the ambient lead concentrations remained very low in 1997 and well within the relevant limit of 1.5 µg/m3.

5. Toxic Air Pollutants

Starting July 1997, two groups of toxic air pollutants, viz. heavy metals and organic substances, are monitored at the Central/Western and Tsuen Wan stations. In general, the level of toxic air pollutants in Hong Kong is lower than or comparable to those observed in other urban areas.

Preliminary analysis of the monitoring results of 1,3-butadiene and formaldehyde in 1997 indicates that vehicle emission may be a major source of toxic air pollutants in Hong Kong. The ambient levels of benzene and perchloroethylene were also relatively high implying that petrol filling stations and dry cleaning facilities may also be important stationary sources of toxic air pollutants.

The measured ambient concentrations of hexavalent chromium remained at a low level in 1997, possibly due to a recent decline in the number of electroplating factories in Hong Kong. Ambient levels of TAPs such as cadmium, nickel, dioxins and furans were relatively low in 1997. These TAPs were typically emitted from power plants and incinerators which were all under licensing control of the Specified Processes regulations.

Table 3 Levels of Toxic Air Pollutants for 1997

Toxic Air Pollutants	Possible Sources	Unit for Concen-tration	Average Concentration (July-December 1997) [1]		Levels Observed in Other Urban Areas [2]
			Tsuen Wan	Central/ Western	
Heavy Metals [3]					
Cadmium	Electricity works	ng/m^3	1.21	1.63	0.1-10
Hexavalent chromium	Electroplating and paint manufacturing facilities	ng/m^3	0.34	0.59	5-10
Lead	Combustion of leaded petrol	ng/m^3	59	60	50-500
Nickel	Electricity works	ng/m^3	5.5	5.4	1-10
Organic Substances					
Benzene	Vehicle exhaust and fugitive emission from petrol filling stations	μg/m^3	2.9	2.4	5-20
Benzo [a] pyrene	Tar and bitumen works, incomplete combustion	ng/m^3	0.35	0.21	1-10
1,3-Butadiene	Incomplete combustion of petrol and diesel fuels	μg/m^3	0.52	0.53	<2-22
Formaldehyde	Vehicle exhaust	μg/m^3	18.4	21.0	1-20
Perchloroethylene	Dry cleaning facilities	μg/m^3	0.8	1.5	<5
2,3,7,8-Tetrachloro - dibenzodioxin	Incinerators	pg/m^3	0.022	0.024	0.1
2,3,7,8-Tetrachloro - dibenzofuran	Incinerators	pg/m^3	0.038	0.044	

[1] For TAP concentrations that are lower than the method detection limit (MDL), one half of the MDL is used in calculating the average concentration.

[2] World Health Organisation, Updating and Revision of the Air Quality Guidelines for Europe, Copenhagen Denmark, 1994 and 1995.

[3] For lead, nickel and cadmium, the reported figures are the respective 1997 annual average concentrations in the elemental analysis of total suspended particulates.

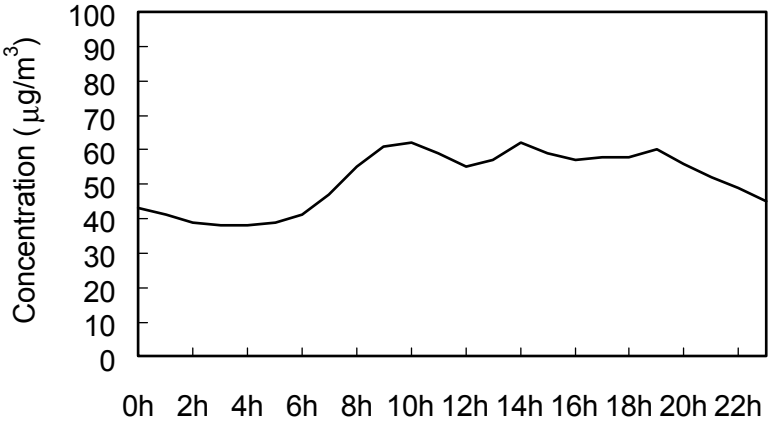
6. Variation of Air Pollution Levels Over Time

The air pollutant concentration in the atmosphere can change over a day, over the months of a year and in the period of several years.

6.1 Over a Day

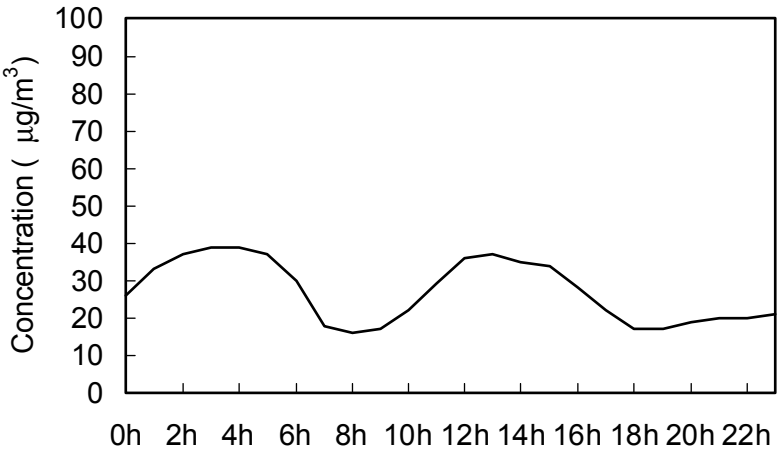
The daily change of the concentrations of most air pollutants, other than ozone and those formed by atmospheric chemical reactions of other air pollutants, follows closely to the pattern of human activities. Higher concentration is observed in the morning and in the late afternoon when more traffic and other activities occur. The lowest concentration occurs at night hours when human activities are usually at their lowest.

Figure 8: Typical hourly variations of RSP 1997 (Central/Western)



The average daily variation of ozone concentrations in 1997 was of a slightly different daily pattern. As ozone is produced from reaction of the emissions from vehicles in the presence of

Figure 9: Typical hourly variations of Ozone 1997 (Central/Western)

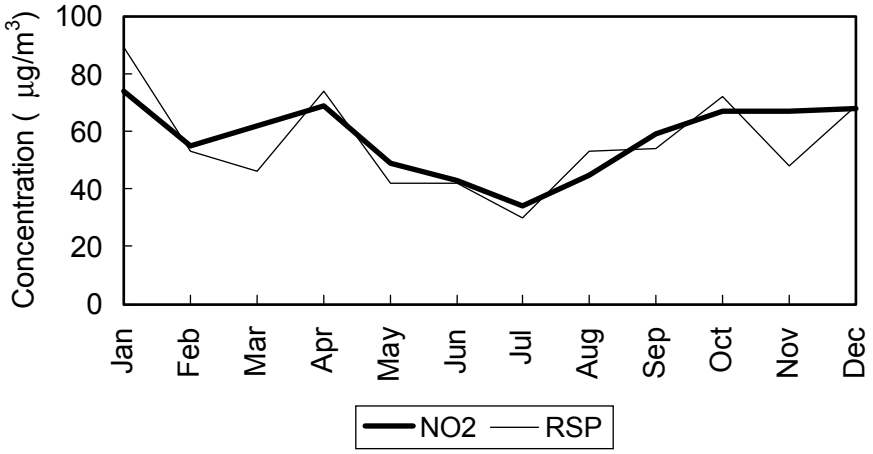


sunlight, the levels build up in the afternoon when the solar radiation levels are the highest. Minimum concentrations were observed at rush hours when nitric oxide emissions from vehicles were destroying ozone.

6.2 Over a Year

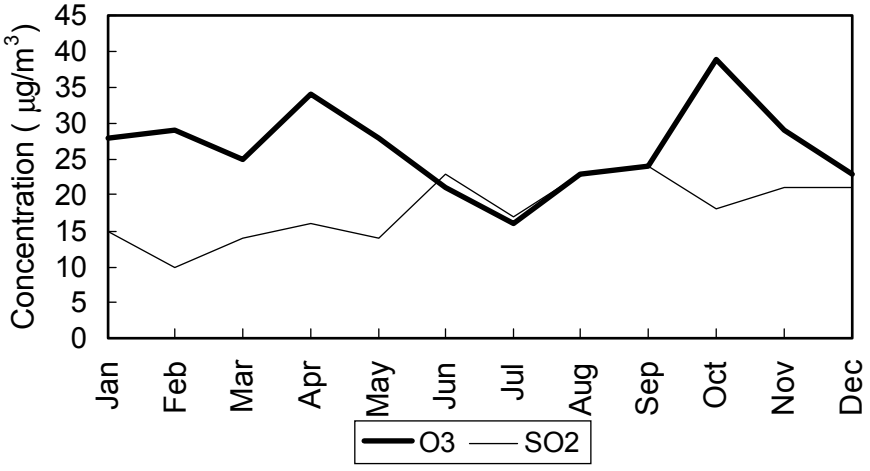
Because of the washout effects of rainfall and/or better dispersion of pollutant, the air pollution levels were substantially lower in the summer months. Higher concentrations were, in general, observed in winter as the weather conditions that trapped the pollutants close to their sources and hindered pollutant dispersion occurred during this period.

Figure 10: Monthly variations of NO_2 and RSP 1997 (Central/Western)



The patterns for sulphur dioxide and ozone vary slightly from others. The former did not show significant variation throughout the year since the higher emissions in the summer months as a result of higher electricity demand during these months might offset the decreases by washout and dispersion effects mentioned above. For ozone, higher average concentrations occurred in April, May, October and November as these months would have more clear and sunny days to provide suitable conditions for photochemical formation of ozone from vehicle emissions.

Figure 11: Monthly variations of SO_2 and O_3 1997 (Central/Western)

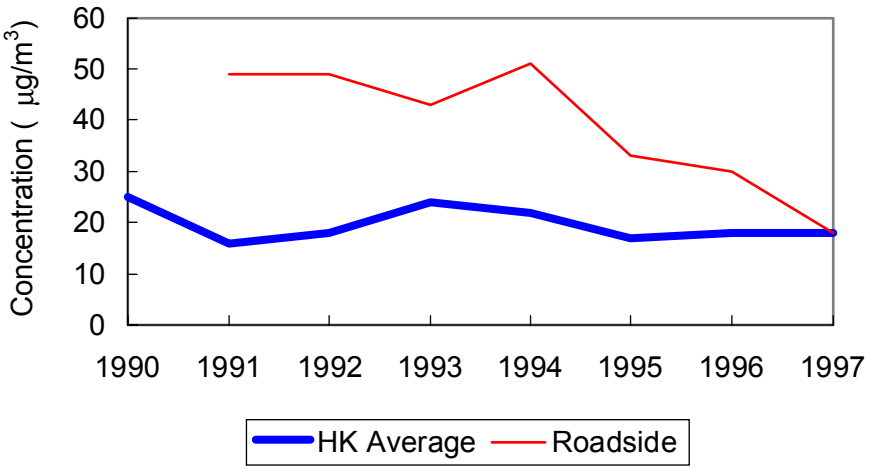


6.3 Long Term Trends

6.3.1 Sulphur Dioxide (SO_2)

Since the enforcement of the Air Pollution Control (Fuel Restriction) Regulations for stationary sources and the more recent Air Pollution Control (Motor Vehicle Fuel) Regulation for mobile sources, the SO_2 concentration has reduced and maintained at low levels far below the statutory limit of 80 µg/m^3. For example, at roadside monitoring site, the 1996 and 1997 annual averages were about 40-64% lower than that before enforcement of the latter regulation. In fact, the roadside level at 1997 was very close to the average Hong Kong level indicating that contribution of SO_2 from vehicle emissions has become less important. With the further tightening on the sulphur content of diesel fuel for mobile vehicles, the SO_2 pollution should become less significant in the future.

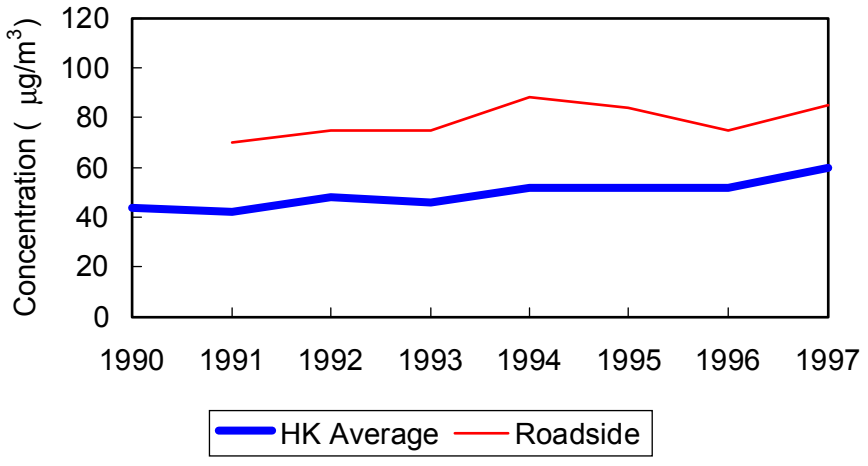
Figure 12: SO_2 long term trend (HK average and Roadside)



6.3.2 Nitrogen Dioxide (NO_2)

The average overall and roadside concentrations of NO_2 have been increased by about 44% and 21%, respectively, when comparing with the respective levels of 1991. These were likely caused by the increases of traffic volume of diesel vehicles. Due to closer proximity to the sources, the levels at roadsides have reached the permissible limits of 80 µg/m^3 in recent years.

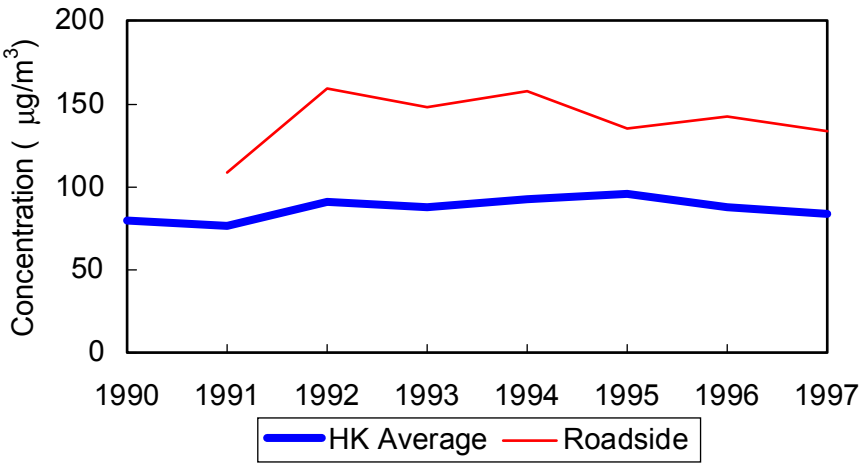
Figure 13: NO_2 long term trend (HK average and Roadside)



6.3.3 Total Suspended Particulates (TSP)

The ambient level of TSP has been high and at roughly similar concentrations since 1992. Apparently the TSP levels are dropping in recent years. However, the 1997 annual average concentration of the Mong Kok roadside station was still 68% above the permissible limit of 80 $\mu g/m^3$ due to the close proximity to the emission sources.

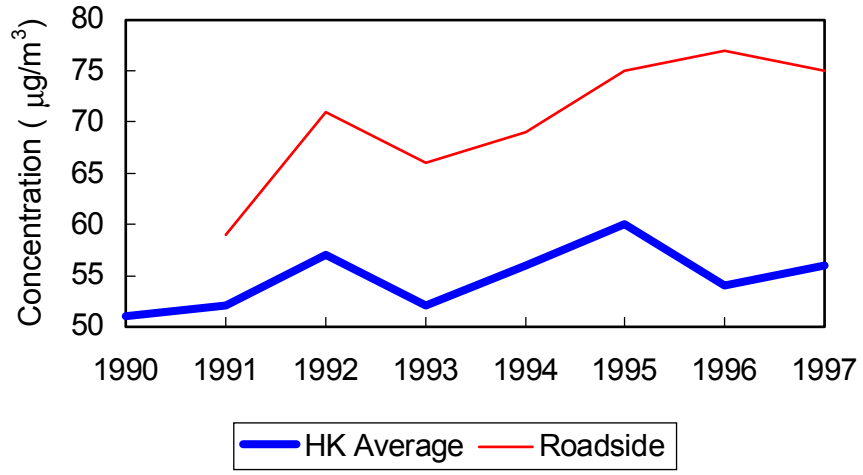
Figure 14: TSP long term trend (HK average and Roadside)



6.3.4 Respirable Suspended Particulates (RSP)

Both the overall and roadside RSP concentrations exhibit similar long term increasing trend, though on a different scale. When compared with the concentrations in 1991, the ambient RSP concentration in 1997 is only 7% higher while the roadside RSP concentration shows a significant increase of 27%. This clearly indicates that the contributions from vehicle emissions, especially those from diesel vehicles, are becoming more important.

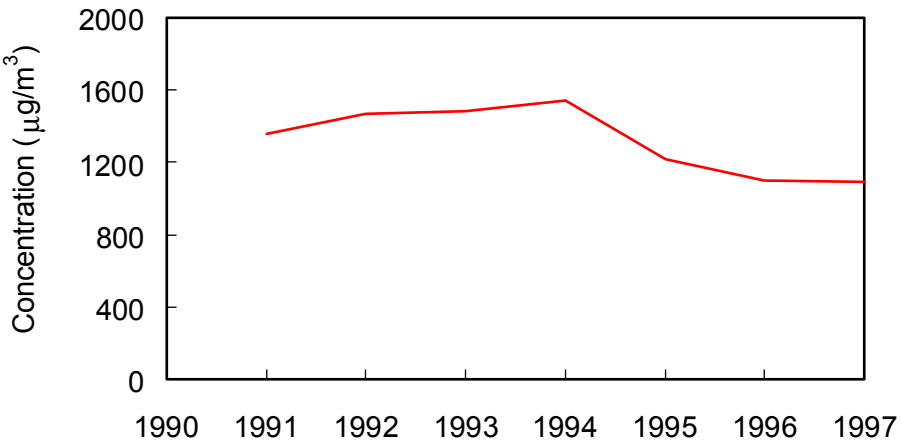
Figure 15: RSP long term trend (HK average and Roadside)



6.3.5 Carbon Monoxide (CO)

The concentrations of CO remained low in the last few years. It could be due to the increase in the number of vehicles fitted with catalytic converters. Even at the roadside close to the vehicular emission sources, the levels were well within the AQOs.

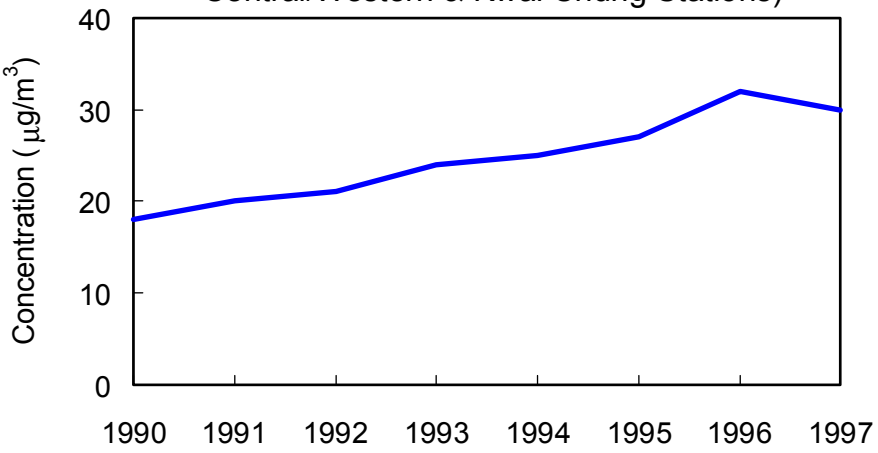
Figure 16: CO long term trend (Roadside)



6.3.6 Ozone (O_3)

The ozone formed by photochemical oxidation has shown a more definite increasing trend than other air pollutants. The mean annual averages of ozone concentrations measured at the Central/Western and Kwai Chung stations from 1990 to 1997 has shown a clear increasing trend. The 1997 mean annual average ozone level was about 67% higher than its corresponding value in 1990.

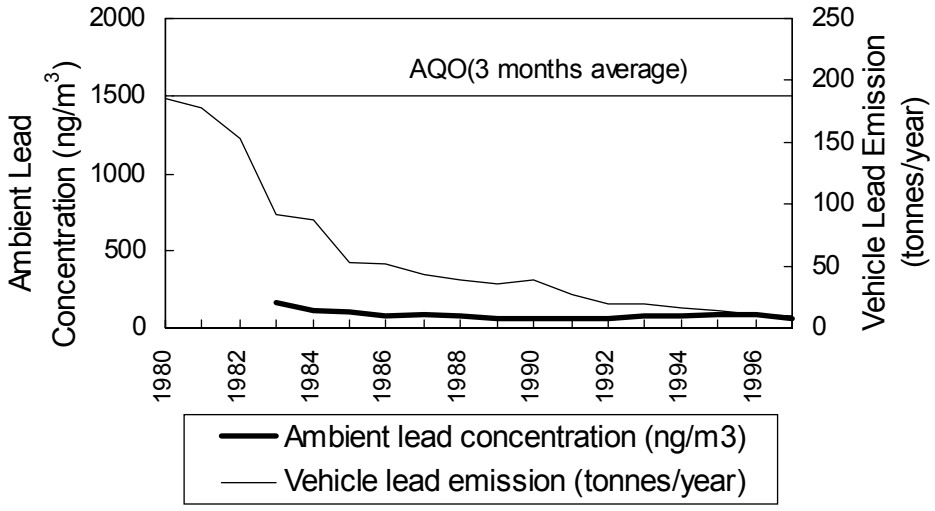
Figure 17: O_3 long term trend (Average of Central/Western & Kwai Chung Stations)



6.3.7 Airborne Lead

The lead content in petrol was reduced by almost 90% in the eighties after the oil companies had taken voluntary action. The ambient lead concentration was already at a rather low level when unleaded petrol was used from April 1992. The lead in the atmosphere has been maintained at very low level since the eighties.

Figure 18. Vehicle lead emission and ambient lead concentration



Appendix A

Monitoring Results of Sulphur Dioxide and Nitrogen Dioxide by HEC and CLP

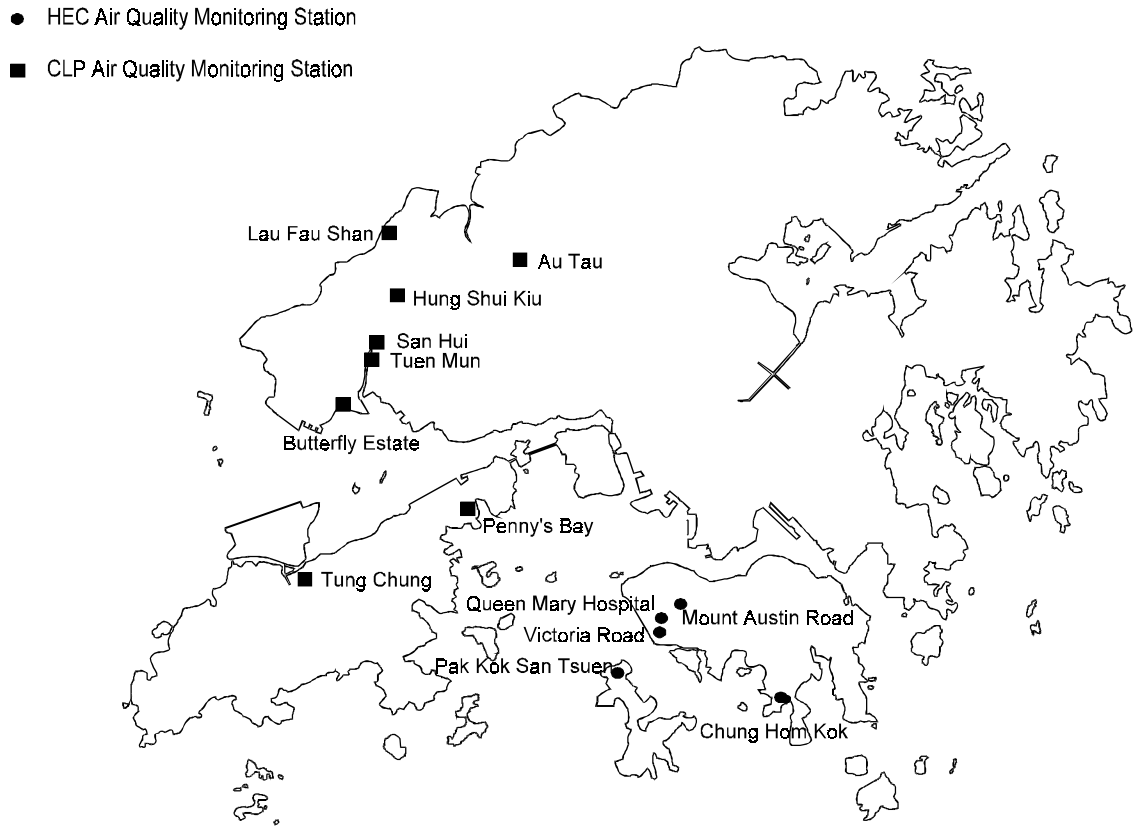


Figure A1 LOCATION OF HEC & CLP AIR QUALITY MONITORING STATIONS FOR SULPHUR DIOXIDE AND NITROGEN DIOXIDE

A.1 The Hongkong Electric Co. Ltd.

Air Quality Monitoring Stations	Annual Mean Concentration[1]	Range of Monthly Mean Concentration
Sulphur Dioxide (SO_2)		
Mount Austin Road	11.2	5 - 17
Chung Hom Kok	6.2	2 - 10
Victoria Road	8.0	2 - 12
Queen Mary Hospital[2]	14.0	7 - 22
Pak Kok San Tsuen	7.6	3 - 12
Nitrogen Dioxide (NO_2)		
Mount Austin Road	22.8	7 - 44
Victoria Road	29.6	17 - 54
Queen Mary Hospital[3]	36.8	28 - 47
Pak Kok San Tsuen	23.8	10 - 37

A.2 China Light & Power Co. Ltd.

Air Quality Monitoring Station	Annual Mean Concentration	Range of Monthly Mean Concentration
Sulphur Dioxide (SO_2)		
San Hui	30.1	17 - 53
Tuen Mun	20.1	9 - 32
Hung Shui Kiu	35.3	27 - 47
Au Tau	55.6	33 - 89
Butterfly Estate	17.1	7 - 27
Penny's Bay	3.5	2 - 8
Lau Fau Shan	16.3	3 - 32
Tung Chung	8.3	1 - 20
Nitrogen Dioxide (NO_2)		
Tuen Mun	52.8	31 - 78
Butterfly Estate	42.9	25 - 58
Penny's Bay	36.3	20 - 56
Lau Fau Shan	38.0	20 - 59
Tung Chung	29.3	12 - 50

[1] All pollutant units are in micrograms per cubic metre on hourly average.

[2] Only 3 months data (January, February and December) are available for calculating the Annual Mean Concentration of SO_2.

[3] Only 4 months data (January, February, November and December) are available for calculating the Annual Mean Concentration of NO_2.

Appendix B

AIR QUALITY MONITORING OPERATION

B.1 Network Operation

The air quality network of nine monitoring stations is operated by the Air Services Laboratory (ASL) of the Environmental Protection Department. The ASL has been accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS) since August 1995 for the measurement of ambient concentrations of total suspended particulates (TSP), respirable suspended particulates (RSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3) and carbon monoxide (CO).

In order to provide good representation of the air quality in areas of high population density, the locations of the nine monitoring stations were carefully chosen by referencing to the United States Environmental Protection Agency's (USEPA) guidelines with practical consideration of the unique congested high-rise development of Hong Kong (see Table B1).

The details for the parameters monitored at each monitoring station and a list of equipment employed for measuring the air pollutants are summarised in Tables B2 and B3 respectively. In general, the concentration of gaseous pollutants and RSP are determined continuously by automatic analysers. Manually operated high volume samplers using the gravimetric methods are also used regularly to measure the TSP and RSP. In addition, meteorological parameters, including temperature and solar radiation, wind speed and direction, are also recorded continuously at each station as appropriate.

Wet and dry deposition samples are collected at 2 stations: Central/Western and Kwun Tong. The parameters measured for all wet and dry samples include: Si, Al, Ca, Fe, Mg, V, Mn, Cu and Ba in the residue; and pH, Na^+, K^+, NH_4^+, NO_3^-, SO_4^{2-}, Cl^-, Ca^{2+}, Mg^{2+}, formate and acetate.

B.2 Data Processing and Dissemination

At each monitoring station, signals from the continuous analysers and the meteorological instruments are sent to a data logger and then to a computer at the ASL's Air Quality Laboratory via telephone lines. After checking and validation, the measurements are made available for use and the monitoring data are disseminated to the public in the following manner:-

Monthly release of the monitoring data of three stations: Mong Kok, Kwai Chung and Central/Western;

Daily reporting of the Air Pollution Index (API) and Forecast of three categories of land-use areas, viz., urban (i.e., Central and Western and Sham Shui Po), industrial (i.e., Kwun Tong, Kwai Chung and Tsuen Wan) and new development (i.e., Sha Tin, Tai Po and Yuen Long) since June 1995. The announcement of API will enable everyone, particularly susceptible groups, such as people with heart or respiratory illness, to consider taking precautionary measures when necessary.

Reporting in the Air Quality in Hong Kong series and annual Environment Hong Kong;

Ad hoc provision of air quality data to the public, academics for research, and consultants for air quality assessment upon request.

The monitoring results are also regularly used to assist the formulation of the air quality management plan and evaluation on the effectiveness of the current air pollution control programmes.

B.3 Quality Control and Assurance

A quality policy is adopted to ensure that ambient air quality monitoring results from the monitoring stations attain a high degree of accuracy and precision. A quality system has been established in accordance with the HOKLAS criteria.

The accuracy of the monitoring network is assessed by performance audits. Similar to overseas standards, warning limits of ±7% and control limits of ±10% are adopted. In 1997, 171 audit checks were carried out on the stations' analyzers and samplers. As shown in Figure B1 and based on the 95% probability limits, the accuracy of the network varied between –6.6% and 8.8%, which was within the control limit of ±10%.

The precision, a measure of the repeatability, of the measurements is checked in accordance with USEPA requirements. In 1997, 655 precision checks were carried out on the analyzers and samplers. As shown in Figure B2 and based on the 95% probability limits, the precision of the network varied between –4.0% and 7.1%, which was again within the target of ±10%.

In addition to the above operations, a system audit to review the quality assurance activities is carried out on an annual basis on the monitoring network. A report outlining the deficiencies and corrective actions is compiled at the end of the audit.

B.4 Toxic Air Pollutants Monitoring Operation

The Air Services Group has installed in July 1997 additional monitoring facilities at the Tsuen Wan and Central/Western stations to measure regularly the levels of Toxic Air Pollutants (TAPs) in Hong Kong. The TAPs being monitored can be broadly classified as volatile organic compounds (e.g. benzene, perchloroethylene and 1,3-butadiene), dioxins and furans (e.g. 2,3,7,8-TCDF and 2,3,7,8-TCDD), carbonyl compounds (e.g. formaldehyde), polycyclic aromatic hydrocarbons (e.g. benzo(a)pyrene), and hexavalent chromium. Five distinct methods were used to analyse the collected samples for target TAPs (please refer to Table B4 for details). All these methods have stringent QA/QC criteria to ensure the data quality. Sampling media used include stainless steel canisters, Sep-Pak cartridges, polyurethane foams and bicarbonate impregnated filters. TAP samples were collected by the Woodward-Clyde Inc. on a 1-year contract and were sent to the Xenon Laboratory in Canada for analysis.

Table B1. Fixed Network Monitoring Stations: Site Information

Monitoring Station	Abbr.	Address	Area Type	Sampling Height (Above P.D.H.K.)	Above Ground	Date Start Operation
Kwun Tong (City District Office)	KT	6 Tung Yan Street, Kwun Tong	Industrial : Mixed Industrial/Residential	34m	25m (6 floors)	Jul 83
Central/Western (Upper Level Police Station)	C/W	1 High Street, Sai Ying Pun	Urban : Residential	78m	18m (4 floors)	Nov 83
Sham Shui Po (Police Station)	SSP	37A Yen Chow St., Sham Shui Po	Urban : Mixed Commercial/ Residential/Industrial	21m	17m (4 floors)	Jul 84
Kwai Chung (Chen Zao Man College)	KC	1-5 Kwai Hop St., Kwai Hing	Industrial : Mixed Industrial/Residential	82m	25m (6 floors)	Jul 88
Tsuen Wan (Princess Alexandra Community Centre)	TW	60 Tai Ho Rd., Tsuen Wan	Industrial : Mixed Commercial/Residential	21m	17m (4 floors)	Aug 88
Tai Po (Tai Po Govt. Office Bldg.)	TP	1 Ting Kok Rd., Tai Po	New Development : Residential	31m	25m (6 floors)	Feb 90
Sha Tin (Sha Tin Govt. Secondary School)	ST	11-17 Man Lai Rd., Tai Wai, Sha Tin	New Development : Mixed Residential/Industrial	27m	21m (5 floors)	Jul 91
Mong Kok (Mong Kok Rd. Pumping Station)	MK	4E Mong Kok Rd., Mong Kok	Ground Level Monitoring Station	7m	2m (1 floor)	Apr 91
Yuen Long (Yuen Long District Branch Offices Bldg.)	YL	269 Castle Peak Road Yuen Long	New Development : Residential	31m	25m (6 floors)	July 95

Note: P.D. = Principal datum

Table B2. Summary of the Parameters Monitored in the Network (1997)

	PARAMETERS									
STATIONS	SO_2	NO_x	NO	NO_2	CO	O_3	TEOM	MET	TSP	RSP
Kwun Tong	X	X	X	X		X	X	X	X	X
Central/Western	X	X	X	X		X	X	X	X	X
Sha Tin	X	X	X	X		X	X	X	X	X
Tai Po	X	X	X	X		X	X	X	X	X
Mong Kok	X	X	X	X	X		X	X	X	X
Sham Shui Po	X	X	X	X			X	X	X	X
Tsuen Wan	X	X	X	X	X	X	X	X	X	X
Kwai Chung	X	X	X	X	X	X	X	X	X	X
Yuen Long	X	X	X	X		X	X	X	X	X

Table B3 List of Equipment Used in Measuring Air Pollutant Concentration

Pollutants	**Measurement Principle**	**Commercial Instrument**
SO_2	UV fluorescence	TECO Model 43A Monitor Laboratories 8850
NO, NO_2, NO_x	Chemiluminescence	TECO Model 42, API 1200A Monitor Laboratories 8840
O_3	UV absorption	TECO 49, API 400
CO	Non-dispersive infra-red absorption with gas filter correlation	TECO Model 48, 48C
TSP	Gravimetric	General Metals 2310
RSP	a) Gravimetric b) Oscillating microbalance	Graseby Andersen PM10 R&P TEOM Series 1400a-PM10

Table B4 Sampling and Analysis Methods Used in Measuring Toxic Air Pollutants

Toxic Air Pollutants	Sampling and Analysis Method	Sampling Instrument/Media	Sampling Schedule	Sampling Period
Benzene	USEPA Method TO-14	Xontech 910A / Canister	Every 6 days	24 hours
Perchloroethylene	USEPA Method TO-14	Xontech 910A / Canister	Every 6 days	24 hours
1,3-Butadiene	USEPA Method TO-14	Xontech 910A / Canister	Every 6 days	24 hours
Formaldehyde	USEPA Method TO-11	Xontech 920 / DNPH coated Sep-Pak Cartridge	Every 12 days	24 hours
Benzo(a)pyrene	USEPA Method TO-13	Graseby GPSI / PUF/XAD-2 Sorbents	Once per month	24 hours
2,3,7,8-TCDD	USEPA Method TO-9 / 23	Graseby GPSI / Polyurethane Foam	Once per month	24 hours
2,3,7,8-TCDF	USEPA Method TO-9 / 23	Graseby GPSI / Polyurethane Foam	Once per month	24 hours
Hexavalent Chromium	CARB SOP MLD 039	Xontech 925 / Bicarbonate Impregnated Filter	Every 12 days	24 hours

Figure B1: Accuracy of Air Quality Monitoring Network, 1997

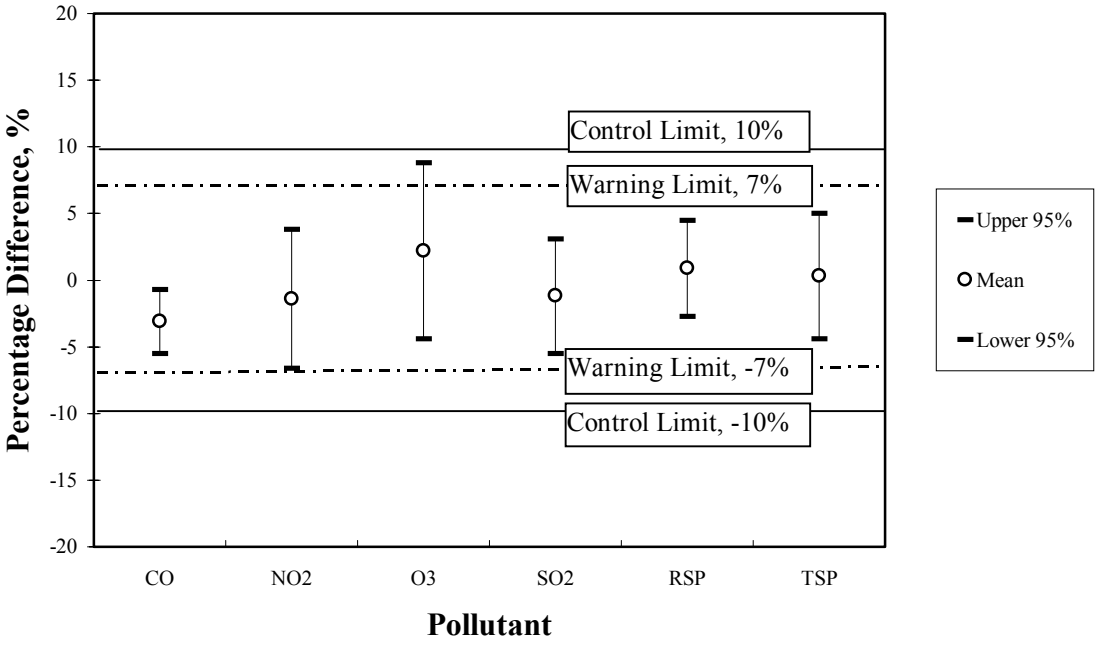
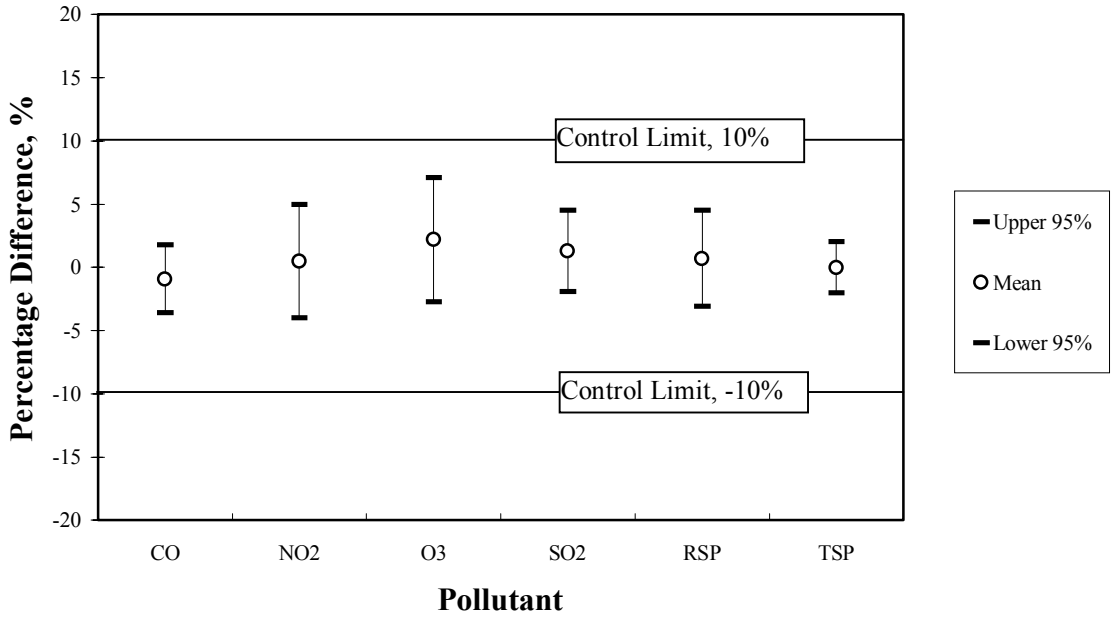


Figure B2: Precision of Air Quality Monitoring Network, 1997



Appendix C

Tables of Air Quality Data

TABLE C1 THE HIGHEST 4 HOURLY AND 2 DAILY POLLUTANT VALUES FOR 1997

Hourly Concentrations

Pollutant: Sulphur Dioxide

Station	1st High	2nd High	3rd High	4th High
Kwun Tong	286	229	219	215
Sha Tin	288	258	175	170
Tai Po	178	175	122	115
Yuen Long	310	302	301	272
Sham Shui Po	288	280	235	224
Central / Western	369	296	286	285
Tsuen Wan	227	220	215	206
Kwai Chung	258	243	212	211
Mong Kok	248	248	209	203

Pollutant: Nitrogen Oxides

Station	1st High	2nd High	3rd High	4th High
Kwun Tong	1716	1691	1647	1600
Sha Tin	990	881	770	762
Tai Po	841	837	752	744
Yuen Long	1095	798	768	711
Sham Shui Po	1493	1464	1143	1085
Central / Western	983	814	799	796
Tsuen Wan	1082	960	929	877
Kwai Chung	900	900	888	812
Mong Kok	1451	1380	1205	1188

Pollutant: Nitric Oxide

Station	1st High	2nd High	3rd High	4th High
Kwun Tong	972	956	926	897
Sha Tin	557	486	431	413
Tai Po	480	448	415	398
Yuen Long	609	438	410	403
Sham Shui Po	929	909	656	631
Central / Western	544	459	435	429
Tsuen Wan	618	543	514	487
Kwai Chung	516	503	453	446
Mong Kok	862	760	648	645

Pollutant: Nitrogen Dioxide

Station	1st High	2nd High	3rd High	4th High
Kwun Tong	323	310	292	278
Sha Tin	203	198	197	191
Tai Po	244	238	228	220
Yuen Long	202	197	196	195
Sham Shui Po	322	310	268	260
Central / Western	205	197	196	193
Tsuen Wan	208	206	204	200
Kwai Chung	238	223	219	211
Mong Kok	342	322	305	302

Pollutant: Carbon Monoxide

Station	1st High	2nd High	3rd High	4th High
Tsuen Wan	3100	2990	2530	2500
Kwai Chung	3230	3150	2880	2700
Mong Kok	4550	3680	3610	3420

Pollutant: Ozone

Station	1st High	2nd High	3rd High	4th High
Kwun Tong	128	100	100	99
Sha Tin	270	268	254	228
Tai Po	116	110	106	106
Yuen Long	231	204	194	194
Central / Western	243	213	208	198
Tsuen Wan	90	89	89	87
Kwai Chung	224	213	212	203

Daily Concentrations

Pollutant: Total Suspended Particulates (High Volume Sampling)

Station	1st High	2nd High
Kwun Tong	253	144
Sha Tin	163	146
Tai Po	204	160
Yuen Long	232	196
Sham Shui Po	186	168
Central / Western	170	158
Tsuen Wan	184	181
Kwai Chung	170	141
Mong Kok	275	239

Daily Concentrations

Pollutant: Sulphur Dioxide

Station	1st High	2nd High
Kwun Tong	103	95
Sha Tin	71	64
Tai Po	54	44
Yuen Long	87	83
Sham Shui Po	133	97
Central / Western	81	80
Tsuen Wan	83	81
Kwai Chung	92	84
Mong Kok	103	96

Pollutant: Nitrogen Oxides

Station	1st High	2nd High
Kwun Tong	844	523
Sha Tin	505	357
Tai Po	381	273
Yuen Long	354	337
Sham Shui Po	627	528
Central / Western	363	355
Tsuen Wan	427	392
Kwai Chung	374	330
Mong Kok	869	567

Pollutant: Nitric Oxide

Station	1st High	2nd High
Kwun Tong	436	287
Sha Tin	239	175
Tai Po	159	122
Yuen Long	156	153
Sham Shui Po	312	297
Central / Western	166	164
Tsuen Wan	219	200
Kwai Chung	169	161
Mong Kok	447	299

Pollutant: Nitrogen Dioxide

Station	1st High	2nd High
Kwun Tong	179	178
Sha Tin	140	119
Tai Po	138	127
Yuen Long	134	132
Sham Shui Po	172	163
Central / Western	131	125
Tsuen Wan	138	119
Kwai Chung	147	115
Mong Kok	186	182

Pollutant: Carbon Monoxide *

Station	1st High	2nd High
Tsuen Wan	1580	1290
Kwai Chung	1880	1280
Mong Kok	1920	1920

Pollutant: Ozone

Station	1st High	2nd High
Kwun Tong	51	49
Sha Tin	88	80
Tai Po	60	59
Yuen Long	84	75
Central / Western	90	88
Tsuen Wan	51	49
Kwai Chung	108	108

Pollutant: Respirable Suspended Particulates (High Volume Sampling)

Station	1st High	2nd High
Kwun Tong	185	93
Sha Tin	117	109
Tai Po	153	104
Yuen Long	164	125
Sham Shui Po	129	127
Central / Western	122	119
Tsuen Wan	139	127
Kwai Chung	129	109
Mong Kok	159	153

Note: 1. All units are in micrograms per cubic metre.
*2. * Carbon Monoxide's value is 8-Hour Average.*

TABLE C2: MONTHLY AND ANNUAL AVERAGES OF GASEOUS POLLUTANTS FOR 1997

Pollutant: Sulphur Dioxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Kwun Tong	17	11	12	13	15	18	16 *	22	25	13	12	12	16
Sha Tin	15	6	8	10	13	18	14	14	9 *	12	10	8	11
Tai Po											14	12	13 *
Yuen Long	26	12	20	18	22 *	17	14	30 *	22	20	20	29	21
Sham Shui Po	22	14	20	21	17	20	14	24	25	17	21	20	20
Central / Western	15	10	14	16	14	23	17	23	24	18	21	21 *	18
Tsuen Wan	21	13	20	22 *	25 *	23	24	31 *	21	14	12	14	20
Kwai Chung	15	8	15	18	23	27	25	23	19	15	10 *	16	18
Mong Kok	22	13	16	17	16	18 *	18 *	16	27	17	22	20	18

Pollutant: Nitrogen Oxides

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Kwun Tong	217	173	193	199	181	191	185 *	204	195	188	209	237	198
Sha Tin	138	73	99	93	91	112	98	103	79 *	100	144	140	106
Tai Po	120	65	73	65	77	76	83	89	119 *	100 *	139	130	95
Yuen Long	164	94	147	121	91 *	83	101	95 *	108	122	149	161	120
Sham Shui Po	173	141	180	175	147	144	137	147	146	137	164	195	157
Central / Western	122	89	127	124	80	84	76	81	97	90	109	141 *	102
Tsuen Wan	159	135	164	181 *	148	146	150	125 *	134	121	146	155	147
Kwai Chung	90	67	100	94	93	96	96	89	78	73	56 *	96	86
Mong Kok	291	247	264	278	306	309 *	242 *	260	285	257	306	327	281

Pollutant: Nitric Oxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Kwun Tong	85	71	80	76	71	81	83 *	89	77	67	83	102	81
Sha Tin	51	20	36	28	26	43	41	42	20 *	28	55	55	37
Tai Po	43	19	23	15	21	26	32	29	34 *	23 *	47	42	29
Yuen Long	50	23	48	32	24 *	31	43	26 *	33	36	53	61	38
Sham Shui Po	60	50	73	60	53	58	62	55	46	34	52	72	56
Central / Western	31	22	42	36	20	27	27	23	25	15	28	48 *	29
Tsuen Wan	54	47	63	69 *	52	56	66	39 *	44	31	46	54	52
Kwai Chung	20	17	33	26	27	32	37	29	19	12	6 *	27	24
Mong Kok	129	108	114	117	145	155 *	120 *	124	134	107	134	149	128

Pollutant: Nitrogen Dioxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Kwun Tong	87	65	71	83	72	67	58 *	68	76	85	81	81	74
Sha Tin	60	42	44	51	50	46	35	39	48 *	57	61	56	49
Tai Po	55	36	44	43	45	37	34	45	67 *	65 *	68	66	50
Yuen Long	87	59	73	72	54 *	35	35	55 *	57	67	68	68	61
Sham Shui Po	82	65	69	83	65	55	42	62	76	85	85	84	71
Central / Western	74	55	62	69	49	43	34	45	59	67	67	68 *	58
Tsuen Wan	78	62	68	76 *	68	60	49	66 *	67	73	76	73	68
Kwai Chung	59	41	49	54	52	47	40	45	49	54	47 *	55	49
Mong Kok	94	82	89	99	84	71 *	59 *	71	80	93	101	99	85

Pollutant: Carbon Monoxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tsuen Wan					676	627	530	685 *	677	863	769	936	720 *
Kwai Chung	745	554	652										651 *
Mong Kok	1066	953	965	656	990	1240 *	958 *	1091	1231	1319	1258	1413	1095

Pollutant: Ozone

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Kwun Tong						9 *	9 *	12	21	28	25	19	17 *
Sha Tin						5 *	11	20	27 *	39	29	23	22 *
Tai Po											31	26	28 *
Yuen Long	23	25	24	34	35 *	20	10	32 *	24	26	22	14	24
Central / Western	28	29	25	34	28	21	16	23	24	39	29	23 *	27
Tsuen Wan											24	20	22 *
Kwai Chung	38	40	35	42	27	17	7	19	31	47	67 *	31	33

Notes: *1. All units are in micrograms per cubic metre.*
2. Value with an '' is below the minimum data requirement for no. of data within the period.*
3. Shaded value is below the minimum data requirement for no. of data within a quarter.

TABLE C3: STATISTICAL ANALYSIS OF THE HOURLY MEASUREMENTS OF GASEOUS POLLUTANTS FOR 1997

Pollutant: Sulphur Dioxide

Station	No. of hours	Data capture rate %	<----------Percentiles----------> 10	25	50	75	90	95	98	99	Geometric mean	Arithmetic mean	Highest 1 hour	Highest 24 hour
Kwun Tong	7863	89.8	2	5	9	16	35	58	92	112	9	14	286	103
Sha Tin	7960	90.9	0	2	6	14	28	42	64	82	8	11	288	71
Tai Po	1453	16.6	3	5	9	15	25	36	54	71	9	13	178	54
Yuen Long	7211	82.3	4	8	14	25	41	58	89	114	14	19	310	87
Sham Shui Po	8119	92.7	3	5	12	22	47	72	104	122	12	19	288	133
Central / Western	7745	88.4	3	5	10	19	44	64	91	117	10	17	369	81
Tsuen Wan	7104	81.1	3	6	11	22	46	64	85	110	12	16	227	83
Kwai Chung	7819	89.3	2	4	9	24	48	65	87	105	10	18	258	92
Mong Kok	7073	80.7	3	5	11	22	43	67	96	121	11	16	248	103

Pollutant: Nitrogen Oxides

Station	No. of hours	Data capture rate %	<----------Percentiles----------> 10	25	50	75	90	95	98	99	Geometric mean	Arithmetic mean	Highest 1 hour	Highest 24 hour
Kwun Tong	7368	84.1	40	125	187	260	338	396	493	599	156	178	1716	844
Sha Tin	7633	87.1	20	36	69	129	254	356	465	538	67	102	990	505
Tai Po	7424	84.7	21	40	73	119	188	256	356	433	65	88	841	382
Yuen Long	6958	79.4	40	65	102	156	232	298	395	465	99	114	1095	354
Sham Shui Po	8530	97.4	41	91	145	198	265	331	460	552	125	154	1493	627
Central / Western	7372	84.2	21	42	80	129	194	255	357	455	71	94	983	363
Tsuen Wan	6989	79.8	35	91	134	185	262	323	419	496	117	130	1082	427
Kwai Chung	7292	83.2	19	38	67	115	178	222	301	365	62	84	900	374
Mong Kok	6787	77.5	97	176	260	360	472	564	676	762	239	239	1451	869

Pollutant: Nitric Oxide

Station	No. of hours	Data capture rate %	<----------Percentiles----------> 10	25	50	75	90	95	98	99	Geometric mean	Arithmetic mean	Highest 1 hour	Highest 24 hour
Kwun Tong	7368	84.1	6	38	70	109	156	189	242	303	49	72	972	436
Sha Tin	7633	87.1	0	3	13	42	115	176	244	285	11	36	557	239
Tai Po	7424	84.7	0	4	14	36	76	115	173	215	12	27	480	159
Yuen Long	6958	79.4	4	10	26	52	94	131	188	221	21	37	609	156
Sham Shui Po	8530	97.4	3	19	44	74	113	158	231	287	30	55	929	312
Central / Western	7376	84.2	0	3	12	34	71	110	171	222	10	26	544	166
Tsuen Wan	6989	79.8	2	19	41	69	110	142	198	248	28	46	618	219
Kwai Chung	7292	83.2	0	3	11	32	68	92	137	174	9	24	516	169
Mong Kok	6783	77.4	28	66	113	172	235	286	346	418	95	108	862	447

Pollutant: Nitrogen Dioxide

Station	No. of hours	Data capture rate %	<----------Percentiles----------> 10	25	50	75	90	95	98	99	Geometric mean	Arithmetic mean	Highest 1 hour	Highest 24 hour
Kwun Tong	7362	84.0	30	52	74	95	115	132	159	180	67	67	323	179
Sha Tin	7633	87.1	17	29	44	64	89	105	125	137	41	47	203	139
Tai Po	7424	84.7	19	29	44	64	87	103	123	139	41	46	243	137
Yuen Long	6958	79.4	27	39	57	81	105	121	141	152	55	58	202	134
Sham Shui Po	8530	97.4	31	45	67	93	114	127	145	160	63	70	322	172
Central / Western	7372	84.2	19	32	55	77	100	114	130	141	47	54	205	131
Tsuen Wan	6989	79.8	30	47	66	86	110	124	140	152	61	60	207	137
Kwai Chung	7292	83.2	17	30	45	63	89	108	128	139	41	48	238	146
Mong Kok	6787	77.5	44	59	84	110	131	146	174	196	79	74	342	185

Pollutant: Carbon Monoxide

Station	No. of hours	Data capture rate %	<----------Percentiles----------> 10	25	50	75	90	95	98	99	Geometric mean	Arithmetic mean	Highest 1 hour	Highest 8 hour
Tsuen Wan	4769	54.4	410	540	710	890	1080	1240	1430	1570	673	604	3100	1580
Kwai Chung	2031	23.2	320	440	610	800	970	1130	1660	2040	589	619	3230	1880
Mong Kok	7104	81.1	520	750	1050	1390	1760	1990	2280	2490	976	927	4550	1920

Pollutant: Ozone

Station	No. of hours	Data capture rate %	<----------Percentiles----------> 10	25	50	75	90	95	98	99	Geometric mean	Arithmetic mean	Highest 1 hour	Highest 24 hour
Kwun Tong	3886	44.4	2	6	14	28	46	58	70	79	12	17	128	51
Sha Tin	4063	46.4	0	4	14	35	63	79	94	106	11	21	270	88
Tai Po	1453	16.6	3	6	20	45	72	81	89	95	16	28	116	60
Yuen Long	7402	84.5	1	4	14	35	60	75	92	104	11	22	231	84
Central / Western	8077	92.2	2	7	20	39	63	77	92	104	15	26	243	90
Tsuen Wan	1445	16.5	3	7	16	32	52	63	73	78	14	22	90	51
Kwai Chung	8090	92.4	0	4	23	52	78	92	103	114	14	31	224	108

Pollutant: Respirable Suspended Particulates (Continuous monitoring)

Station	No. of hours	Data capture rate %	<----------Percentiles----------> 10	25	50	75	90	95	98	99	Geometric mean	Arithmetic mean	Highest 1 hour	Highest 24 hour
Kwun Tong	7652	87.4	24	37	53	72	93	110	136	159	49	50	294	162
Sha Tin	7986	91.2	18	28	44	63	85	101	127	143	41	45	226	154
Tai Po	3695	42.2	16	26	43	65	86	105	130	154	40	42	225	132
Yuen Long	7803	89.1	19	31	50	76	107	128	154	181	46	51	339	155
Sham Shui Po	2096	23.9	29	41	55	73	97	121	158	177	54	39	270	149
Central / Western	7924	90.5	17	28	46	68	91	107	132	152	42	48	309	147
Tsuen Wan	7887	90	23	33	47	66	92	113	136	155	46	50	280	168
Kwai Chung	8036	91.7	17	27	40	58	78	95	125	143	38	44	247	153
Mong Kok	7312	83.5	24	37	54	73	96	115	145	177	51	51	380	177

Note: All pollutant units are in micrograms per cubic metre.

TABLE C4: MONTHLY AND ANNUAL AVERAGES OF PARTICULATE CONCENTRATIONS FOR 1997

Pollutant: Total Suspended Particulates (High Volume Sampling)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Kwun Tong	126	84	104	95	86	70	69	71	80	90	113	127	93
Sha Tin	89	58	59	82	51	44	36	65	60	83	88	89	66
Tai Po	92	84	106	79	64	60	47	68	61	102	86	102	80
Yuen Long	174	83	97	91	75	74	56	95	85	138	122	135	103
Sham Shui Po	125	78	91	95	79	67	53	65	81	94	103	136	89
Central / Western	133	76	77	104	59	55	45	72	75	105	99	100	84
Tsuen Wan	141	72	80	92	70	58	53	61	60	97	108	89	82
Kwai Chung	104	47	63	68	65	65	50	72	70	90	73	72	71
Mong Kok	181	99	125	131	154	133	105	142	110	142	120	135	134

Pollutant: Respirable Suspended Particulates (High Volume Sampling)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Kwun Tong	78	55	62	61	53	43	42	45	55	61	69	86	59
Sha Tin	61	40	41	62	35	34	26	46	42	60	59	59	47
Tai Po	65	51	59	57	43	46	36	54	46	74	59	72	55
Yuen Long	106	57	56	59	49	48	35	59	52	88	71	84	64
Sham Shui Po	82	54	59	62	48	39	34	43	49	63	65	92	58
Central / Western	89	53	46	74	42	42	30	53	54	72	48	69	56
Tsuen Wan	95	52	55	69	46	40	38	43	44	71	65	56	56
Kwai Chung	77	39	40	56	45	49	32	51	52	67	47	53	51
Mong Kok	101	59	58	83	76	75	56	83	63	86	67	80	75

Pollutant: Respirable Suspended Particulates (Continuous Monitoring)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Kwun Tong	75	49	54	66	47	44	43 *	50	53	69	61	66	56
Sha Tin	78	44	46	55	40	36	29	36	43 *	63	58	58	49
Tai Po							29	39	55 *	61 *	56	60	50 *
Yuen Long	87	47	55	57	50 *	36	27	40	51	74	73	82	57
Sham Shui Po									56 *	69	65 *	66	64 *
Central / Western	77	48	56	62	39	33	27	43	48	67	61	56 *	51
Tsuen Wan	77	46	52	62 *	49	41	35	47	50	68	58	63	54
Kwai Chung	65	39	45	49	38	33	28	41	43	58	60 *	55	46
Mong Kok	69	50	55	60	48	47 *	32 *	44	48	80	75	77	57

Notes:

1. All units are in micrograms per cubic metre.

2. Value with an '' is below the minimum data requirement for no. of data within the period.*

3. Shaded value is below the minimum data requirement for no. of data within a quarter.

TABLE C5(a): AIRBORNE SPECIES CONCENTRATIONS, DERIVED FROM TOTAL SUSPENDED PARTICULATES FOR 1997

Station	TSP	As	Be	Cd	Ni	Pb	Cr	Al	Mn	Fe	Ca	Mg	V	Zn	Ba	Cu	Hg	Na+	K+	Cl-	Br-	SO4=	C	THC	BAP	NH4+	NO3-
Kwun Tong	93	3.9	0.07	1.85	5.4	60	4.6	630	34	1166	2387	427	6.0	173	35	88	0.19	2427	602	2567	15	10667	39083	2390	0.18	2150	4409
Shatin	66	4.0	0.06	0.97	3.7	60	3.5	451	23	935	1574	321	6.3	114	31	61	0.20	1918	537	1505	11	9351	28802	1494	0.20	1752	3143
Tai Po	80	4.6	0.06	1.47	3.9	71	3.2	510	24	994	2509	328	6.2	156	27	69	0.19	1666	751	1420	13	10832	33624	1655	0.21	2655	4473
Yuen Long	102	6.4	0.09	1.71	5.4	88	4.3	782	34	1262	2344	334	6.9	191	27	156	0.20	1564	898	1503	12	12073	40678	2382	0.35	3055	5360
Sham Shui Po	89	3.9	0.06	1.23	8.1	60	4.1	577	33	1096	2130	426	6.9	166	31	59	0.19	2664	618	2930	16	10253	37950	2455	0.17	2100	4498
Central / Western	84	4.8	0.06	1.63	5.4	68	3.5	559	29	908	2274	514	7.8	191	20	80	0.19	3562	706	3929	19	12505	32290	1652	0.10	2460	5214
Tsuen Wan	82	4.7	0.07	1.21	5.5	64	3.4	530	28	928	1867	373	8.4	158	27	97	0.19	2128	669	2004	14	11234	35729	2136	0.23	2545	4083
Kwai Chung	71	4.7	0.06	1.51	7.2	67	4.0	466	24	744	1931	316	12.3	151	17	128	0.19	1896	654	1412	10	11657	29148	1482	0.12	2622	4080
Mong Kok	134	5.1	0.08	1.51	9.7	83	6.5	1039	51	1917	4768	555	9.5	231	43	71	0.23	2906	751	3396	20	12493	58300	4497	0.31	2010	6064
Average	89	4.7	0.07	1.45	6.0	69	4.1	616	31	1105	2420	399	7.8	170	29	90	0.20	2303	687	2296	14	11229	37289	2238	0.21	2372	4591

Note: *1. All figures are in nanograms per cubic metre except TSP which is in micrograms per cubic metre.*

2. All values presented are arithmetic annual averages.

TABLE C5(b): AIRBORNE SPECIES CONCENTRATIONS IN TOTAL SUSPENDED PARTICULATES EXPRESSED AS PERCENTAGE BY WEIGHT FOR 1997

Station	As	Be	Cd	Ni	Pb	Cr	Al	Mn	Fe	Ca	Mg	V	Zn	Ba	Cu	Hg	Na+	K+	Cl-	Br-	SO4=	C	THC	BAP	NH4+	NO3-
Kwun Tong	0.00	0.00	0.00	0.01	0.06	0.00	0.68	0.04	1.25	2.57	0.46	0.01	0.19	0.04	0.10	0.00	2.61	0.65	2.76	0.02	11.48	42.06	2.57	0.00	2.31	4.74
Shatin	0.01	0.00	0.00	0.01	0.09	0.01	0.68	0.03	1.41	2.37	0.48	0.01	0.17	0.05	0.09	0.00	2.89	0.81	2.27	0.02	14.10	43.42	2.25	0.00	2.64	4.74
Tai Po	0.01	0.00	0.00	0.00	0.09	0.00	0.64	0.03	1.25	3.15	0.41	0.01	0.20	0.03	0.09	0.00	2.09	0.94	1.78	0.02	13.61	42.24	2.08	0.00	3.33	5.62
Yuen Long	0.01	0.00	0.00	0.01	0.09	0.00	0.77	0.03	1.24	2.30	0.33	0.01	0.19	0.03	0.15	0.00	1.53	0.88	1.47	0.01	11.84	39.88	2.33	0.00	2.99	5.25
Sham Shui Po	0.00	0.00	0.00	0.01	0.07	0.00	0.65	0.04	1.23	2.39	0.48	0.01	0.19	0.03	0.07	0.00	2.99	0.69	3.29	0.02	11.51	42.59	2.75	0.00	2.36	5.05
Central / Western	0.01	0.00	0.00	0.01	0.08	0.00	0.66	0.03	1.08	2.71	0.61	0.01	0.23	0.02	0.10	0.00	4.24	0.84	4.67	0.02	14.88	38.41	1.96	0.00	2.93	6.20
Tsuen Wan	0.01	0.00	0.00	0.01	0.08	0.00	0.65	0.03	1.13	2.28	0.46	0.01	0.19	0.03	0.12	0.00	2.60	0.82	2.45	0.02	13.71	43.59	2.61	0.00	3.10	4.98
Kwai Chung	0.01	0.00	0.00	0.01	0.09	0.01	0.66	0.03	1.05	2.72	0.45	0.02	0.21	0.02	0.18	0.00	2.68	0.92	1.99	0.01	16.44	41.12	2.09	0.00	3.70	5.76
Mong Kok	0.00	0.00	0.00	0.01	0.06	0.00	0.78	0.04	1.44	3.57	0.42	0.01	0.17	0.03	0.05	0.00	2.18	0.56	2.54	0.01	9.36	43.67	3.37	0.00	1.51	4.54
Average	0.01	0.00	0.00	0.01	0.08	0.00	0.68	0.03	1.23	2.67	0.45	0.01	0.19	0.03	0.10	0.00	2.64	0.79	2.58	0.02	12.99	41.89	2.45	0.00	2.76	5.21

TABLE C6(a): AIRBORNE SPECIES CONCENTRATIONS, DERIVED FROM RESPIRABLE SUSPENDED PARTICULATES FOR 1997

Station	RSP	As	Be	Cd	Ni	Pb	Cr	Al	Mn	Fe	Ca	Mg	V	Zn	Ba	Cu	Hg	Na+	K+	Cl-	Br-	SO4=	C	THC	BAP	NH4+	NO3-
Kwun Tong	59	3.7	0.05	1.08	3.4	51	2.1	237	18	526	760	241	5.5	134	21	34	0.19	1471	535	1137	11	9545	31207	2189	0.22	2636	2992
Shatin	47	3.5	0.06	0.98	3.0	52	1.8	180	13	506	574	205	6.0	97	23	19	0.21	1329	491	717	11	8934	25252	1548	0.24	2250	2132
Tai Po	55	4.2	0.06	1.41	3.3	66	1.8	232	14	515	754	204	6.3	136	19	37	0.21	1253	674	853	13	10068	29454	1549	0.27	2923	3061
Yuen Long	64	5.8	0.06	1.63	3.6	77	2.1	291	17	524	814	191	6.2	146	15	28	0.20	1084	808	857	12	11010	33653	2045	0.44	3589	3960
Sham Shui Po	58	3.9	0.06	1.07	4.8	52	2.0	224	18	467	697	241	6.5	128	17	38	0.20	1614	562	1265	12	9687	30913	2297	0.21	2737	3249
Central / Western	56	4.4	0.06	1.57	4.6	60	1.7	219	18	400	713	266	7.5	162	12	32	0.20	1866	632	1476	13	11593	27508	1732	0.13	3298	3460
Tsuen Wan	57	4.4	0.05	1.10	4.0	59	1.6	225	16	420	669	220	6.9	124	14	22	0.20	1411	638	891	11	10373	30127	1991	0.29	2900	2937
Kwai Chung	51	4.6	0.06	1.45	5.7	64	1.8	201	14	358	641	200	11.6	125	11	23	0.20	1317	639	656	9	11360	27346	1457	0.15	3192	2780
Mong Kok	75	4.4	0.06	1.39	5.8	70	3.1	314	24	659	1252	269	8.7	155	22	37	0.24	1693	626	1473	12	11123	41133	3692	0.32	2999	3965
Average	58	4.3	0.06	1.30	4.2	61	2.0	236	17	486	764	226	7.2	134	17	30	0.21	1449	623	1036	11	10410	30732	2056	0.25	2947	3170

Note: *1. All figures are in nanograms per cubic metre except RSP which is in micrograms per cubic metre.*

2. All values presented are arithmetic annual averages.

TABLE C6(b): AIRBORNE SPECIES CONCENTRATIONS IN RESPIRABLE SUSPENDED PARTICULATES EXPRESSED AS PERCENTAGE BY WEIGHT FOR 1997

Station	As	Be	Cd	Ni	Pb	Cr	Al	Mn	Fe	Ca	Mg	V	Zn	Ba	Cu	Hg	Na+	K+	Cl-	Br-	SO4=	C	THC	BAP	NH4+	NO3-
Kwun Tong	0.01	0.00	0.00	0.01	0.09	0.00	0.40	0.03	0.89	1.28	0.41	0.01	0.23	0.04	0.06	0.00	2.49	0.90	1.92	0.02	16.13	52.74	3.70	0.00	4.46	5.06
Shatin	0.01	0.00	0.00	0.01	0.11	0.00	0.38	0.03	1.08	1.23	0.44	0.01	0.21	0.05	0.04	0.00	2.84	1.05	1.53	0.02	19.08	53.93	3.31	0.00	4.81	4.55
Tai Po	0.01	0.00	0.00	0.01	0.12	0.00	0.42	0.03	0.94	1.37	0.37	0.01	0.25	0.03	0.07	0.00	2.27	1.22	1.55	0.02	18.28	53.47	2.81	0.00	5.31	5.56
Yuen Long	0.01	0.00	0.00	0.01	0.12	0.00	0.45	0.03	0.81	1.26	0.30	0.01	0.23	0.02	0.04	0.00	1.68	1.25	1.33	0.02	17.10	52.26	3.18	0.00	5.57	6.15
Sham Shui Po	0.01	0.00	0.00	0.01	0.09	0.00	0.39	0.03	0.81	1.21	0.42	0.01	0.22	0.03	0.07	0.00	2.79	0.97	2.19	0.02	16.77	53.52	3.98	0.00	4.74	5.62
Central / Western	0.01	0.00	0.00	0.01	0.11	0.00	0.39	0.03	0.71	1.26	0.47	0.01	0.29	0.02	0.06	0.00	3.30	1.12	2.61	0.02	20.53	48.72	3.07	0.00	5.84	6.13
Tsuen Wan	0.01	0.00	0.00	0.01	0.10	0.00	0.40	0.03	0.74	1.18	0.39	0.01	0.22	0.02	0.04	0.00	2.49	1.13	1.57	0.02	18.31	53.19	3.52	0.00	5.12	5.18
Kwai Chung	0.01	0.00	0.00	0.01	0.12	0.00	0.39	0.03	0.70	1.25	0.39	0.02	0.24	0.02	0.04	0.00	2.58	1.25	1.28	0.02	22.21	53.46	2.85	0.00	6.24	5.43
Mong Kok	0.01	0.00	0.00	0.01	0.09	0.00	0.42	0.03	0.88	1.67	0.36	0.01	0.21	0.03	0.05	0.00	2.26	0.84	1.97	0.02	14.85	54.92	4.93	0.00	4.00	5.29
Average	0.01	0.00	0.00	0.01	0.11	0.00	0.40	0.03	0.84	1.30	0.39	0.01	0.23	0.03	0.05	0.00	2.52	1.08	1.77	0.02	18.14	52.91	3.48	0.00	5.12	5.44

TABLE C7: TOTAL WET AND DRY DEPOSITION FOR 1997

(a) WET DEPOSITION

	Monitoring Station	Kwun Tong	Central / Western
	WET DEPOSITION (ton/ha)	18936	19131
	WEIGHTED MEAN pH (based on volume-weighted mean hydrogen ion concentrations ([H+])	4.72	4.81
	WEIGHTED MEAN pH (based on volume-weighted mean pH)	5.13	5.07
	NO. OF SAMPLES	27	19
Filtrate (kg/ha)	**NH4+**	8.89	5.18
	NO3-	20.91	9.98
	SO4=	44.34	35.00
	Cl-	28.83	42.62
	Na+	16.49	23.09
	K+	5.07	5.05
	Formate	3.80	3.83
	Acetate	3.79	3.83
	Ca	7.82	3.79
	Mg	1.73	2.30
Residue (kg/ha)	**WEIGHT**	83.32	45.38
	Si	5.89	8.60
	Al	2.04	1.63
	Ca	0.44	0.51
	Fe	0.95	0.50
	Mg	0.19	0.27
	V	0.08	0.09
	Mn	0.08	0.09
	Cu	0.20	0.20
	Ba	0.18	0.21

(b) DRY DEPOSITION

	Monitoring Station	Kwun Tong	Central / Western
	NO. OF SAMPLES	39	27
Filtrate (kg/ha)	**NH4+**	0.35	0.28
	NO3-	5.50	3.96
	SO4=	9.03	7.62
	Cl-	7.69	7.43
	Na+	4.40	4.43
	K+	0.74	0.43
	Formate	0.31	0.23
	Acetate	0.30	0.22
	Ca	6.14	4.38
	Mg	0.60	0.56
Residue (kg/ha)	**WEIGHT**	113.63	32.97
	Si	17.36	4.93
	Al	6.50	1.74
	Ca	2.47	0.77
	Fe	2.45	0.90
	Mg	0.34	0.13
	V	0.01	0.00
	Mn	0.07	0.02
	Cu	0.03	0.02
	Ba	0.04	0.02

** Note: The weighted mean pH is calculated from the pH value measured by the Gov't Lab.*

TABLE C8: DIURNAL VARIATION OF AIR POLLUTANT CONCENTRATION FOR 1997

Pollutant: Sulphur Dioxide

Station	Hr00	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23
Kwun Tong	7	10	8	7	7	7	10	15	19	21	21	20	18	18	19	20	22	20	18	17	16	15	13	12
Sha Tin	7	7	6	5	5	5	7	10	12	13	12	11	11	12	12	14	15	16	17	17	16	14	13	11
Tai Po	10	9	8	7	6	7	9	15	18	16	14	12	11	11	11	11	14	20	20	19	18	17	14	11
Yuen Long	18	13	12	12	12	12	14	19	24	26	26	25	24	24	26	27	27	26	24	22	20	19	18	17
Sham Shui Po		13	13	11	11	12	14	19	23	24	24	24	21	23	24	23	24	23	24	23	20	20	19	16
Central / Western	22	13	12	11	11	11	12	15	19	21	22	21	22	21	22	20	24	24	21	20	20	18	17	15
Tsuen Wan	7	11	9	8	8	9	10	15	22	23	26	26	24	25	26	27	27	27	24	21	18	17	15	15
Kwai Chung	8	13	11	11	10	10	10	13	18	20	23	24	23	23	23	25	26	25	24	22	20	18	16	15
Mong Kok	15	12	10	9	9	9	10	14	21	30	35	34	30	31	29	25	22	18	17	15	13	13	13	12

Pollutant: Nitrogen Oxides

Station	Hr00	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23
Kwun Tong	188	96	61	52	49	69	167	269	297	275	239	210	192	196	212	220	245	270	281	257	213	208	211	204
Sha Tin	191	128	71	60	55	60	106	156	157	124	94	76	65	67	67	72	83	98	125	151	158	162	170	154
Tai Po	160	116	62	53	50	55	87	150	140	106	83	72	70	64	65	71	79	95	114	126	126	130	131	122
Yuen Long	162	125	75	66	63	76	127	186	162	132	111	102	96	98	103	113	128	143	157	166	161	154	152	146
Sham Shui Po	136	94	77	65	64	69	117	194	231	218	194	175	154	161	171	174	188	203	215	202	179	173	162	162
Central / Western	171	102	55	46	45	45	61	105	135	144	129	111	96	96	103	105	113	125	130	129	118	108	104	95
Tsuen Wan	126	67	51	42	39	52	112	183	220	204	183	162	152	151	159	160	175	196	214	192	166	159	159	149
Kwai Chung	76	45	42	35	31	34	53	89	111	110	105	96	89	88	91	95	105	113	127	124	110	103	96	88
Mong Kok	277	188	136	127	120	119	186	311	392	397	373	328	276	296	325	321	341	364	368	323	275	281	284	273

Pollutant: Nitric Oxide

Station	Hr00	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23
Kwun Tong	74	31	16	13	12	19	68	124	139	125	103	85	74	74	81	84	97	111	118	107	84	82	85	84
Sha Tin	85	53	25	20	17	19	41	66	65	46	29	21	16	16	15	16	19	25	39	56	62	66	72	65
Tai Po	61	41	19	15	13	16	30	63	56	36	24	18	16	14	14	15	16	21	30	39	41	46	48	45
Yuen Long	66	48	22	18	17	23	50	82	63	44	32	26	23	22	24	27	32	40	49	57	57	55	57	55
Sham Shui Po	47	30	22	17	17	19	41	81	100	92	76	64	51	52	56	57	64	73	80	74	63	61	57	58
Central / Western	67	37	14	11	10	10	15	34	47	51	42	32	25	23	25	25	28	33	35	36	32	29	28	25
Tsuen Wan	37	13	9	7	6	10	38	75	96	85	71	58	51	49	52	52	58	68	79	69	57	55	57	53
Kwai Chung	18	7	9	7	5	6	12	28	39	38	35	29	25	24	24	24	27	29	36	36	32	30	28	25
Mong Kok	122	75	50	47	44	43	80	152	198	197	179	151	120	129	143	140	152	167	172	148	121	126	130	125

Pollutant: Nitrogen Dioxide

Station	Hr00	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23
Kwun Tong	75	48	36	32	31	39	64	78	84	84	82	80	79	82	88	91	96	100	99	94	85	82	80	77
Sha Tin	60	47	33	30	28	31	43	54	58	54	49	44	40	42	44	47	53	60	65	66	63	61	59	54
Tai Po	67	53	34	31	30	32	42	54	54	51	47	45	45	44	44	48	54	62	68	67	63	60	58	54
Yuen Long	61	51	41	38	37	41	50	61	65	64	62	61	61	63	67	71	78	82	82	79	74	70	65	61
Sham Shui Po	63	48	43	39	38	40	55	70	78	78	77	78	77	81	84	87	90	92	92	88	83	79	75	72
Central / Western	68	46	34	30	29	30	38	53	62	66	64	63	58	60	64	66	70	75	76	74	68	64	61	57
Tsuen Wan	68	47	36	31	29	36	55	67	73	74	73	73	74	76	79	81	87	91	93	86	78	74	72	69
Kwai Chung	49	34	29	25	23	25	35	46	51	52	52	51	51	52	54	58	63	68	72	68	61	56	53	50
Mong Kok	91	73	60	56	53	54	64	79	90	96	99	98	92	98	106	107	109	108	105	97	90	88	86	82

Pollutant: Carbon Monoxide

Station	Hr00	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23
Tsuen Wan	680	600	550	520	500	510	580	720	810	770	760	740	750	750	770	770	790	840	950	920	850	860	830	790
Kwai Chung	640	600	580	550	530	540	570	630	680	680	660	640	620	630	640	640	680	720	770	780	750	750	730	680
Mong Kok	940	780	740	700	660	680	740	980	1220	1240	1160	1110	1030	1110	1230	1250	1310	1450	1620	1450	1240	1240	1230	1160

Pollutant: Ozone

Station	Hr00	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23
Kwun Tong	15	28	33	34	34	28	14	10	11	14	19	25	28	29	28	25	18	13	11	11	12	12	12	12
Sha Tin	15	19	22	23	23	21	14	12	15	20	28	36	42	44	45	42	35	25	18	15	14	14	13	14
Tai Po	17	22	24	26	26	24	18	14	19	28	39	48	54	57	57	53	45	25	15	14	14	14	14	15
Yuen Long	15	19	21	22	23	20	15	13	15	22	30	39	45	46	46	40	32	23	15	13	13	12	13	13
Central / Western	26	33	37	39	39	37	30	18	16	17	22	29	36	37	35	34	28	22	17	17	19	20	20	21
Tsuen Wan	16	29	33	37	38	32	17	11	13	18	23	29	32	36	35	32	23	14	10	10	11	11	11	11
Kwai Chung	30	36	40	42	42	39	30	22	21	26	32	37	42	45	44	40	34	26	19	19	22	23	23	24

Pollutant: Respirable Suspended Particulates (Continuous Monitoring)

Station	Hr00	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23
Kwun Tong	48	44	42	41	40	41	49	58	64	66	65	63	60	62	63	64	66	68	69	67	62	57	56	53
Sha Tin	48	44	42	41	41	42	45	51	53	51	49	48	45	46	48	49	51	52	54	57	58	55	54	51
Tai Po	45	43	40	40	39	39	44	53	53	51	48	48	49	48	47	48	50	54	58	60	57	54	51	47
Yuen Long	49	46	44	44	44	47	54	64	66	65	62	60	59	58	60	61	64	67	68	69	66	62	56	53
Sham Shui Po	50	48	47	47	47	48	51	59	68	66	65	65	63	64	66	64	65	71	74	73	68	61	57	53
Central / Western	43	41	39	38	38	39	41	47	55	61	62	59	55	57	62	59	57	58	58	60	56	52	49	45
Tsuen Wan	45	42	40	39	39	41	45	49	52	53	56	58	56	59	61	60	64	67	71	70	63	57	52	49
Kwai Chung	39	37	37	36	37	36	38	42	46	49	50	51	49	49	52	52	53	52	52	52	50	47	43	40
Mong Kok	48	44	42	42	41	42	47	57	70	73	71	67	62	69	72	66	67	68	68	67	63	59	55	52

Note: All units are in micrograms per cubic metre.