AIR QUALITY
IN HONG KONG 2013

Air Science Group

Environmental Protection Department

The Government of the Hong Kong
Special Administrative Region

A report on the results from the Air Quality Monitoring Network (AQMN) (2013)

Report Number	:	EPD/TR 1/14
Report Prepared by	:	C. F. Chow
Work Done by	:	Air Science Group
Checked by	:	W. M. Pun
Approved by	:	S. W. Pang
Security Classification	:	Unrestricted

Summary

This report summarises the 2013 air quality monitoring data collected by the Environmental Protection Department's monitoring network comprising 11 general stations and 3 roadside stations.

As a result of the enhanced vehicle emission control programme implemented by the Government since 2000, concentrations of nitrogen oxides (NOx), respirable suspended particulates (RSP) and sulphur dioxide (SO_2) at roadside have reduced substantially over the past decade. The increasing trend of roadside nitrogen dioxide (NO_2) in the past years was, by and large, stabilised although its concentrations remained high in the period. Additional control measures are being introduced to reduce its concentration.

Thanks to the joint control efforts of the Hong Kong Special Administrative Region Government and the Guangdong Provincial Government in cutting emissions in the Pearl River Delta (PRD) Region, the ambient levels of NOx, SO_2 and RSP have also reduced in recent years. However, concentrations of ozone, a major constituent of photochemical smog, were on a slow rising trend over the past years. The two governments will continue to implement measures to alleviate photochemical smog and ozone problem in the PRD Region.

As in previous years, concentrations of carbon monoxide and lead in 2013 remained at levels well below their respective Air Quality Objectives limits.

C O N T E N T S

List of Tables

List of Figures

1. Introduction

The Environmental Protection Department (EPD) operates a network of 14 air quality monitoring stations for measuring concentrations of major air pollutants. It consists of 11 general stations for monitoring ambient air quality and three roadside stations for measuring street level air quality. Details of these monitoring stations are shown in Table B1 of Appendix B.

Additional monitoring facilities specifically designed for collecting Toxic Air Pollutants (TAPs) samples have been installed at the Tsuen Wan and Central/Western monitoring stations since 1997.

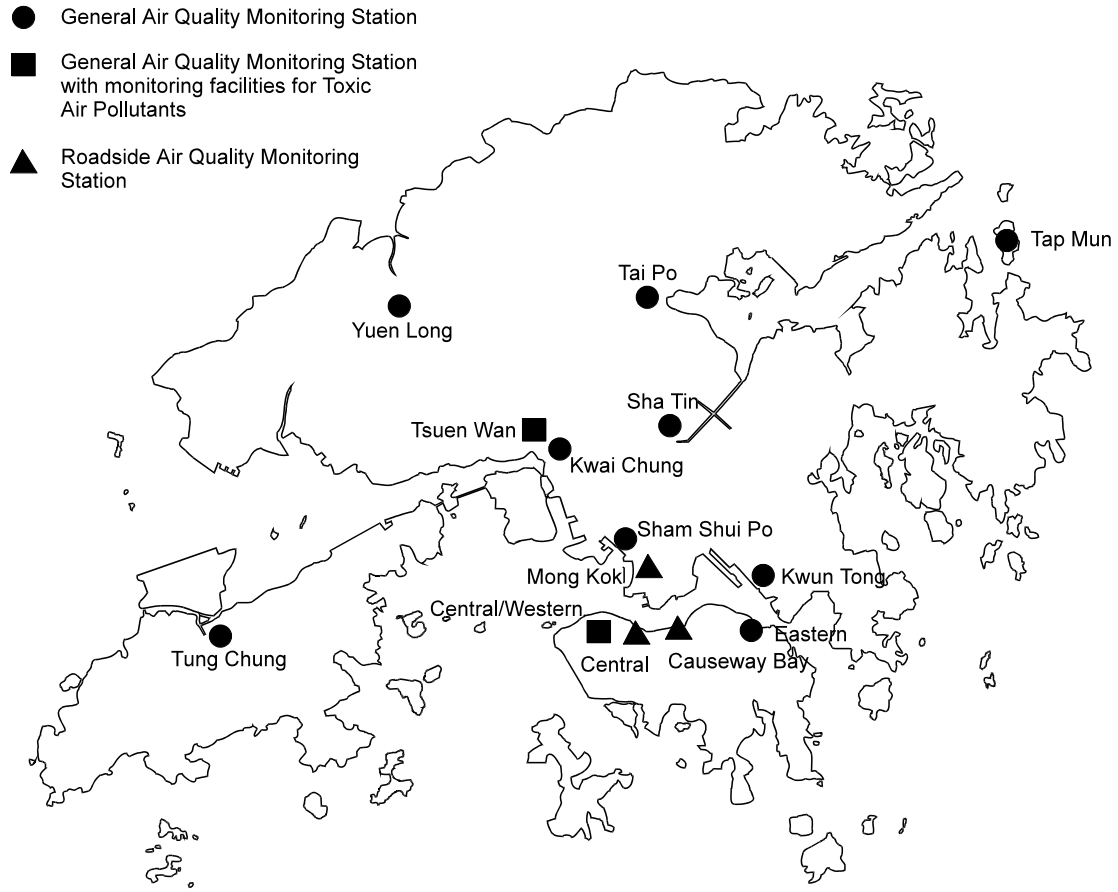


Figure 1: Location of EPD's Air Quality Monitoring Stations (2013)

Apart from EPD's network, the Hongkong Electric Co. Ltd. (HEC) and the CLP Power Hong Kong Limited (CLP) also operate a number of monitoring stations 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 and the relevant monitoring results in 2013 are at Appendix D.

2. Gaseous Pollutants

2.1 Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) is formed primarily from the combustion of sulphur-containing fossil fuels. In Hong Kong, power stations and marine vessels are the major source of SO_2, followed by fuel combustion equipment and motor vehicles.

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 diseases.

Figure 2a: Sulphur Dioxide Monitoring 2013
(1-Hour Average Statistics)

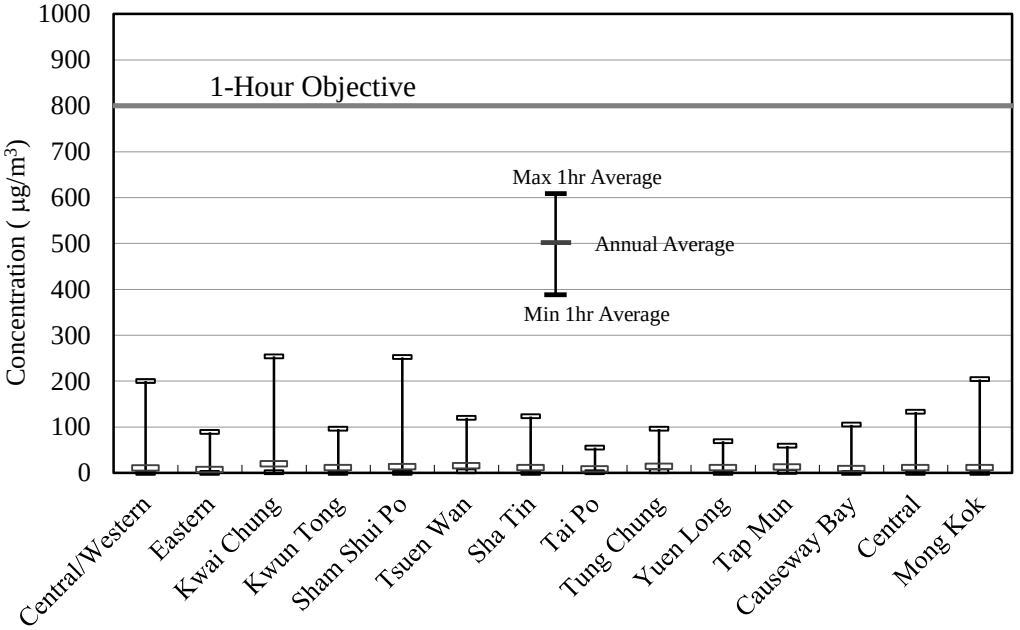


Figure 2b: Sulphur Dioxide Monitoring 2013
(24-Hour Average Statistics)

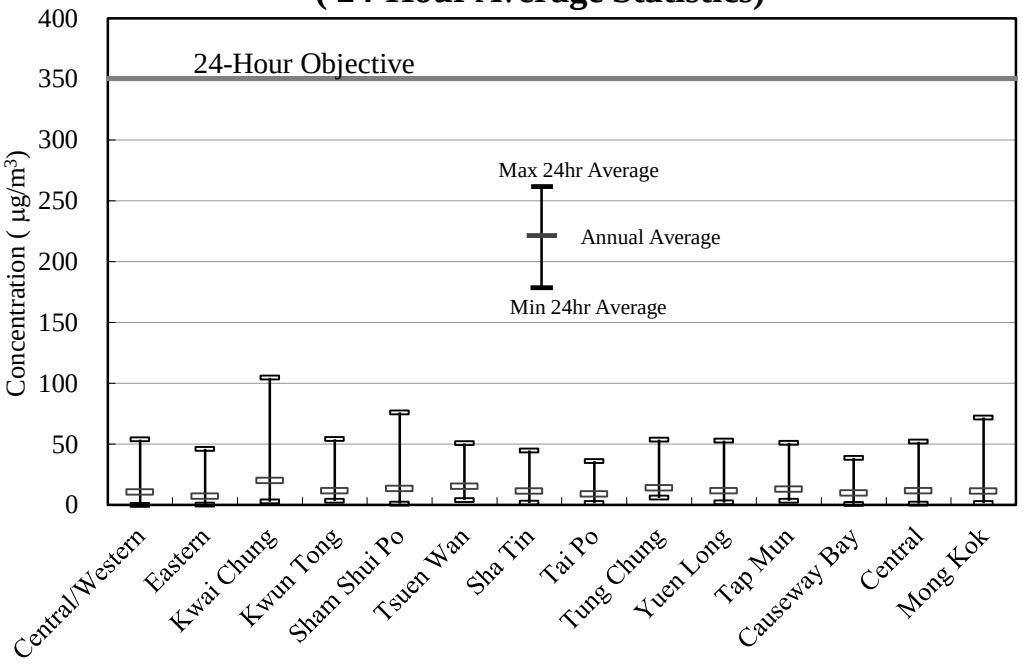
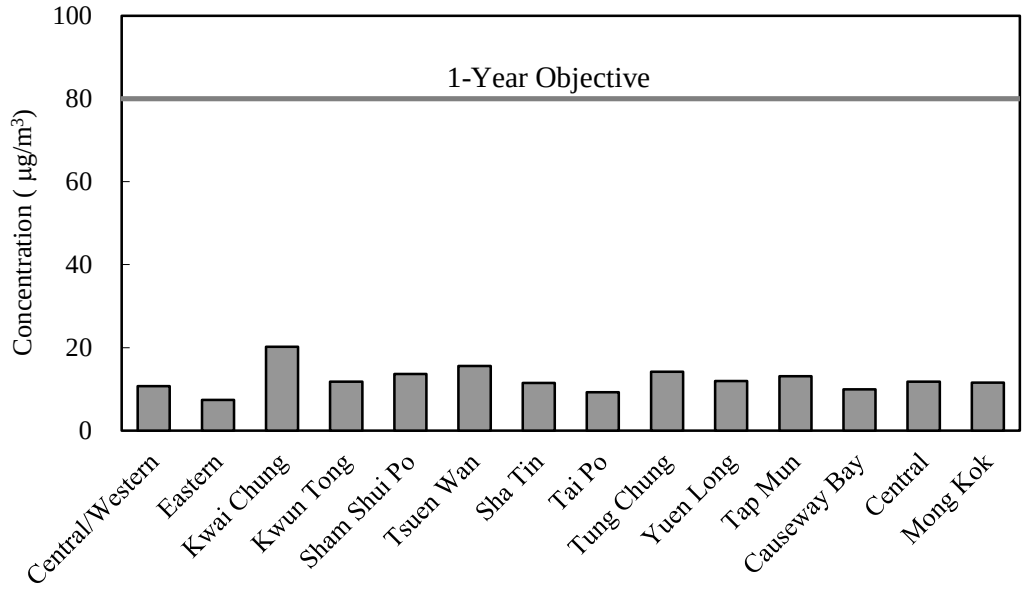


Figure 2c: Sulphur Dioxide Monitoring 2013
(Annual Average)



Sulphur dioxide was continuously measured at all the 14 monitoring stations during 2013. As in previous years, SO_2 concentrations remained low throughout the territory. All of the 14 monitoring stations complied with the relevant short and long term Hong Kong Air Quality Objectives[1] (AQOs) for SO_2. Both the highest 1-hour average (254 μg/m^3) and the highest 24-hour average (105 μg/m^3) in the year were recorded at the Kwai Chung general station. As for the annual average, the Kwai Chung station also recorded the highest value (20 μg/m^3) in the year. The highest 1-hour average, 24-hour average and annual average were all well below their respective AQO limits.

2.2 Nitrogen Oxides (NOx) and Nitrogen Dioxide (NO_2)

The various chemical species of the oxides of nitrogen are collectively termed as nitrogen oxides. From an air pollution standpoint, the most important nitrogen oxides in the atmosphere are nitric oxide (NO) and nitrogen dioxide (NO_2). In the context of air pollution, these two gases are often mentioned as nitrogen oxides (NOx). They are usually produced in combustion processes. Emissions from power stations, marine vessels and motor vehicles are the major sources of NOx in Hong Kong. NOx emissions from motor vehicles have greater impact on roadside air quality.

NO_2 is mainly formed from the oxidation of NO emitted from fuel combustion. Long-term exposure to NO_2 can lower a person's resistance to respiratory infections and aggravate existing chronic respiratory diseases.

NO_2 was continuously measured at all the 14 monitoring stations during 2013. In 2013, the highest 1-hour average (468 μg/m^3) and the highest 24-hour average (287 μg/m^3) were recorded at the Central and Causeway Bay roadside stations respectively. As regards the 1-hour AQO (300 μg/m^3 with allowance of exceedance for three occasions), all general stations were in compliance in the year. For the 24-hour AQO, all general stations were in compliance except the 3 general stations of Kwai Chung, Kwun Tong and Sham Shui Po

[1] Details of the Hong Kong Air Quality Objectives can be found in Appendix A.

where they recorded more than one count of exceedance with the 24-hour AQO limit in the year. Non-compliance with the 1-hour and 24-hour AQOs for NO_2 was recorded at all the three roadside stations.

As in previous years, all general stations complied with the annual AQO for NO_2 in 2013 while non-compliance was observed at all the three roadside stations. The highest annual average (122 μg/m^3) was recorded at the Central roadside station in the year.

Figure 3a: Nitrogen Dioxide Monitoring 2013
(1-Hour Average Statistics)

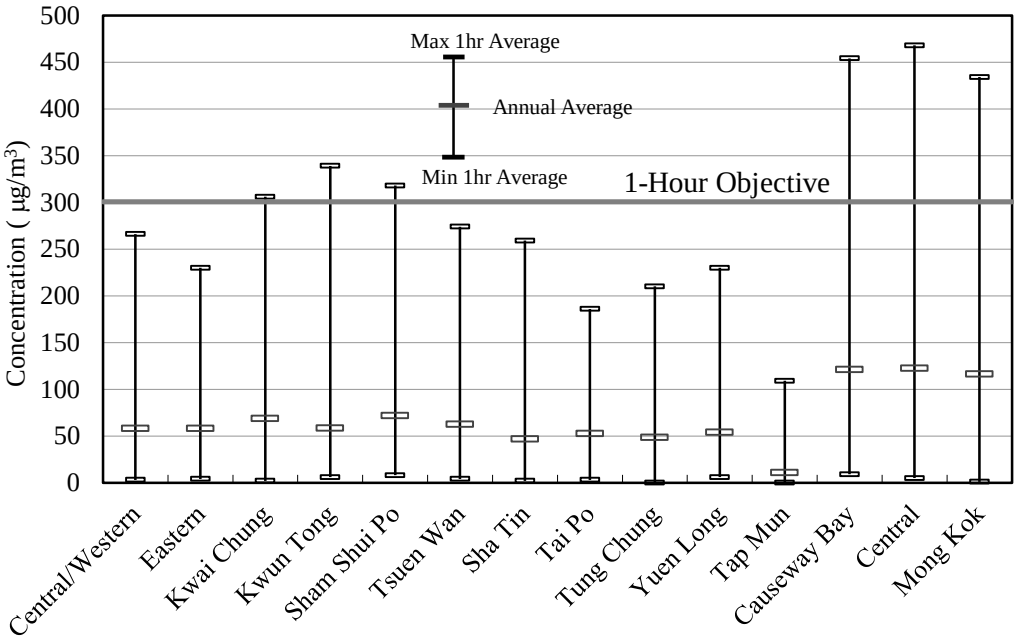


Figure 3b: Nitrogen Dioxide Monitoring 2013
(24-Hour Average Statistics)

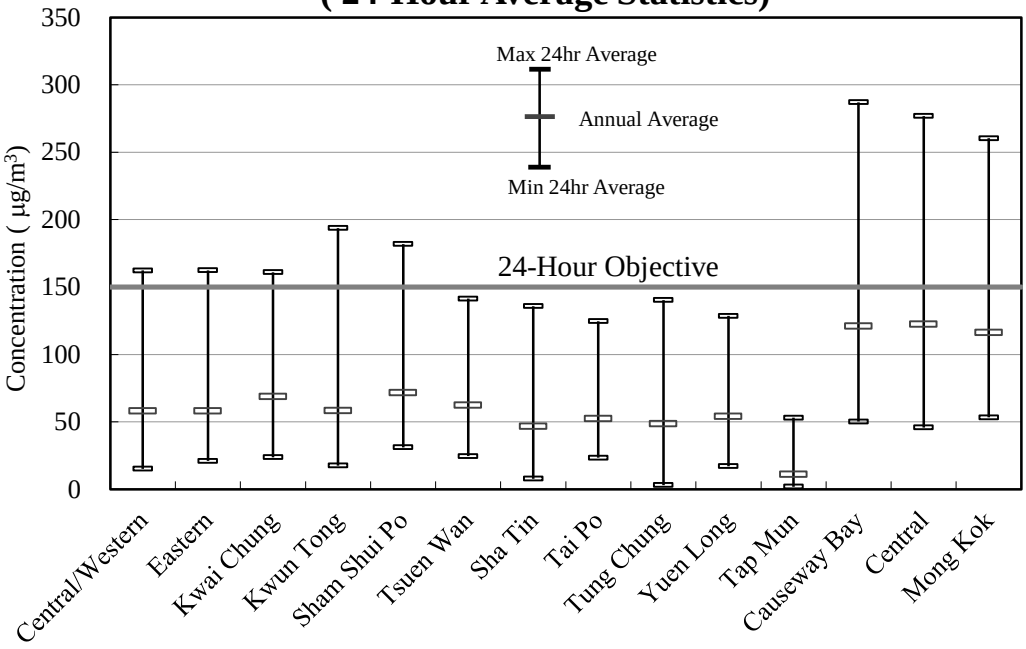
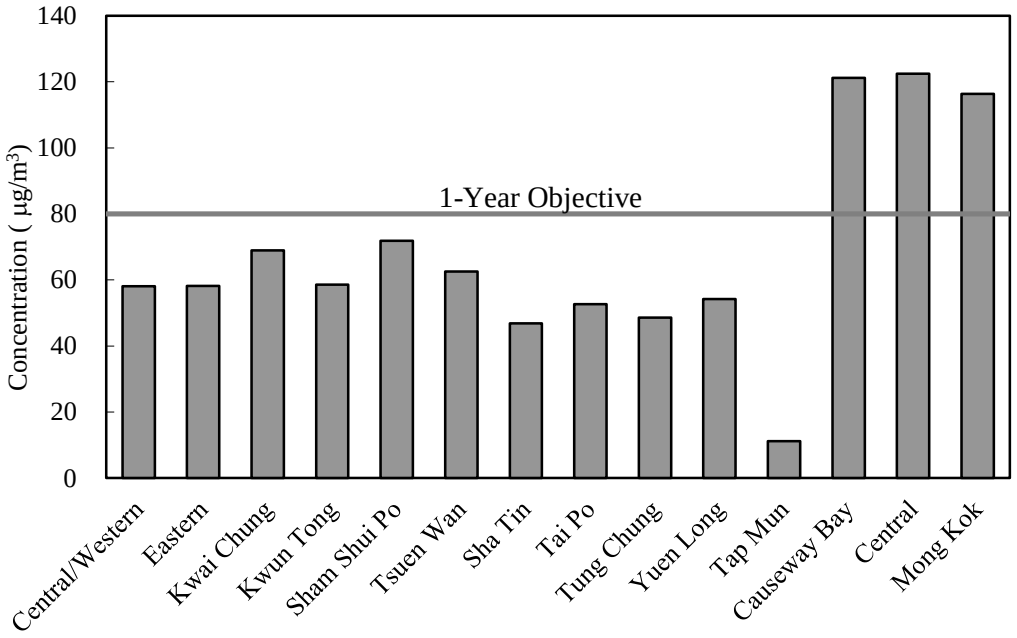


Figure 3c: Nitrogen Dioxide Monitoring 2013
(Annual Average)



2.3 Ozone (O_3)

Ozone (O_3) is a major constituent of photochemical smog. It is not a pollutant directly emitted from man-made sources but formed by photochemical reactions of primary pollutants such as NOx and volatile organic compounds (VOCs) under sunlight. As it takes several hours for these photochemical reactions to take place, O_3 recorded in one place could be attributed to VOC and NOx emissions from places afar. Hence, O_3 is a regional air pollution problem.

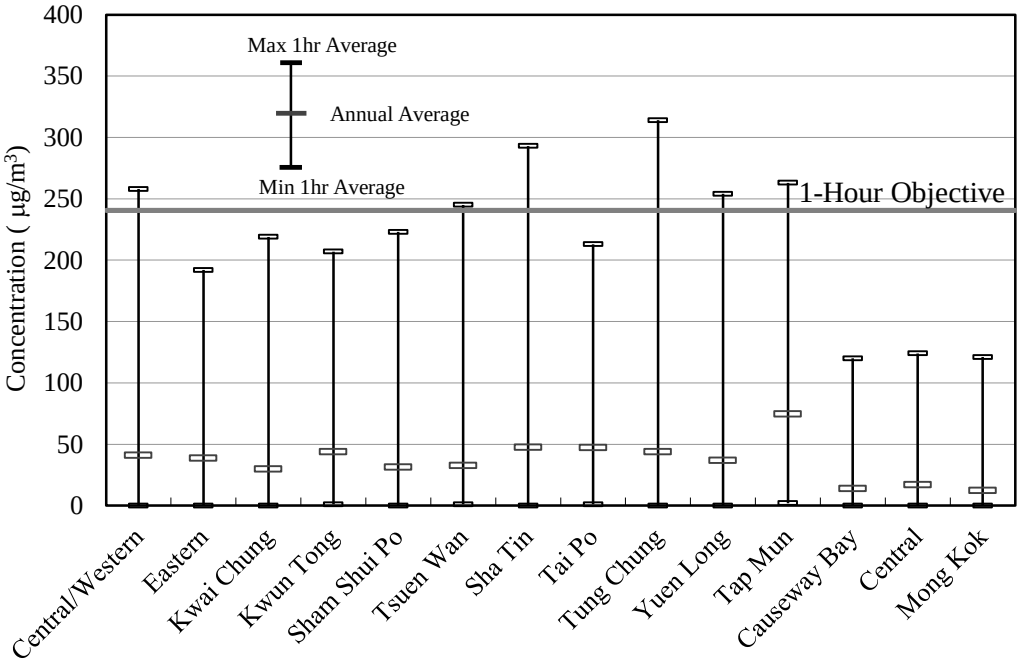
Being a strong oxidant, ozone can cause irritation to the eyes, nose and throat even at low concentrations. At elevated levels, it can increase a person's susceptibility to respiratory infections and aggravate pre-existing respiratory illnesses such as asthma.

Ozone was monitored at all of the general and roadside stations in 2013. Among the 11 general stations, five of them recorded non-compliance with the 1-hour AQO in 2013 (i.e., the 1-hour AQO limit was exceeded more than three times in the year). The highest 1-hour average (314 $\mu g/m^3$) was recorded at the Tung Chung general station.

All the three roadside stations complied with the 1-hour AQO in the year. At the roadside, the NOx emitted from motor vehicles readily reacts with O_3 to form NO_2, thereby removing O_3. Because of such O_3 scavenging effect, the O_3 concentrations at the roadside are significantly lower than those at the general stations.

In Hong Kong, elevated O_3 incidents are mostly associated with very hot, fine and calm weather conditions in the region, which favour the formation via photochemical reactions and accumulation of ozone. Such weather conditions mostly occur in summer and autumn, especially when Hong Kong and the Pearl River Delta Region is under the influence of subsiding air induced by a tropical cyclone located in the Western Pacific Ocean near Taiwan.

Figure 4a: Ozone Monitoring 2013
(1-Hour Average Statistics)



2.4 Carbon Monoxide (CO)

Carbon monoxide (CO) comes mainly from vehicular emissions although a small amount of which may also come from flue gases of factories and power stations. When it enters the bloodstream, CO can reduce oxygen delivery to the body's organs and tissues. Typical symptoms of CO poisoning include shortness of breath, chest pain, headaches, and loss of co-ordination. The health threat from CO is more severe for those who suffer from heart diseases.

Carbon monoxide was continuously monitored at seven stations including four general stations and three roadside stations during 2013. Similar to previous years, both the ambient and roadside CO concentrations remained very low throughout the year. All the seven monitoring stations complied with the 1-hour and 8-hour AQOs for CO. In 2013, the highest 1-hour average (4070 $\mu g/m^3$) and the highest 8-hour average (2860 $\mu g/m^3$) were both recorded at the Causeway Bay roadside station; these values were around one seventh and one third of the respective AQO limits.

Figure 5a: Carbon Monoxide Monitoring 2013 (1-Hour Average Statistics)

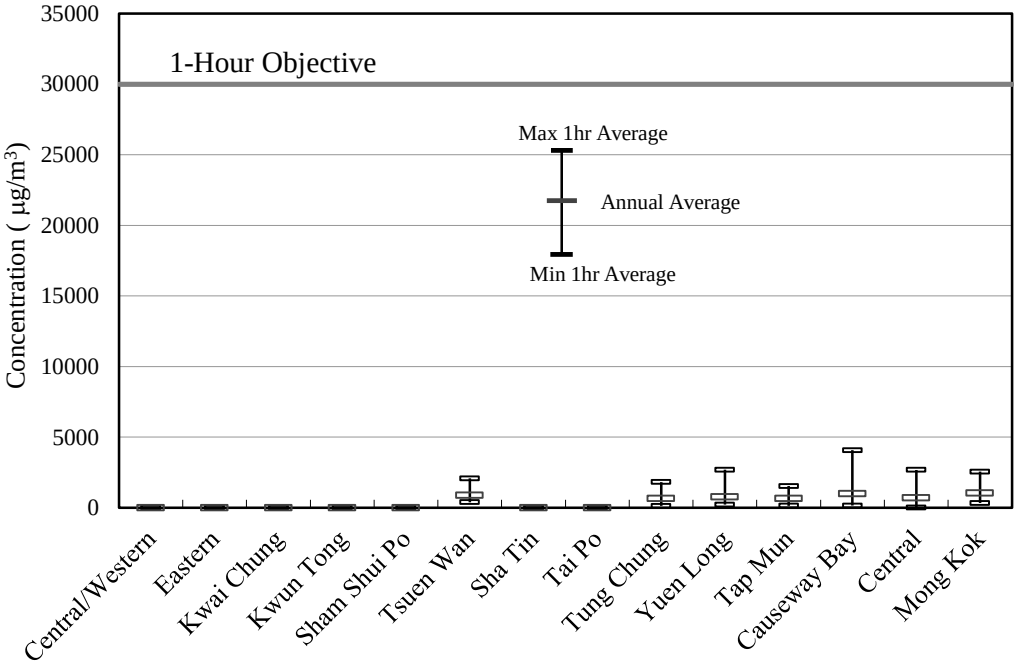
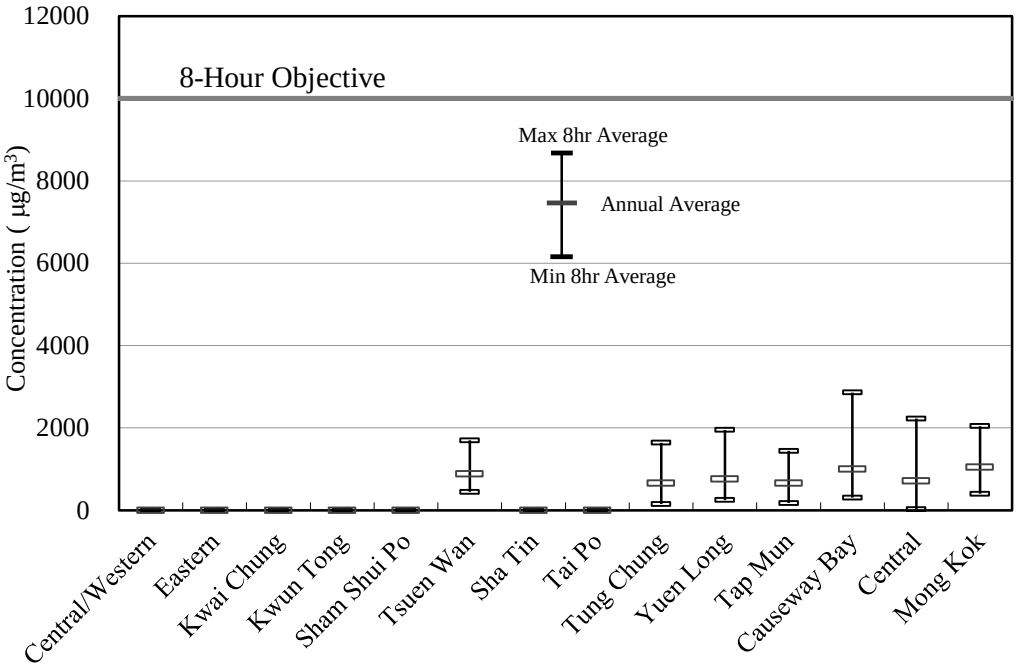


Figure 5b: Carbon Monoxide Monitoring 2013 (8-Hour Average Statistics)



3. Suspended Particulates

3.1 Total Suspended Particulates (TSP)

Total suspended particulates (TSP) are small airborne particulates such as dust, fume and smoke with diameters less than 100 micrometres. Major sources of TSP include power stations, marine vessels, construction activities and vehicle exhausts. TSP can be further divided into different categories according to the sizes. Particulates with a nominal aerodynamic diameter of 10 micrometres or less are called respirable suspended particulates (RSP or PM_{10} for short) while the sizes of 2.5 micrometres or less are named fine suspended particulates (FSP or $PM_{2.5}$ for short). The smaller the size of particulate, the greater is the concern on its health impact (see Sections 3.2 and 3.3 below). On the other hand, suspended particulates that are larger than 10 micrometres in diameter mainly cause soiling and dust nuisance.

TSP measurement was conducted by sampling using high-volume samplers at seven general stations and one roadside station throughout 2013. Samples are taken for the duration of 24 hours at a frequency of about one sample per six days.

All stations complied with the 24-hour AQO (260 μg/m^3) and annual AQO (80 μg/m^3) for TSP in 2013. The highest 24-hour average (218 μg/m^3) was recorded at Yuen Long general station while the highest annual average (75 μg/m^3) was recorded at the Mong Kok roadside station in the year.

Figure 6a: TSP Monitoring 2013
(24-Hour Average Statistics)

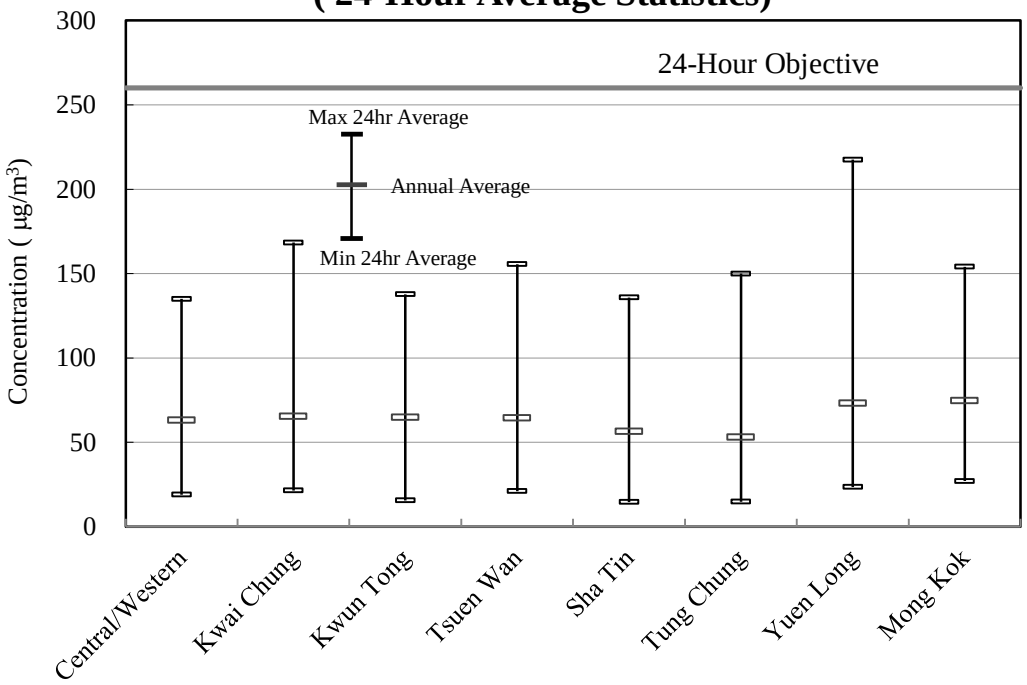
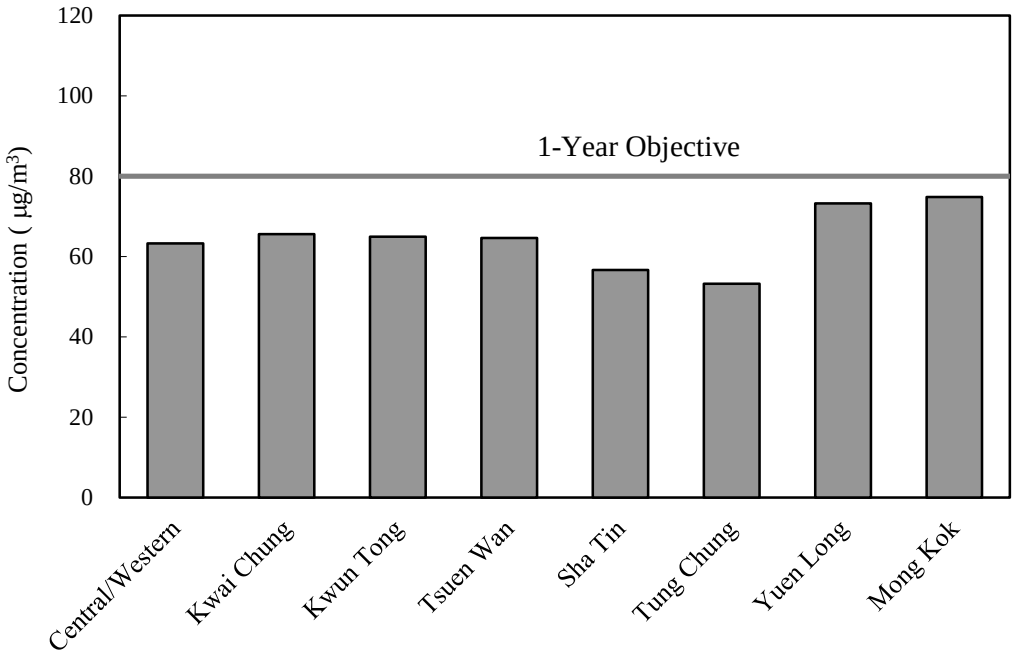


Figure 6b: TSP Monitoring 2013
(Annual Average)



3.2 Respirable Suspended Particulates (RSP)

Respirable suspended particulates (RSP or PM_{10}) refer to those suspended particulates with nominal aerodynamic diameters of 10 micrometres or less. Combustion sources, in particular marine vessels, diesel vehicle and power plants, are the major sources of RSP in Hong Kong. Besides, RSP can be formed by photochemical reactions of nitrogen oxides and volatile organic compounds and atmospheric oxidation of gaseous pollutants such as sulphur dioxide and nitrogen oxides. Although to a lesser extent, crustal derived dust and marine aerosols are also sources of RSP.

RSP at high levels 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. These effects are enhanced if high RSP levels are associated with higher levels of other pollutants, such as SO_2.

RSP was continuously measured at all 14 monitoring stations during 2013. Most of these stations were also equipped with high-volume sampler to collect particulate samples for chemical analysis.

In 2013, all stations complied with the 24-hour AQO of RSP (180 $\mu g/m^3$ with allowance of exceedance for once per year) and the highest 24-hour average (184 $\mu g/m^3$) was recorded at the Yuen Long general station. As regard the annual AQO limit of RSP (55 $\mu g/m^3$), non-compliance was observed at Yuen Long general station and two roadside stations of Causeway Bay and Central where Causeway Bay roadside station recorded the highest annual average (64 $\mu g/m^3$) in the year.

Figure 7a: RSP Monitoring 2013
(24-Hour Average Statistics)

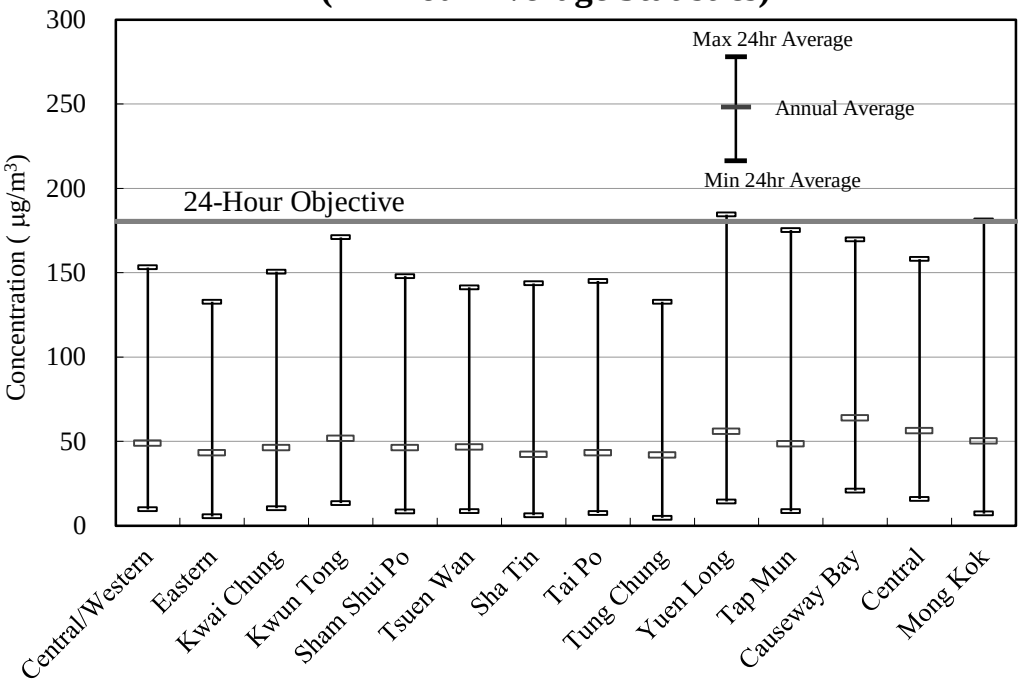
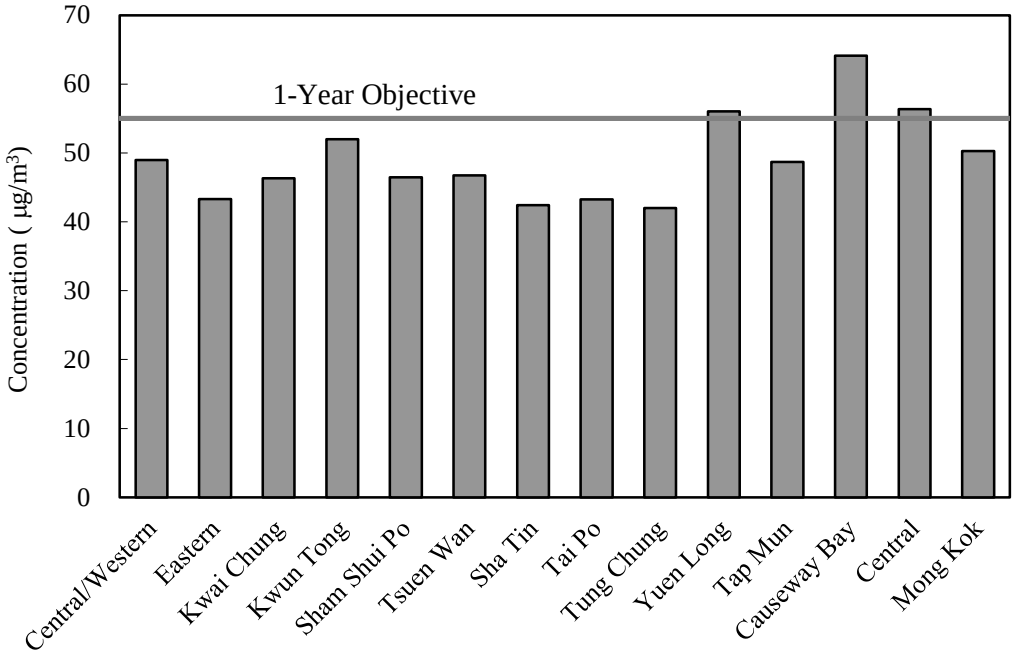


Figure 7b: RSP Monitoring 2013
(Annual Average)



3.3 Fine Suspended Particulates (FSP)

Fine suspended particulates (FSP or $PM_{2.5}$) refer to those suspended particulates with nominal aerodynamic diameters of 2.5 micrometres or less, which is the finer component of RSP. FSP is able to penetrate to the deepest parts of the lung because of its small size, hence poses a higher risk to health. Besides, FSP also causes visibility impairment in air.

FSP was continuously measured at all 14 monitoring stations during 2013. In the year, the highest 24-hour average (147 $\mu g/m^3$) was recorded at the Mong Kok roadside station while the highest annual average (45 $\mu g/m^3$) was recorded at the Causeway Bay roadside station.

Figure 8a: PM2.5 Monitoring 2013
(24-Hour Average Statistics)

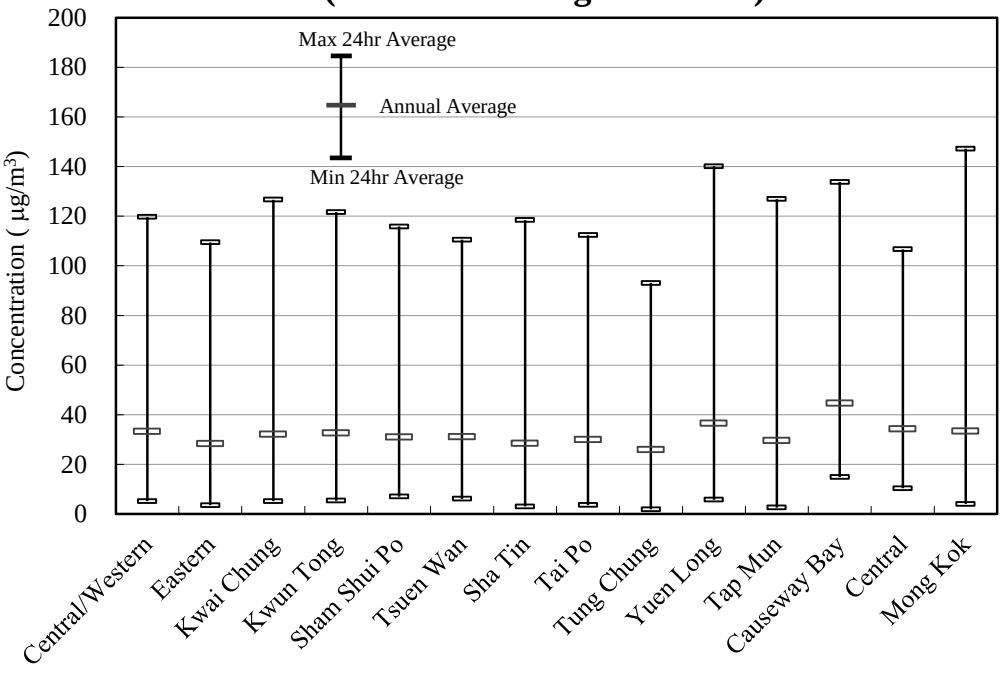
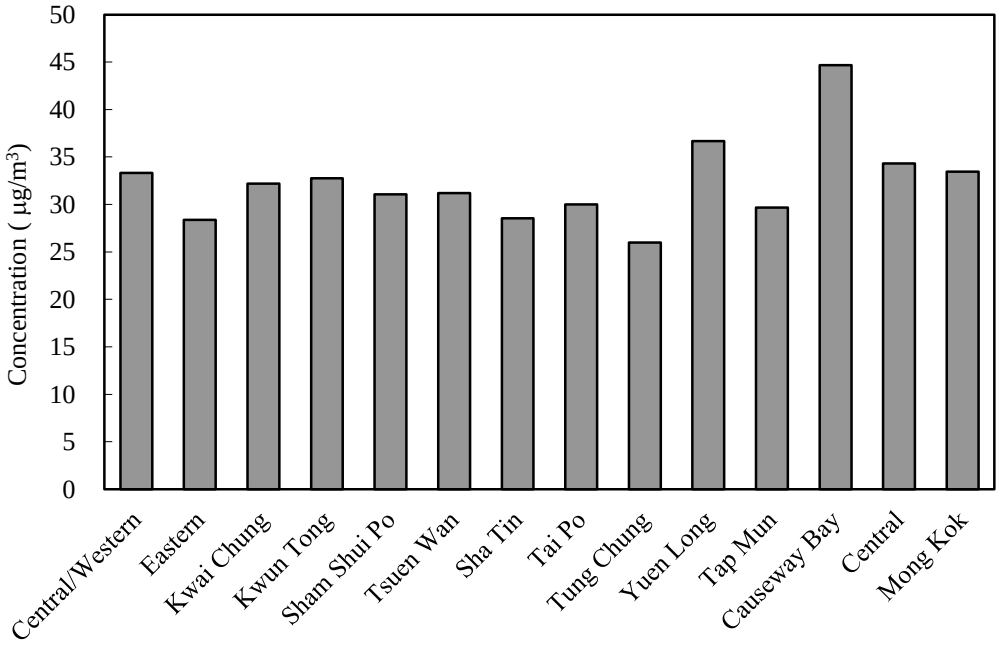


Figure 8b: PM2.5 Monitoring 2013
(Annual Average)



3.4 Lead (Pb)

Lead is the only one criteria pollutant included in the AQO that is also a toxic air pollutant. In Hong Kong, the sale and supply of leaded petrol, which is a known major source of lead, was banned from 1 April 1999. As in previous years, the ambient lead concentrations continued to linger at very low levels during 2013. The overall 3-month averages, ranging from 4 ng/m^3 (Tung Chung) to 100 ng/m^3 (Yuen Long), were well below the AQO limit of 1,500 ng/m^3.

4. Toxic Air Pollutants (TAPs)

Two groups of toxic air pollutants (TAPs), viz. heavy metals and organic substances, were regularly monitored at the Central/Western and Tsuen Wan stations since mid 1997. Among the various TAPs monitored in 2013, eight of them are considered more important in terms of their health impacts and their annual averages are summarised in Table C7. Detailed description of the TAPs monitoring operation is given in Appendix B4. The monitoring data collected so far indicate that the levels of toxic air pollutants in Hong Kong are comparable to those observed in other major cities.

5. Variation of Air Pollution Levels over Time

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

5.1 Over a Day

The concentrations of most air pollutants generally follow the diurnal pattern of human activities and traffic. For instance, higher levels of NO_2 and RSP are usually observed in the morning and the evening rush hours when there are more traffic and human activities. Likewise, the lowest concentrations often occur from midnight to dawn when the traffic is at its minimum. This type of traffic induced diurnal pattern is much more distinct for pollutant levels at roadside.

Figure 9: 2013 Diurnal variations of NO_2

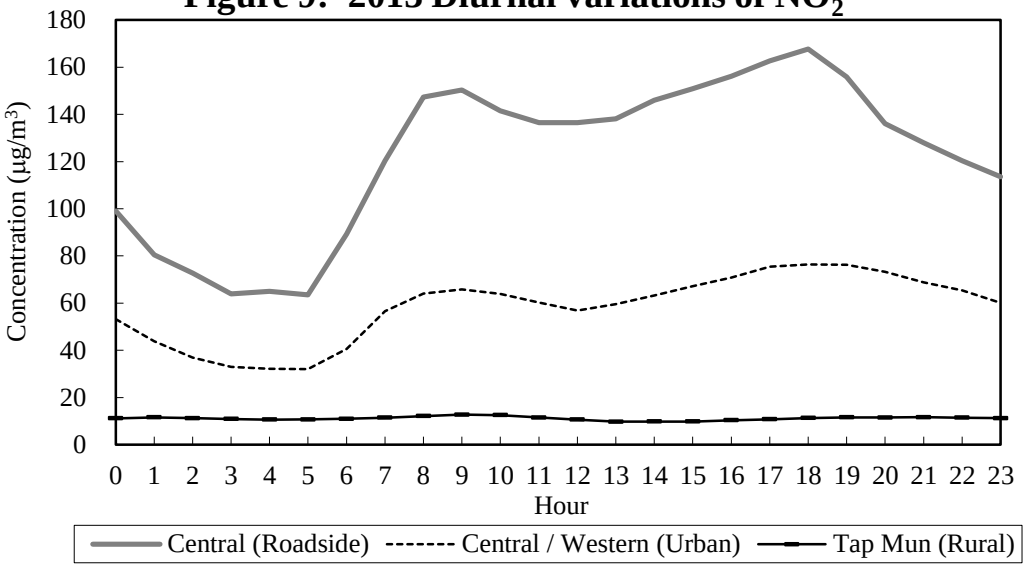
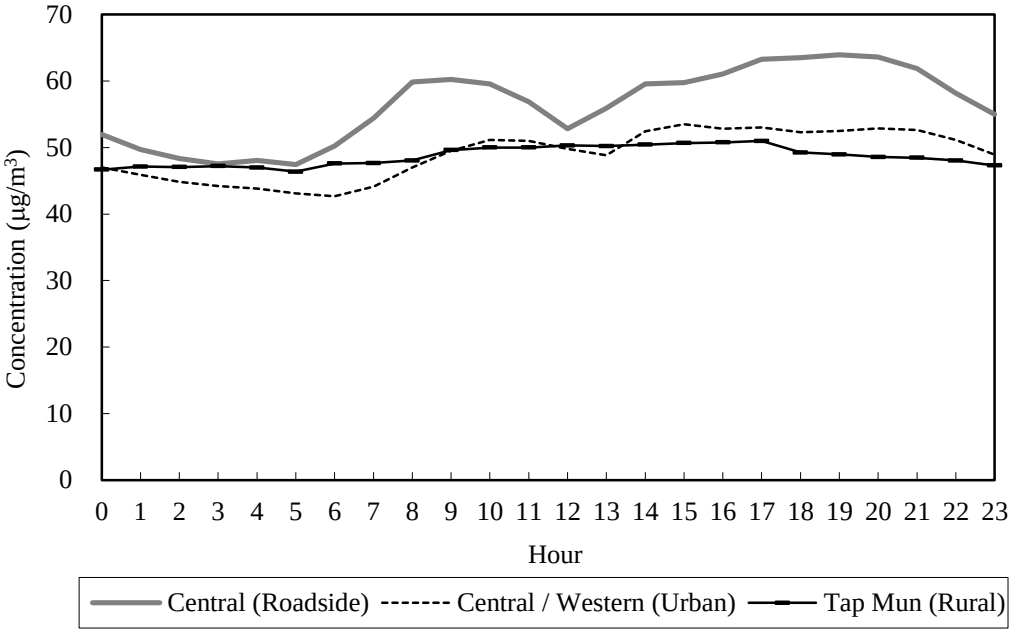
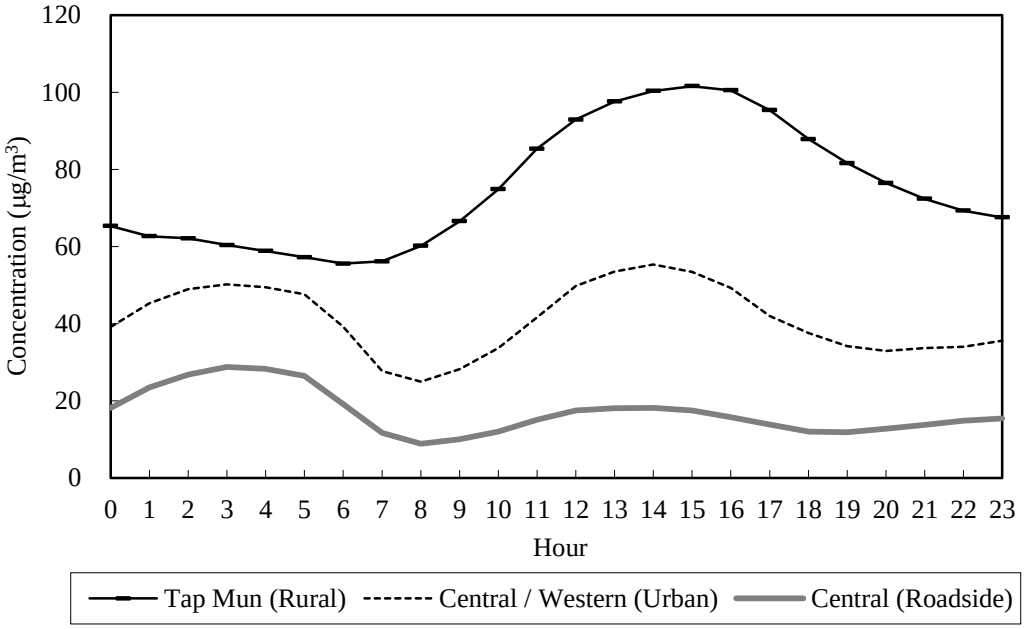


Figure 10: 2013 Diurnal variations of RSP



The diurnal pattern of O_3 is different from that of NO_2 and RSP. O_3 is formed by photochemical reactions of its precursor pollutants such as NOx and VOCs under sunlight. Outside urban centres the ambient O_3 levels start to build up before noon and peak in the afternoon, when precursor pollutants are accumulated and sunlight is strong. In urban areas and roadside, the lowest O_3 concentrations are often observed during rush hours. This is because a large amount of nitric oxide from rush-hour traffic acts as an efficient scavenger of O_3. At the roadside, O_3 levels are significantly lower than those at the general stations because of the scavenging effect due to higher concentrations of NOx from vehicular emissions.

Figure 11: 2013 Diurnal variations of O_3



5.2 Over a Year

Concentrations of NO_2, RSP and O_3 are in general lower in summer (June to August) than autumn and winter due to a number of reasons. The higher temperatures in summer months induce larger mixing heights, which favour the dispersion of pollutants. The rain in summer helps to wash out pollutants more frequently. The south-westerly monsoon in summer also helps to replenish the region with cleaner oceanic air.

Figure 12: Monthly variations of NO_2 and RSP at Central / Western in 2013

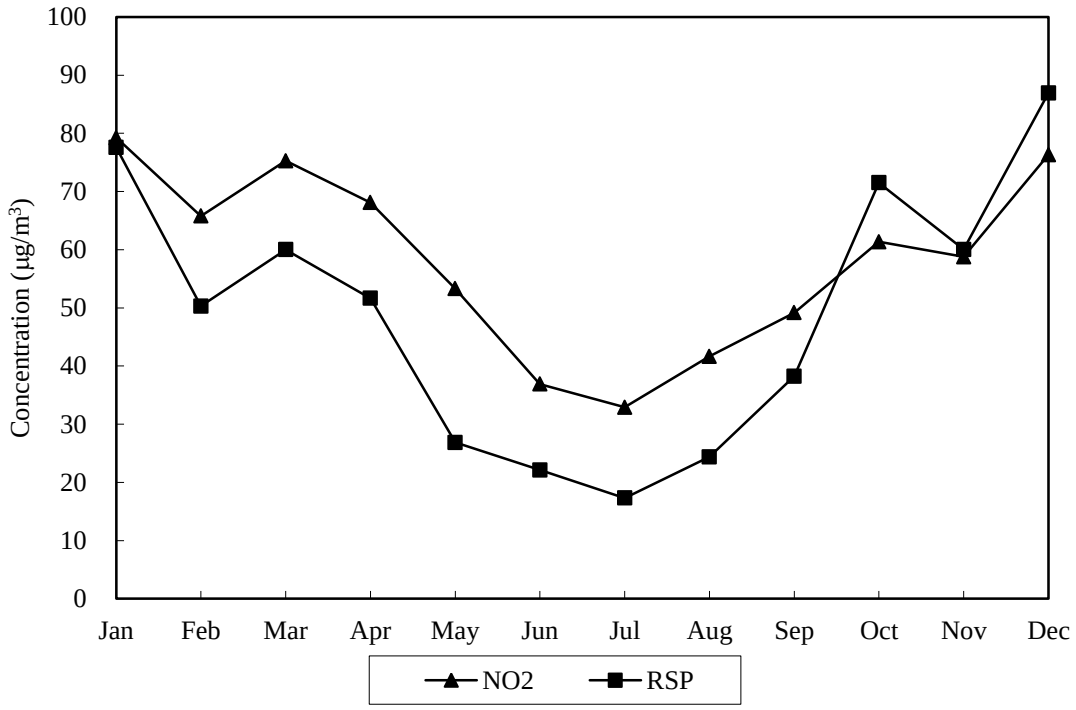
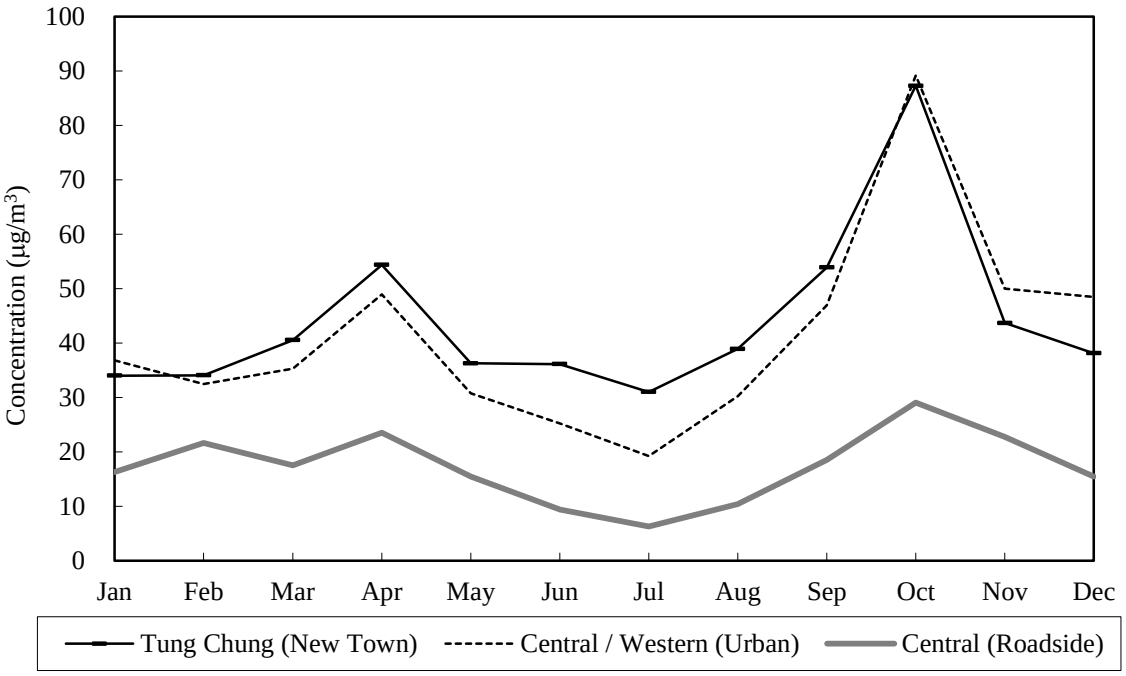


Figure 13: Monthly variations of O_3 in 2013



5.3 Long Term Trends

Air quality is affected by both emissions and meteorology. Over a short period, for instance a few months to a year, air quality is more subject to variations in weather and meteorological changes, such as stronger solar radiation which promotes photochemical smog formation or more rainfall that cleans the pollutants from the air, even though the emission levels remain more or less the same. Air quality is primarily affected by emission sources in the long run. Therefore a scientific way to assess air quality changes and the effectiveness of emission control measures is to examine the long-term trend of annual averaged pollutant concentrations over several years.

The long term trends of most air pollutants have reduced except O_3 in the general air and roadside NO_2.

As compared to 2012, the air quality in 2013 was slightly poorer, for instance, increases of the annual concentrations of 3 to 12 $\mu g/m^3$ in RSP and 1 to 13 $\mu g/m^3$ in ozone have been recorded respectively. These increases were likely attributable to the increasing influence of emissions outside Hong Kong and the fluctuation of meteorological conditions, e.g., an increase of sunshine and decrease of cloud cover, which would prone to higher photochemical air pollution formation.

The long-term trends for the air pollutants presented in this section are based on their annual average concentrations recorded from the relevant air quality monitoring stations categorised into four groups of land use types, namely Urban, New Town, Rural and Roadside as defined in Table 1 below.

Table 1: Classification of Air Monitoring Stations by Land Use Types

Land Use Type	Land Use Characteristics	Air Monitoring Stations
Urban	Densely populated residential areas mixed with some commercial and/or industrial areas	Central/Western, Eastern, Kwai Chung, Kwun Tong, Sham Shui Po and Tsuen Wan
New Town	Mainly residential areas	Sha Tin, Tai Po, Tung Chung and Yuen Long
Rural	Rural areas	Tap Mun (background station)
Roadside	Urban roadside in mixed residential/ commercial area with heavy traffic and surrounded by many tall buildings	Causeway Bay, Central and Mong Kok

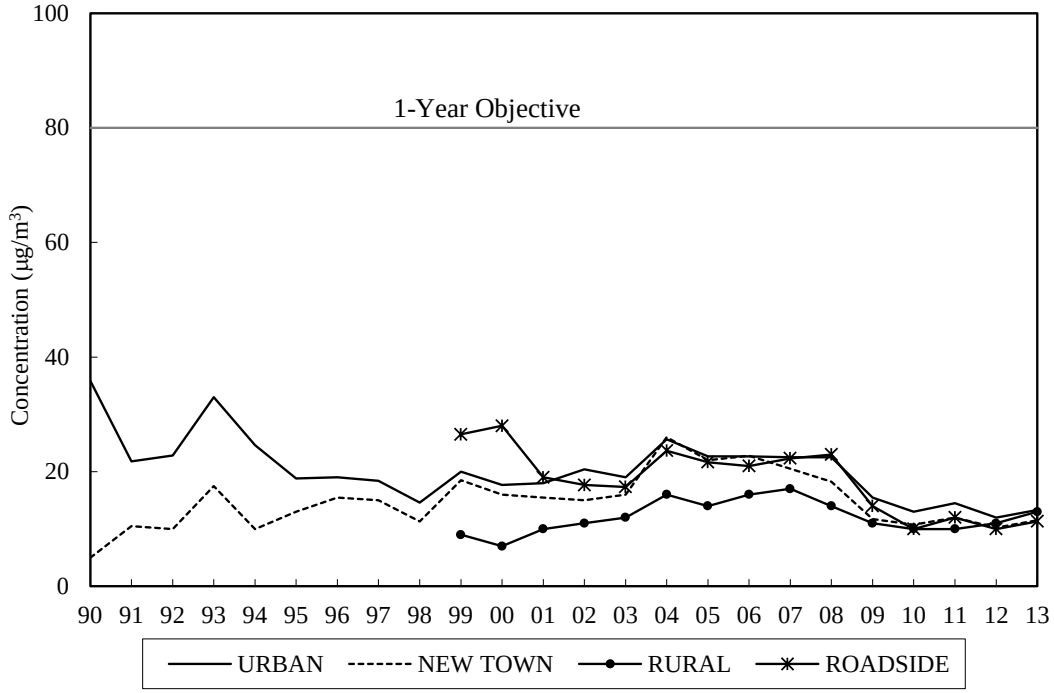
5.3.1 Sulphur Dioxide (SO_2)

Since the implementation of the Air Pollution Control (Fuel Restriction) Regulations in 1990 for restricting sulphur content of industrial fuels and the Air Pollution Control (Motor Vehicle Fuel) Regulations in 1995 for controlling motor vehicle fuel quality, SO_2 concentrations in Hong Kong have remained at levels well below the annual AQO limit of 80 $\mu g/m^3$. Significant improvement was noted in the past few years due to measures taken by Governments in Guangdong Province and Hong Kong, such as retrofitting power

plants with flue gas desulphurization devices, phasing out highly polluting industrial plants in the Pearl River Delta, introducing fuels with lower sulphur content, etc.

As a result of the introduction of ultra-low sulphur diesel for vehicle fleet in late 2000 and the subsequent introduction of Euro V motor diesel in Dec 2007, the average SO_2 concentration at roadside in 2013 (11 μg/m^3) dropped by 59% as compared with the 1999 value (27 μg/m^3).

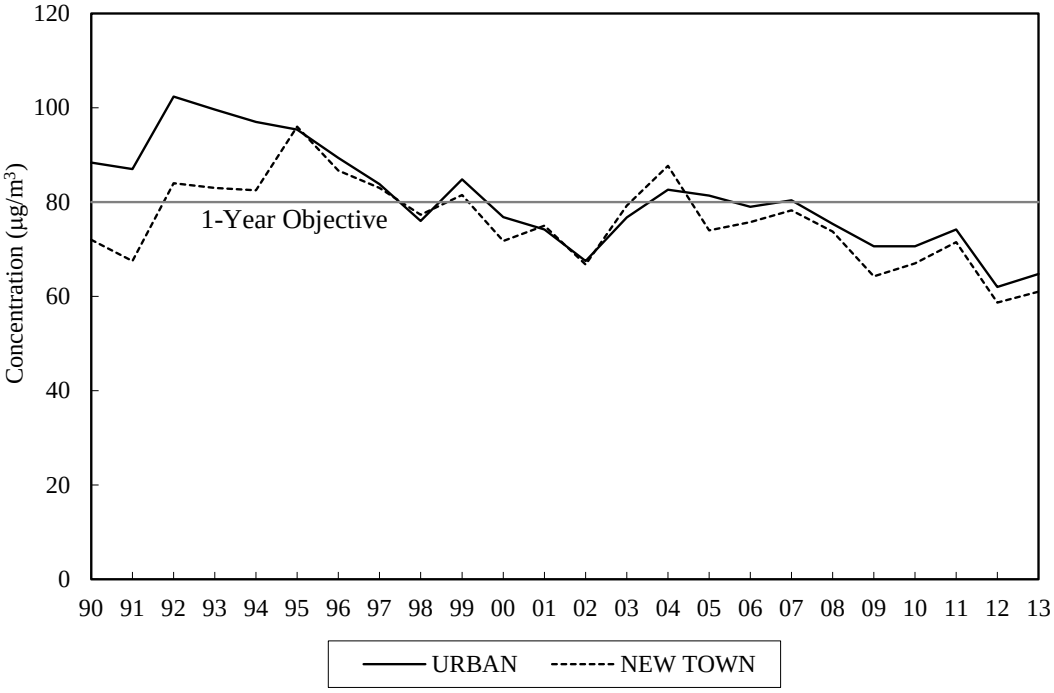
Figure 14: SO_2 long term trend



5.3.2 Total Suspended Particulates (TSP)

The TSP concentrations in the territory exhibited a general declining trend from mid-1990s.

Figure 15: TSP long term trend

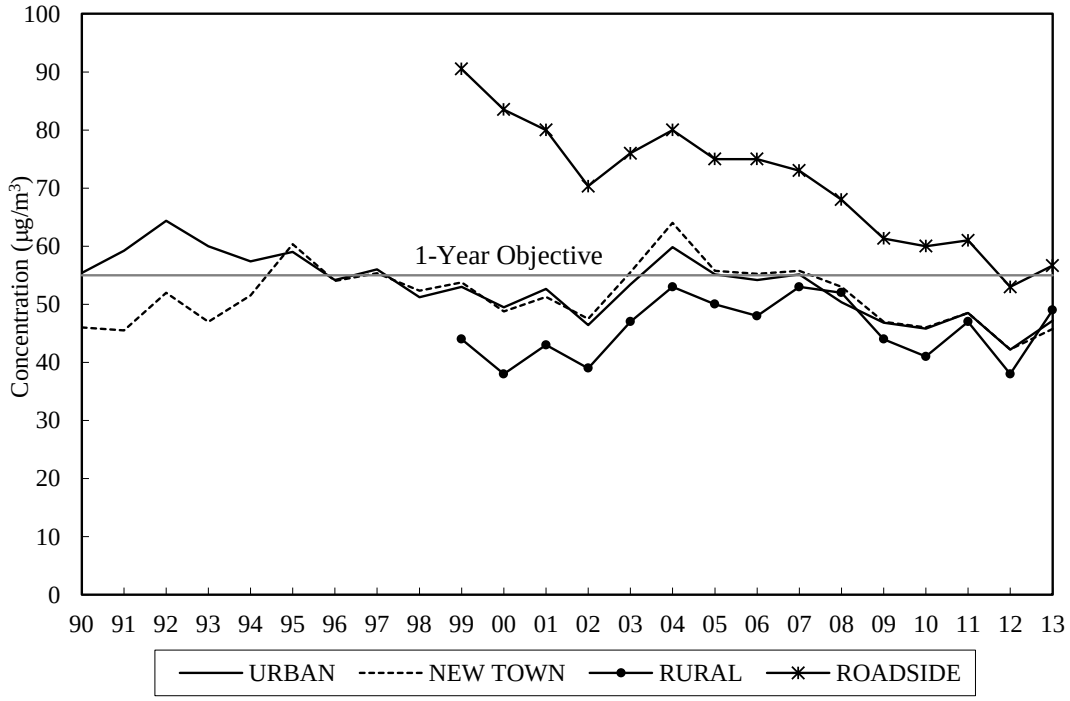


5.3.3 Respirable Suspended Particulates (RSP)

The ambient concentrations of RSP in the territory showed a primarily downward trend between 1995 and 2002, followed by a rebound that peaked in 2004 which was caused by the increase in regional background RSP levels. The RSP concentrations then dropped to a level below the annual AQO limit, reflecting a reduction in regional background RSP levels in the past few years.

In Hong Kong, high level of roadside RSP, caused mainly by the exhaust emissions of diesel vehicles, has long been a major air pollution concern. As a result of the implementation of various vehicle emission control measures in recent years, the annual average of RSP concentration at roadside in 2013 had reduced by 37% when compared with the 1999 value.

Figure 16: RSP long term trend



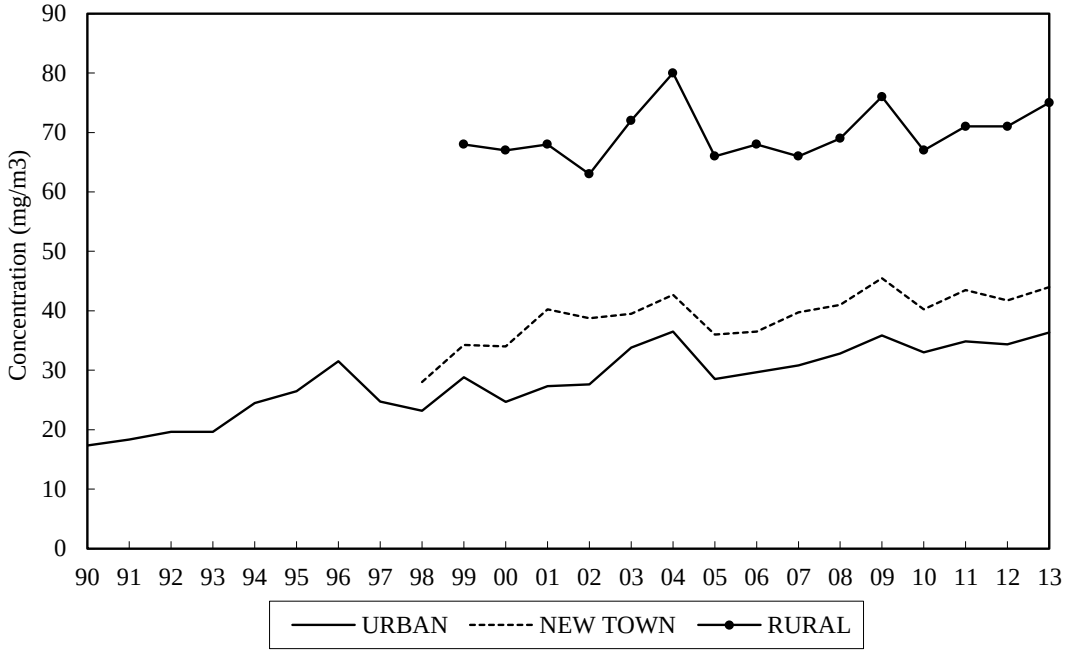
5.3.4 Ozone (O_3)

The O_3 concentrations in the territory have shown a moderate upward trend since 1990.

As nitric oxide emissions from motor vehicles can react with and remove O_3 in the air, regions with heavy traffic normally have lower O_3 levels than areas with light traffic. Hence, Tap Mun station has steadily recorded more than twice the O_3 levels measured in urban areas since the commencement of monitoring at rural area in 1999.

O_3, a major constituent of photochemical smog, is a regional air pollution issue. The Hong Kong Special Administrative Region Government and Guangdong Provincial Government are implementing a regional air quality management plan to alleviate photochemical smog problem and reduce O_3 levels in the Pearl River Delta region.

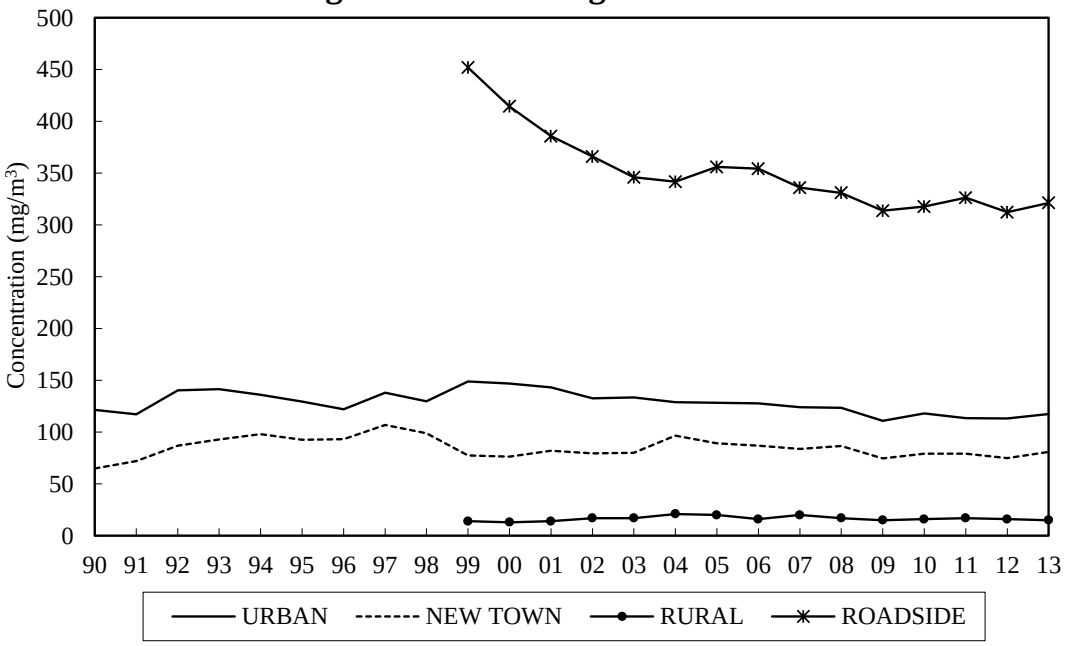
Figure 17: O3 long term trend



5.3.5 Nitrogen Oxides (NOx) and Nitrogen Dioxide (NO_2)

The annual average of NOx in urban areas exhibited a gradual declining trend over the past decade. During the same period, the roadside NOx concentration showed a more distinct decreasing trend, reflecting a reduction in vehicular NOx emission as a result of vehicle emission control measures implemented in the past decade. The roadside NOx concentration in 2013 was 29% lower than that in 1999.

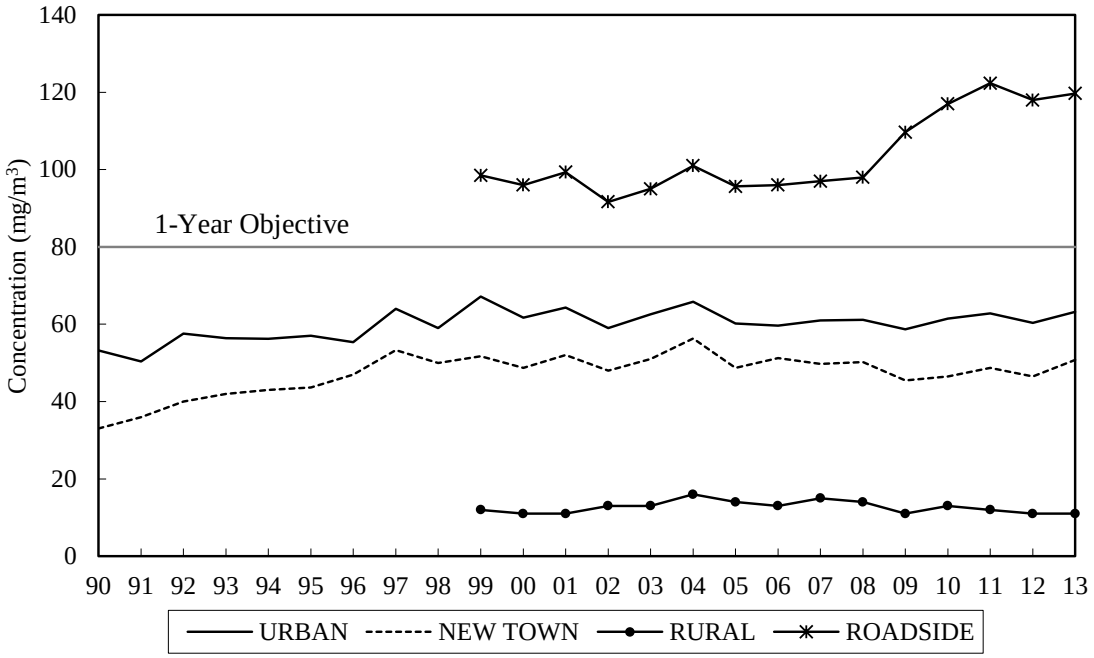
Figure 18: NOx long term trend



NO_2 is mainly formed from the oxidation of nitric oxide, a major component of NOx. The oxidation can be promoted by the presence of more ozone and VOCs in the ambient air. The ambient NO_2 levels have exhibited slow rising trends since 1990 but the trends have levelled off in recent years. The increasing trend of roadside NO_2 concentrations over the past years, which could be caused by a combination of the ageing of motor vehicles, increase in direct NO_2 emissions from motor vehicles and rise in regional background

ozone concentration promoting the conversion of nitric oxide emitted from motor vehicles to NO_2, was, by and large, stabilised in 2013. To address the problem of the elevated roadside NO_2 pollution, the government has put forward additional measures including supporting the transport trades to test green vehicles, testing the feasibility of installing after-treatment devices to franchised buses to reduce their NOx emissions, stepping up the control on emissions from petrol and liquefied petroleum gas vehicles and providing incentives to accelerate the phasing out of old and polluting diesel commercial vehicles.

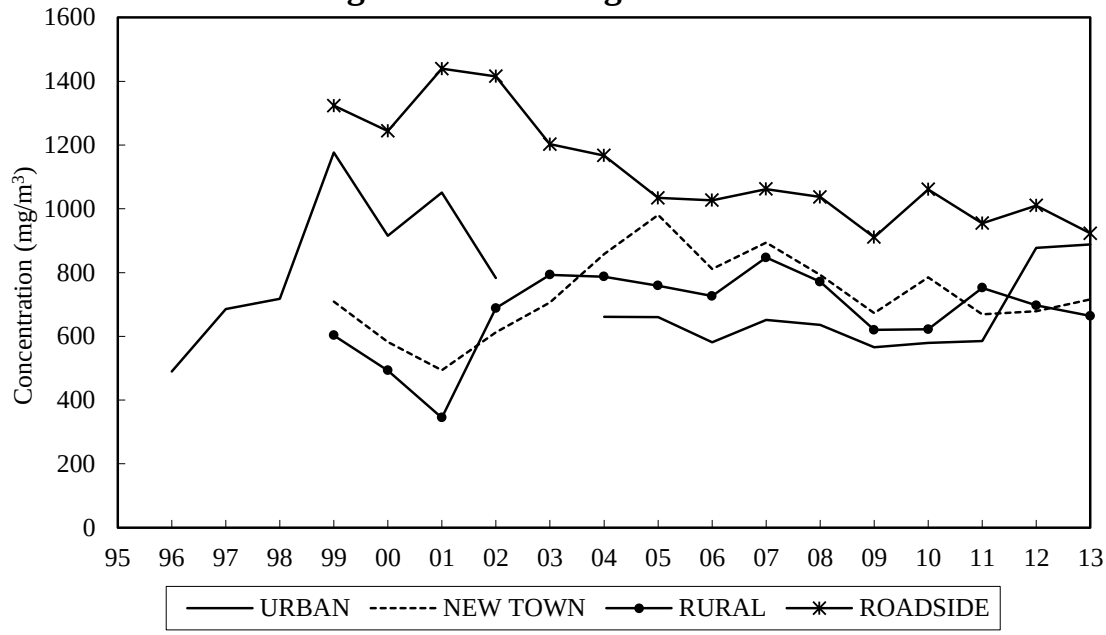
Figure 19: NO_2 long term trend



5.3.6 Carbon Monoxide (CO)

The concentrations of CO in Hong Kong remained at very low levels in the past several years. Even at the roadside close to the vehicular emission sources, the CO levels were well within the 1-hour AQO (30,000 μg/m^3) and 8-hour AQO (10,000 μg/m^3) levels.

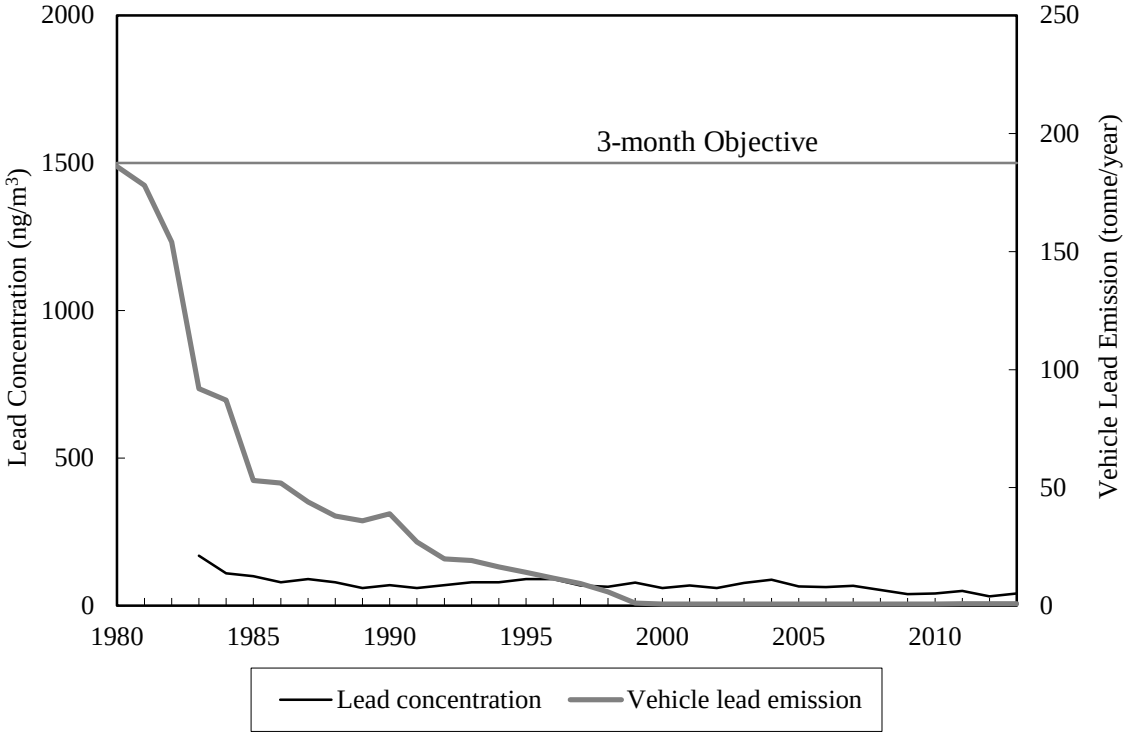
Figure 20: CO long term trend



5.3.7 Lead (Pb)

The ambient lead concentrations have been lingering at very low levels since the oil companies took voluntary action in reducing the lead content of petrol in the early eighties. Lead emissions from motor vehicles were further reduced as a result of the introduction of unleaded petrol in April 1992 and completely eliminated when the sale and supply of leaded petrol was banned in April 1999.

Figure 21: Vehicle lead emission and lead concentration



Appendix A

Air Quality Objectives and their Compliance Status

Established in 1987, the Hong Kong Air Quality Objectives (AQOs) for seven major air pollutants were set at levels to protect public health. The compliance status of the AQO has been used as the indicator of air quality in different districts in Hong Kong.

Table A1: Hong Kong Air Quality Objectives (AQOs) **

Concentration in micrograms per cubic metre [1]

Pollutant	Averaging Time				
	1 hour [2]	**8 hours** [3]	**24 hours** [3]	**3 months** [4]	**1 year** [4]
Sulphur dioxide (SO_2)	800		350		80
Total suspended particulates (TSP)			260		80
Respirable suspended particulates (RSP) [5]			180		55
Nitrogen dioxide (NO_2)	300		150		80
Carbon monoxide (CO)	30000	10000			
Photochemical oxidants (as ozone (O_3) [6])	240				
Lead (Pb)				1.5	

[1] Measured at 298K (25^{o}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 mean suspended particulates in air with a nominal aerodynamic diameter of 10 micrometres or smaller.
[6] Photochemical oxidants are determined by measurement of ozone only.

***Note: A new set of AQO has been implemented on 1 January 2014 to replace the above AQOs.*

Compliance with the short-term AQOs

Table A2 shows the percentage time of compliance with the short-term AQOs (i.e. 1-hour to 24-hour AQO) recorded at each of the monitoring stations in 2013. For NO_2, the compliance percentages of the 24-hour AQO were above 98% for general stations and between 80% to 90% for roadside stations; its 1-hour AQO compliance rates were above 99% for general stations and 98% for roadside stations. As regards TSP, the compliance percentage of the 24-hr AQO achieved 100% at all stations. For RSP, the 24-hour AQO compliance rates were well above 99% at all stations. The compliance levels of 1-hour AQO for O_3 were over 99% at all monitoring stations. The compliance percentage of SO_2 reached 100% for all stations. For CO, all monitoring stations achieved full compliance with AQO in 2013.

Table A2: Percentage Time in compliance with Short-Term Air Quality Objectives in 2013

Station		O_3	NO_2		TSP	RSP	SO_2		CO	
		1-hr	1-hr	24-hr	24-hr	24-hr	1-hr	24-hr	1-hr	8-hr
General Station	Central/Western	99.95	100	99.72	100	100	100	100	--	--
	Eastern	100	100	99.72	--	100	100	100	--	--
	Kwai Chung	100	99.99	98.89	100	100	100	100	--	--
	Kwun Tong	100	99.98	98.89	100	100	100	100	--	--
	Sham Shui Po #	100	99.98	98.63	(100)	100	100	100	--	--
	Tsuen Wan	99.99	100	100	100	100	100	100	100	100
	Sha Tin	99.92	100	100	100	100	100	100	--	--
	Tai Po ^	100	100	100	--	(100)	100	100	--	--
	Tung Chung	99.78	100	100	100	100	100	100	100	100
	Yuen Long	99.95	100	100	100	99.73	100	100	100	100
	Tap Mun	99.94	100	100	--	100	100	100	100	100
Roadside Station	Causeway Bay	100	99.11	81.62	--	100	100	100	100	100
	Central	100	98.91	80.49	--	100	100	100	100	100
	Mong Kok	100	99.78	89.17	100	99.72	100	100	100	100

Notes: Percentage in parentheses are based on less than 66% available data or unevenly distributed data

"--" *Not measured*

"#" Sham Shui Po Station - TSP data only available from July to December in the year

"^" Tai Po Station - RSP data not evenly distributed for compliance assessment

Compliance with the long-term AQO

Table A3 shows the compliance status of the long-term (annual) AQO for all 14 monitoring stations in 2013. Similar to previous years, all monitoring stations achieved full compliance with the long-term AQO for SO_2 and lead in 2013. Compliance with the annual AQO for NO_2 was recorded at 11 out of 14 stations. For TSP, all of the 9 stations complied with the annual AQO. The annual AQO for RSP was complied with at 11 out of 14 stations in 2013.

Table A3: Compliance Status of Long-Term (Annual) Air Quality Objectives in 2013

Station		NO_2	TSP	RSP	SO_2	Lead
		1-year	1-year	1-year	1-year	3-months
General Station	Central/Western	✓	✓	✓	✓	✓
	Eastern	✓	--	✓	✓	--
	Kwai Chung	✓	✓	✓	✓	✓
	Kwun Tong	✓	✓	✓	✓	✓
	Sham Shui Po	✓	(✓)	✓	✓	--
	Tsuen Wan	✓	✓	✓	✓	✓
	Sha Tin	✓	✓	✓	✓	--
	Tai Po	✓	--	(✓)	✓	--
	Tung Chung	✓	✓	✓	✓	✓
	Yuen Long	✓	✓	×	✓	✓
	Tap Mun	✓	--	✓	✓	--
Roadside Station	Causeway Bay	×	--	×	✓	--
	Central	×	--	×	✓	--
	Mong Kok	×	✓	✓	✓	✓

Notes: "✓" *Complied with the AQO* "×" *Violated the AQO* "--" *Not measured*

"(✓)" Measured data either insufficient or unevenly distributed for compliance assessment

Appendix B

Air Quality Monitoring Operation

B.1 Network Operation

The air quality monitoring network of 14 monitoring stations is operated by the Air Science Group of the Environmental Protection Department. Table B1 shows the station site information. 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) have been accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS) since August 1995.

In order to provide good representation of the air quality in areas of high population density, the locations of the 14 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.

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, RSP and FSP 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 three stations: Central/Western, Kwun Tong and Yuen Long. The parameters measured for all wet and dry samples include: pH, Na^+, K^+, NH_4^+, NO_3^-, SO_4^{2-}, Cl^-, F^-, Ca^{2+}, Mg^{2+}, formate and acetate in the filtrate.

B.2 Data Processing and Dissemination

At each monitoring station, signals from the continuous analysers and the meteorological instruments are first stored in a data logger and then sent back to the Data Processing Unit of the Air Science Group via dedicated telephone lines for further processing. After careful checking and validation, the monitoring data are disseminated to the public in the following manner:-

- Hourly Air Pollution Index ## (API) reporting for individual station
- Monthly release of the API summary for all monitoring stations
- Monthly updating the data in the Environmental Protection Interactive Centre (EPIC) for the public to download air quality monitoring data (http://www.epd.gov.hk/epd/epic/english/epichome.html)
- Reporting of monitoring data in the annual reports "*Air Quality in Hong Kong"* and "*Environment Hong Kong"*
- Ad hoc provision of air quality data to the public, academics and environmental consultants upon request for the purposes of research and air quality assessment

Note: The Air Pollution Index (API) has been replaced by the Air Quality Health Index (AQHI) on 30 December 2013.

The reporting and forecast of API will help the public (particularly susceptible groups such as the elderly, children and people with heart or respiratory illness) to decide on taking precautionary measures when necessary. The monitoring results are also regularly used to assist the formulation of air quality management plans and the 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, control limits of ±15% and ±10% are adopted for the gaseous pollutants and particulates (TSP, RSP and FSP) respectively. In 2013, 500 audit checks were carried out on the stations' analysers and samplers. Based on the 95% probability limits, the accuracy of the network was within the specified control limits as shown in Figure B1.

The precision, a measure of the repeatability, of the measurements is checked in accordance with EPD's quality manuals. In 2013, 2685 precision checks were carried out on the analysers and samplers. As shown in Figure B2 and based on the 95% probability limits, the precision of the network varied between -6.1% and 6.1%, which was again within the control limits of ±20% and ±10% for the gaseous pollutants and particulates (TSP, RSP and FSP) respectively.

In addition to the above operation, 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 Science Group installed in July 1997 additional monitoring facilities at 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 are analysed by the Government Laboratory.

Table B1: Fixed Network Monitoring Stations: Site Information

Monitoring Station	Address	Area Type	Sampling Height (Above P.D.H.K.)	Above Ground	Date Start Operation
Central/Western (Sai Ying Pun Community Complex)	2 High Street, Sai Ying Pun	Urban : Mixed residential/ commercial	82m	16m (5 floors)	Oct 09
Eastern (Sai Wan Ho Fire Station)	20 Wai Hang Street, Sai Wan Ho	Urban : Residential	28m	15m (4 floors)	Jan 99
Kwai Chung (Kwai Chung Police Station)	999 Kwai Chung Road, Kwai Chung	Urban : Mixed residential/ commercial/industrial	19m	13m (2 floors)	Jan 99
Kwun Tong (Yue Wah Mansion)	407-431 Kwun Tong Road, Kwun Tong	Urban : Mixed residential/ commercial/industrial	34m	25m	Apr 12
Sham Shui Po (Police Station)	37A Yen Chow Street, Sham Shui Po	Urban : Mixed residential/ commercial	21m	17m (4 floors)	Jul 84
Tsuen Wan (Princess Alexandra Community Centre)	60 Tai Ho Road, Tsuen Wan	Urban : Mixed residential/ commercial/industrial	21m	17m (4 floors)	Aug 88
Sha Tin (Sha Tin Govt. Secondary School)	11-17 Man Lai Road, Tai Wai, Sha Tin	New Town : Residential	31m	25m (6 floors)	Jul 91
Tai Po (Tai Po Govt. Office Bldg.)	1 Ting Kok Road, Tai Po	New Town : Residential	31m	25m (6 floors)	Feb 90
Tung Chung (Tung Chung Health Centre)	6 Fu Tung Street, Tung Chung	New Town : Residential	34.5m	27.5m (4 floors)	Apr 99
Yuen Long (Yuen Long District Branch Offices Bldg.)	269 Castle Peak Road Yuen Long	New Town : Residential	31m	25m (6 floors)	July 95
Tap Mun (Tap Mun Police Station)	Tap Mun	Background : Rural	26m	11m (3 floors)	Apr 98
Causeway Bay	1 Yee Woo Street, Causeway Bay	Urban Roadside : Mixed commercial/ residential area surrounded by many tall buildings	6.5m	3m	Jan 98
Central	Junction of Des Voeux Road Central and Chater Road, Central	Urban Roadside : Busy commercial/ financial area surrounded by many tall buildings	8.5m	4.5m	Oct 98
Mong Kok	Junction of Nathan Road and Lai Chi Kok Road	Urban Roadside : Mixed commercial/ residential area surrounded by many tall buildings	8.5m	3m	Jan 01

Note: P.D. = Principal Datum

Table B2: Summary of the Parameters Monitored in the Network (2013)

STATIONS	PARAMETERS										
	SO_2	NO_x	NO	NO_2	CO	O_3	FSP	RSP		TSP	MET [3]
								Cont [1]	Hi-Vol [2]		
Central/ Western	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Eastern	✓			✓		✓	✓	✓			✓
Kwai Chung	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Kwun Tong	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Sham Shui Po	✓	✓	✓	✓		✓	✓	✓		✓	✓
Tsuen Wan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sha Tin	✓	✓	✓	✓		✓	✓	✓		✓	✓
Tai Po	✓			✓		✓	✓	✓			✓
Tung Chung	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Yuen Long	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tap Mun	✓	✓	✓	✓	✓	✓	✓	✓			
Causeway Bay	✓	✓	✓	✓	✓	✓	✓	✓			
Central	✓	✓	✓	✓	✓	✓	✓	✓			
Mong Kok	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note:
[1] "Cont" denotes continuous monitoring.
[2] "Hi-Vol" denotes high-volume sampling.
[3] "MET" denotes meteorological parameters such as temperature, wind speed, wind direction, etc.

Table B3 List of Equipment Used in Measuring Air Pollutant Concentration

Pollutants	Measurement Principle	Commercial Instrument
SO_2	UV fluorescence	TECO 43A, API 100E, TECO 43I
NO, NO_2, NO_x	Chemiluminescence	API 200A
O_3	UV absorption	API 400, API 400A
SO_2, NO_2, O_3	Differential Optical Absorption Spectroscopy	Opsis AR 500 System
CO	Non-dispersive infra-red absorption with gas filter correlation	TECO 48C, API 300
TSP	Gravimetric	General Metal Works GS2310
RSP (PM10)	a) Gravimetric b) Oscillating microbalance	Graseby Andersen PM10 R&P TEOM Series 1400a-AB-PM10 Thermo Scientific TEOM 1405-DF
FSP (PM2.5)	a) Gravimetric b) Oscillating microbalance	Thermo Scientific Partisol-Plus 2025 R&P TEOM Series 1400a-AB-PM2.5 Thermo Scientific TEOM 1405-DF

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

Toxic Air Pollutants	Sampling and Analysis method	Sampling Instrument	Sampling Media	Sampling Schedule	Sampling Period
Benzene	USEPA Method TO-14A	Xontech 910A / RM 910A	Canister	Twice per month	24 hours
Perchloro-ethylene	USEPA Method TO-14A	Xontech 910A / RM 910A	Canister	Twice per month	24 hours
1,3-Butadiene	USEPA Method TO-14A	Xontech 910A / RM 910A	Canister	Twice per month	24 hours
Formaldehyde	USEPA Method TO-11A	Xontech 925 / RM 925 / ATEC 2200	DNPH coated silica gel cartridge	Once per month	24 hours
Benzo(a)pyrene	USEPA Method TO-13	Graseby GPS1 / Tisch TE-1000	Quartz fibre filter and polyurethane foam with XAD-2 resin	Once per month	24 hours
Dioxin	USEPA Method TO-9A	Graseby GPS1 / Tisch TE-1000	Quartz fibre filter and polyurethane foam	Once per month	24 hours
Hexavalent Chromium	CARB SOP MLD 039	Xontech 920 / Xontech 924	Bicarbonate Impregnated Filter	Once per month	24 hours

Figure B1: Accuracy of Air Quality Monitoring Network, 2013

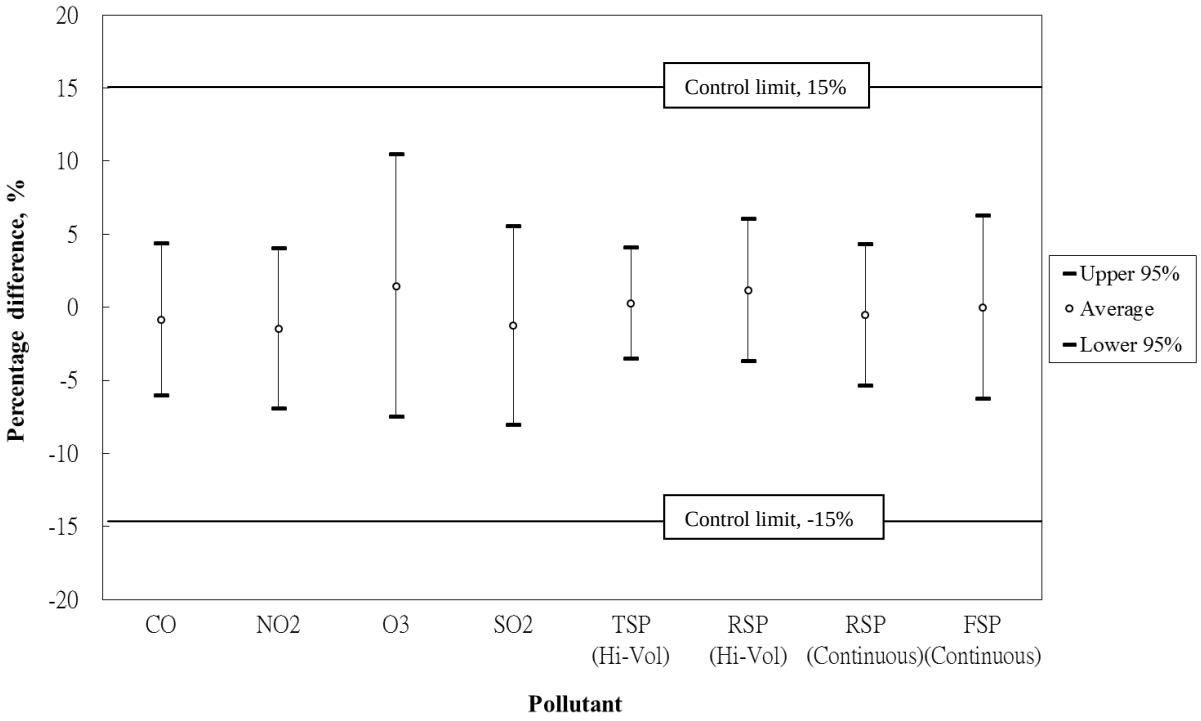
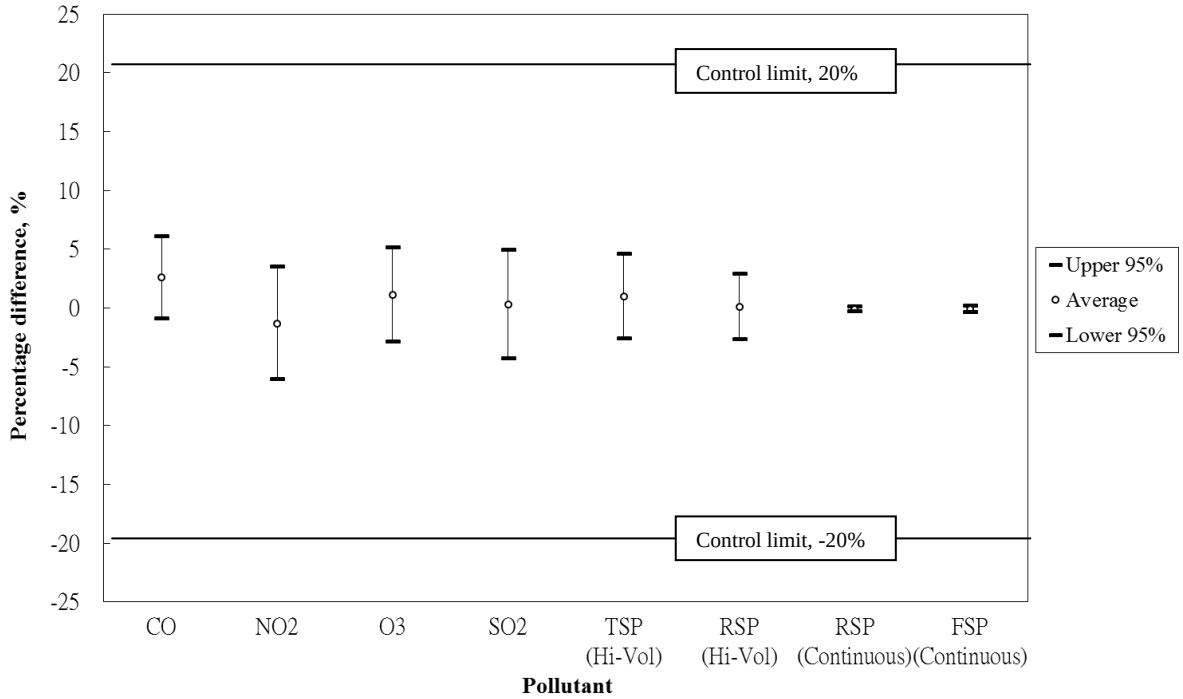


Figure B2: Precision of Air Quality Monitoring Network, 2013



Note: The Control Limits for TSP, RSP and FSP are ±10% for both Accuracy and Precision.

Appendix C

Tables of Air Quality Data

Table C1: The Highest 4 Hourly Pollutant Concentrations Measured in 2013

Pollutant: Sulphur Dioxide *
(1-hour AQO = 800)

Station	1st High	2nd High	3rd High	4th High
Central / Western	200	147	135	133
Eastern	89	81	80	78
Kwai Chung	254	239	228	209
Kwun Tong	96	90	79	79
Sham Shui Po	252	204	198	189
Tsuen Wan	120	120	119	118
Sha Tin	123	116	102	97
Tai Po	55	50	48	48
Tung Chung	96	92	91	86
Yuen Long	69	68	67	63
Tap Mun	59	58	57	57
Causeway Bay	105	92	86	85
Central	133	125	110	106
Mong Kok	204	178	176	167

Pollutant: Nitrogen Dioxide *
(1-hour AQO = 300)

Station	1st High	2nd High	3rd High	4th High
Central / Western	266	252	250	245
Eastern	230	227	225	220
Kwai Chung	306	298	279	275
Kwun Tong	339	311	286	276
Sham Shui Po	318	313	292	281
Tsuen Wan	274	270	260	257
Sha Tin	259	211	206	205
Tai Po	186	186	183	177
Tung Chung	210	204	199	197
Yuen Long	230	214	212	212
Tap Mun	109	109	107	106
Causeway Bay	454	453	428	426
Central	468	435	435	420
Mong Kok	434	406	402	373

Pollutant: Nitrogen Oxides

Station	1st High	2nd High	3rd High	4th High
Central / Western	1030	1019	866	835
Kwai Chung	1101	1095	949	931
Kwun Tong	1310	1070	1061	885
Sham Shui Po	1209	1136	1067	1042
Tsuen Wan	857	834	732	715
Sha Tin	666	527	519	512
Tung Chung	445	383	382	379
Yuen Long	715	585	571	560
Tap Mun	143	143	117	116
Causeway Bay	1570	1527	1295	1281
Central	1899	1825	1770	1650
Mong Kok	1497	1349	1276	1264

Pollutant: Nitric Oxide

Station	1st High	2nd High	3rd High	4th High
Central / Western	545	511	460	448
Kwai Chung	614	610	515	473
Kwun Tong	694	560	540	454
Sham Shui Po	634	588	537	527
Tsuen Wan	468	408	384	378
Sha Tin	333	278	251	248
Tung Chung	180	179	179	162
Yuen Long	382	286	275	275
Tap Mun	44	42	37	33
Causeway Bay	824	780	629	603
Central	1025	993	940	874
Mong Kok	789	696	663	653

Pollutant: Carbon Monoxide *
(1-hour AQO = 30000)

Station	1st High	2nd High	3rd High	4th High
Tsuen Wan	2070	1820	1750	1740
Tung Chung	1810	1770	1710	1680
Yuen Long	2690	2470	2410	2330
Tap Mun	1530	1490	1490	1490
Causeway Bay	4070	3670	3470	3280
Central	2680	2630	2550	2510
Mong Kok	2550	2460	2370	2370

Pollutant: Ozone *
(1-hour AQO = 240)

Station	1st High	2nd High	3rd High	4th High
Central / Western	258	247	245	244
Eastern	192	187	176	175
Kwai Chung	219	189	166	162
Kwun Tong	207	202	192	189
Sham Shui Po	223	203	179	176
Tsuen Wan	245	228	207	187
Sha Tin	293	280	270	259
Tai Po	213	209	207	206
Tung Chung	314	285	284	281
Yuen Long	254	249	248	242
Tap Mun	263	263	260	252
Causeway Bay	120	107	98	98
Central	124	122	122	121
Mong Kok	121	120	110	104

Pollutant: Respirable Suspended Particulates (PM10)

Station	1st High	2nd High	3rd High	4th High
Central / Western	251	237	232	204
Eastern	180	179	171	170
Kwai Chung	231	230	222	217
Kwun Tong	212	209	209	206
Sham Shui Po	214	204	201	199
Tsuen Wan	200	193	192	189
Sha Tin	198	197	197	193
Tai Po	205	198	191	189
Tung Chung	234	229	225	224
Yuen Long	242	237	232	231
Tap Mun	256	237	236	227
Causeway Bay	227	218	211	210
Central	252	248	239	233
Mong Kok	276	273	264	263

Pollutant: Fine Suspended Particulates (PM2.5)

Station	1st High	2nd High	3rd High	4th High
Central / Western	198	180	178	162
Eastern	128	122	122	120
Kwai Chung	197	195	195	179
Kwun Tong	160	159	155	153
Sham Shui Po	153	151	151	151
Tsuen Wan	131	126	126	125
Sha Tin	171	171	167	166
Tai Po	178	165	165	161
Tung Chung	158	154	151	149
Yuen Long	191	190	188	188
Tap Mun	176	175	174	173
Causeway Bay	175	174	171	169
Central	155	148	146	145
Mong Kok	234	227	224	214

Notes:
1. All concentration units are in microgram per cubic metre.
2. Shaded 1-hour averages are above their respective AQO.
3. Only the asterisked pollutants have hourly AQO.

Table C2: The Highest 2 Daily Pollutant Concentrations Measured in 2013

Pollutant: Nitrogen Dioxide * (24-hour AQO = 150)

Station	1st High	2nd High
Central / Western	162	148
Eastern	162	137
Kwai Chung	161	159
Kwun Tong	194	177
Sham Shui Po	182	160
Tsuen Wan	141	138
Sha Tin	136	124
Tai Po	125	109
Tung Chung	140	132
Yuen Long	129	117
Tap Mun	53	47
Causeway Bay	287	259
Central	277	260
Mong Kok	260	239

Pollutant: Sulphur Dioxide * (24-hour AQO = 350)

Station	1st High	2nd High
Central / Western	54	42
Eastern	46	41
Kwai Chung	105	90
Kwun Tong	54	46
Sham Shui Po	76	76
Tsuen Wan	51	46
Sha Tin	45	35
Tai Po	36	30
Tung Chung	54	44
Yuen Long	53	40
Tap Mun	51	30
Causeway Bay	39	38
Central	52	50
Mong Kok	72	60

Pollutant: Respirable Suspended Particulates * (24-hour AQO = 180)

Station	1st High	2nd High
Central / Western	153	153
Eastern	133	122
Kwai Chung	151	142
Kwun Tong	171	167
Sham Shui Po	148	144
Tsuen Wan	141	137
Sha Tin	144	143
Tai Po	145	136
Tung Chung	133	132
Yuen Long	184	174
Tap Mun	175	173
Causeway Bay	170	166
Central	158	153
Mong Kok	181	148

Pollutant: Nitrogen Oxides

Station	1st High	2nd High
Central / Western	374	343
Kwai Chung	388	341
Kwun Tong	594	437
Sham Shui Po	422	370
Tsuen Wan	358	300
Sha Tin	253	240
Tung Chung	202	192
Yuen Long	273	237
Tap Mun	67	60
Causeway Bay	877	771
Central	881	743
Mong Kok	677	567

Pollutant: Nitric Oxide

Station	1st High	2nd High
Central / Western	159	146
Kwai Chung	187	175
Kwun Tong	262	182
Sham Shui Po	178	152
Tsuen Wan	172	136
Sha Tin	94	92
Tung Chung	82	67
Yuen Long	99	95
Tap Mun	20	9
Causeway Bay	386	336
Central	412	376
Mong Kok	304	261

Pollutant: Carbon Monoxide * (8-hour AQO = 10000)

Station	1st High	2nd High
Tsuen Wan	1699	1691
Tung Chung	1640	1631
Yuen Long	1950	1929
Tap Mun	1441	1440
Causeway Bay	2860	2816
Central	2226	2221
Mong Kok	2044	2035

Pollutant: Ozone

Station	1st High	2nd High
Central / Western	128	118
Eastern	110	101
Kwai Chung	101	99
Kwun Tong	126	120
Sham Shui Po	102	102
Tsuen Wan	96	95
Sha Tin	139	128
Tai Po	119	116
Tung Chung	129	126
Yuen Long	110	103
Tap Mun	172	161
Causeway Bay	51	51
Central	69	66
Mong Kok	71	54

Pollutant: Fine Suspended Particulates (PM2.5)

Station	1st High	2nd High
Central / Western	120	118
Eastern	109	105
Kwai Chung	127	120
Kwun Tong	122	119
Sham Shui Po	116	111
Tsuen Wan	111	99
Sha Tin	118	114
Tai Po	112	108
Tung Chung	93	90
Yuen Long	140	137
Tap Mun	127	107
Causeway Bay	134	131
Central	107	88
Mong Kok	147	107

Pollutant: Total Suspended Particulates * (24-hour AQO = 260)

Station	1st High	2nd High
Central / Western	135	125
Kwai Chung	168	140
Kwun Tong	138	129
Sham Shui Po ^	133	131
Tsuen Wan	156	140
Sha Tin	136	121
Tung Chung	150	140
Yuen Long	218	181
Mong Kok	154	143

Notes:

1. All concentration units are in microgram per cubic metre.
2. Values for Carbon Monoxide are 8-hour averages.
3. Shaded 24-hour averages are above their respective AQO.
4. Only the asterisked pollutants have either 8-hour or 24-hour AQO.
5. ^ Sham Shui Po Station - TSP data are only available from July to December in the year.

Table C3: 2013 Monthly and Annual Averages of Air Pollutants

Pollutant: Sulphur Dioxide (Annual AQO = 80)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central / Western	14	9	17	10	9	7	7	10	8	13	7	17	11
Eastern	10	5	9	7	5	4	4	8	6	9	6	16	7
Kwai Chung	17	17	25	25	34	26	18	26	10	15	11	19	20
Kwun Tong	14	10	12	11	11	10	8	13	10	12	11	18	12
Sham Shui Po	14	13	18	14	16	10	8	19	8	12	11	21	14
Tsuen Wan	15	15	18	16	19	15	14	16	11	14	13	22	16
Sha Tin	11	10	15	11	12	10	9	12	9	14	7	18	11
Tai Po	9	3	9	11	9	7	7	9	8	12	10	15	9
Tung Chung	18	13	13	13	9	7	9	11	15	20	14	28	14
Yuen Long	13	10	12	10	8	8	8	13	10	15	13	23	12
Tap Mun	15	10	12	12	10	9	11	12	12	18	16	20	13
Causeway Bay	17	11	13	6	9	4	5	10	9	11	9	15	10
Central	17	13	17	14	11	6	6	11	8	14	9	18	12
Mong Kok	14	9	17	11	10	8	7	13	8	12	9	19	12

Pollutant: Nitrogen Oxides

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central / Western	123	123	148	107	96	64	63	73	71	70	73	96	92
Kwai Chung	162	154	174	157	169	138	128	151	104	124	111	153	144
Kwun Tong	121	98	140	123	140	130	98	135	78	81	78	126	112
Sham Shui Po	162	147	178	155	141	104	112	122	110	100	103	126	130
Tsuen Wan	135	134	132	121	121	95	98	103	77	91	86	128	110
Sha Tin	103	69	95	73	75	55	63	71	50	69	62	114	75
Tung Chung	115	93	85	71	61	40	37	49	52	72	80	116	73
Yuen Long	139	97	114	98	91	77	79	87	72	84	80	123	95
Tap Mun	21	11	19	16	16	10	9	15	11	13	16	22	15
Causeway Bay	401	335	350	248	327	301	298	333	263	280	273	382	316
Central	377	333	381	344	344	309	299	330	269	316	276	353	328
Mong Kok	358	329	369	340	336	309	330	337	283	298	253	292	320

Pollutant: Nitric Oxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central / Western	29	37	48	26	28	18	20	20	14	6	9	13	22
Kwai Chung	51	56	61	53	70	55	54	60	33	25	28	41	49
Kwun Tong	32	28	47	39	52	51	37	49	21	13	17	36	35
Sham Shui Po	45	47	60	46	48	34	40	41	32	15	22	28	38
Tsuen Wan	35	44	39	33	40	32	36	34	19	15	19	29	31
Sha Tin	26	18	25	16	21	14	21	21	11	10	11	30	19
Tung Chung	28	25	19	15	16	10	12	14	10	7	14	20	16
Yuen Long	41	29	33	27	30	26	29	29	17	13	15	32	27
Tap Mun	1	1	2	2	2	2	2	3	3	3	5	5	3
Causeway Bay	164	140	145	90	140	133	136	146	102	89	98	145	127
Central	152	141	163	136	152	141	139	150	105	103	99	130	134
Mong Kok	147	138	155	136	150	143	158	155	116	98	93	108	133

Pollutant: Nitrogen Dioxide (Annual AQO = 80)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central / Western	79	66	75	68	53	37	33	42	49	61	59	76	58
Eastern	79	64	76	70	56	40	39	43	51	61	55	65	58
Kwai Chung	84	68	80	76	61	54	46	59	54	86	68	90	69
Kwun Tong	72	55	68	63	60	52	42	60	46	61	51	70	59
Sham Shui Po	93	76	87	85	68	53	50	60	62	77	69	83	72
Tsuen Wan	82	67	73	71	60	46	43	52	49	68	57	84	63
Sha Tin	64	41	57	49	44	34	31	40	33	55	45	69	47
Tai Po	62	41	63	58	51	38	39	48	43	62	54	69	53
Tung Chung	71	54	55	49	38	24	19	28	36	61	59	86	49
Yuen Long	76	54	63	56	45	37	34	43	46	64	57	74	54
Tap Mun	18	10	16	14	13	8	6	10	7	9	9	14	11
Causeway Bay	151	121	127	110	112	98	90	110	107	144	123	161	121
Central	145	117	132	137	111	94	86	101	108	159	124	155	122
Mong Kok	133	118	133	132	107	90	88	99	107	148	112	127	116

Pollutant: Carbon Monoxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tsuen Wan	961	896	856	998	719	837	885	966	755	824	859	1091	888
Tung Chung	997	825	694	626	473	616	371	538	567	690	693	887	665
Yuen Long	1159	780	917	867	645	619	531	572	616	770	675	1049	767
Tap Mun	806	910	891	762	484	572	538	568	389	605	634	813	664
Causeway Bay	1734	1320	1036	913	817	764	616	946	824	905	955	1209	1004
Central	997	748	813	829	707	611	532	657	508	689	624	884	717
Mong Kok	1178	1079	1169	1072	1076	963	919	835	914	1091	1010	1259	1048

Table C3 (Cont.): 2013 Monthly and Annual Averages of Air Pollutants

Pollutant: Ozone

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central / Western	37	32	35	49	31	25	19	30	47	89	50	48	41
Eastern	38	33	32	44	32	26	21	29	42	72	47	46	39
Kwai Chung	31	31	28	37	20	11	10	14	36	61	41	40	30
Kwun Tong	47	44	43	55	31	23	19	21	52	86	57	52	44
Sham Shui Po	24	24	27	34	22	20	15	20	36	69	43	43	31
Tsuen Wan	28	26	30	40	21	20	16	21	43	70	40	39	33
Sha Tin	47	49	43	59	38	30	23	30	60	86	59	49	48
Tai Po	51	46	40	57	37	21	19	30	56	96	67	47	47
Tung Chung	34	34	41	54	36	36	31	39	54	87	44	38	44
Yuen Long	31	35	32	39	26	22	19	30	45	78	46	41	37
Tap Mun	78	73	73	85	55	51	47	53	79	125	88	90	75
Causeway Bay	14	14	13	16	11	7	5	7	16	30	20	14	14
Central	16	22	18	23	15	9	6	10	18	29	23	15	17
Mong Kok	11	9	9	13	7	7	5	7	14	27	18	22	12

Pollutant: Respirable Suspended Particulates (Annual AQO = 55)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central / Western	78	50	60	52	27	22	17	24	38	72	60	87	49
Eastern	58	39	49	49	26	21	16	26	37	71	56	72	43
Kwai Chung	75	42	48	52	32	24	18	30	35	68	53	79	46
Kwun Tong	65	39	49	51	29	29	24	37	44	85	72	95	52
Sham Shui Po	66	40	50	52	29	25	20	31	38	68	58	82	46
Tsuen Wan	64	38	44	46	29	29	24	35	39	77	56	77	47
Sha Tin	70	36	43	46	24	18	14	23	33	69	53	80	42
Tai Po	69	33	48	47	25	21	19 *	31 *	33 *	71 *	49 *	83 *	#
Tung Chung	78	41	41	42	21	16	12	21	33	72	52	74	42
Yuen Long	79	41	46	46	32	29	24	38	51	97	76	112	56
Tap Mun	62	38	46	45	24	22	18	30	45	86	71	94	49
Causeway Bay	84	58	69	66	47	44	39	50	62	84	69	98	64
Central	79	52	60	64	39	36	28	37	47	81	65	87	56
Mong Kok	73	44	53	60	33	28	26	36	46	70	58	78	50

Pollutant: Fine Suspended Particulates (PM2.5)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central / Western	55	35	40	37	18	14	10	17	25	48	36	65	33
Eastern	41	26	28	33	17	13	9	16	25	47	33	53	28
Kwai Chung	57	29	31	38	20	15	11	19	23	48	34	62	32
Kwun Tong	43	25	29	34	19	18	13	23	28	53	40	65	33
Sham Shui Po	45	27	31	35	20	16	13	21	26	45	33	61	31
Tsuen Wan	47	27	30	34	20	17	13	20	25	51	34	55	31
Sha Tin	51	24	28	32	15	10	7	13	20	47	32	63	29
Tai Po	51	23	30	34	16	12	11 *	20 *	20 *	50 *	32 *	62 *	#
Tung Chung	50	25	23	27	13	8	6	12	20	44	28	53	26
Yuen Long	50	27	29	32	21	16	12	21	32	65	48	85	37
Tap Mun	43	24	29	32	16	11	7	12	22	48	39	67	30
Causeway Bay	61	41	45	50	34	31	28	35	29 *	54	44	74	45
Central	50	32	36	41	26	20	18	24	31	51	38	57 *	34
Mong Kok	56	31	35	41	21	17	16	23	29	44	32	55	33

Pollutant: Total Suspended Particulates (Annual AQO = 80)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central / Western	100	62	68	49	40	29	23	40	54	97	89	99	63
Kwai Chung	113	58	65	57	47	33	31	53	51	92	88	82	66
Kwun Tong	95	68	69	52	43	24	25	55	48	96	99	104	65
Sham Shui Po	-	-	-	-	-	-	28	53	54	94	96	100	#
Tsuen Wan	112	62	60	49	39	28	32	61	52	99	89	93	65
Sha Tin	94	63	52	42	32	25	22	44	43	88	85	90	57
Tung Chung	106	54	46	43	28	29	25	27	47	83	80	103	53
Yuen Long	149	76	65	50	39	30	28	50	58	109	103	141	73
Mong Kok	107	81	85	56	52	37	36	55	63	108	107	107	75

Notes:

1. All units are in microgram per cubic metre.
2. Shaded annual averages are above their respective AQO.
3. Asterisked values are below their respective minimum data requirement of 66% for number of data within the period.
4. # Annual average is not published for noncompliance with the representative requirement of no less than 2/3 representative period in a quarter.

Table C4: 2013 Hourly Statistics of Air Pollutants

Pollutant: Sulphur Dioxide

Station	No. of hours	Data capture rate %	<----------Percentiles---------->								Arithmetic mean	Highest 1 hour	Highest 24 hour
			10	25	50	75	90	95	98	99			
Central / Western	8398	95.9	2	4	7	13	23	32	44	55	11	200	54
Eastern	8657	98.8	2	3	5	9	15	22	32	41	7	89	46
Kwai Chung	8632	98.5	5	7	10	24	51	69	94	113	20	254	105
Kwun Tong	8553	97.6	6	7	10	13	19	25	39	47	12	96	54
Sham Shui Po	8585	98.0	3	5	8	14	28	47	72	89	14	252	76
Tsuen Wan	8486	96.9	6	8	12	19	30	40	52	63	16	120	51
Sha Tin	8578	97.9	5	6	9	13	21	30	41	51	11	123	45
Tai Po	8488	96.9	4	6	8	11	16	19	24	28	9	55	36
Tung Chung	8521	97.3	7	8	12	17	25	31	40	47	14	96	54
Yuen Long	8601	98.2	4	6	9	15	23	28	36	43	12	69	53
Tap Mun	8391	95.8	8	9	12	15	20	25	30	33	13	59	51
Causeway Bay	8505	97.1	2	4	7	13	21	29	37	44	10	105	39
Central	8629	98.5	4	6	8	14	24	33	45	54	12	133	52
Mong Kok	8532	97.4	3	4	7	13	23	35	55	71	12	204	72

Pollutant: Nitrogen Oxides

Station	No. of hours	Data capture rate %	<----------Percentiles---------->								Arithmetic mean	Highest 1 hour	Highest 24 hour
			10	25	50	75	90	95	98	99			
Central / Western	8557	97.7	27	46	72	109	171	228	343	435	92	1030	374
Kwai Chung	8561	97.7	51	82	124	179	254	312	414	476	144	1101	388
Kwun Tong	8562	97.7	32	52	84	139	232	292	372	434	112	1310	594
Sham Shui Po	8620	98.4	42	78	116	158	214	271	371	478	130	1209	422
Tsuen Wan	8456	96.5	36	67	95	132	192	249	329	384	110	857	358
Sha Tin	8632	98.5	20	30	51	91	163	224	294	344	75	666	253
Tung Chung	8497	97.0	18	31	56	102	152	183	219	239	73	445	202
Yuen Long	8603	98.2	38	55	80	113	166	215	279	336	95	715	273
Tap Mun	8408	96.0	6	8	12	18	26	35	52	67	15	143	67
Causeway Bay	8508	97.1	117	175	266	415	586	687	813	891	316	1570	877
Central	8637	98.6	112	179	292	425	588	713	839	979	328	1899	881
Mong Kok	8523	97.3	121	212	324	410	492	553	635	698	320	1497	677

Pollutant: Nitric Oxide

Station	No. of hours	Data capture rate %	<----------Percentiles---------->								Arithmetic mean	Highest 1 hour	Highest 24 hour
			10	25	50	75	90	95	98	99			
Central / Western	8557	97.7	2	4	9	23	52	86	154	206	22	545	159
Kwai Chung	8561	97.7	7	17	34	64	105	140	192	233	49	614	187
Kwun Tong	8562	97.7	3	7	18	43	93	125	162	199	35	694	262
Sham Shui Po	8620	98.4	4	13	27	46	77	107	169	228	38	634	178
Tsuen Wan	8456	96.5	4	10	21	39	67	96	142	180	31	468	172
Sha Tin	8632	98.5	1	2	5	19	55	83	116	141	19	333	94
Tung Chung	8497	97.0	2	3	7	20	43	60	78	93	16	180	82
Yuen Long	8603	98.2	4	8	18	34	58	81	113	141	27	382	99
Tap Mun	8408	96.0	0	1	2	3	5	5	9	14	3	44	20
Causeway Bay	8508	97.1	32	56	99	175	261	315	386	431	127	824	386
Central	8636	98.6	28	58	110	182	268	332	415	502	134	1025	412
Mong Kok	8520	97.3	35	76	130	180	227	260	305	345	133	789	304

Pollutant: Nitrogen Dioxide

Station	No. of hours	Data capture rate %	<----------Percentiles---------->								Arithmetic mean	Highest 1 hour	Highest 24 hour
			10	25	50	75	90	95	98	99			
Central / Western	8557	97.7	22	33	52	76	101	119	146	164	58	266	162
Eastern	8636	98.6	26	38	55	74	92	106	129	153	58	230	162
Kwai Chung	8561	97.7	33	46	62	84	112	136	165	181	69	306	161
Kwun Tong	8562	97.7	25	36	53	73	95	117	152	186	59	339	194
Sham Shui Po	8620	98.4	34	48	67	90	114	132	158	174	72	318	182
Tsuen Wan	8456	96.5	28	42	57	77	103	121	141	162	63	274	141
Sha Tin	8632	98.5	17	25	39	58	89	115	141	159	47	259	136
Tai Po	8488	96.9	26	35	47	65	87	102	122	134	53	186	125
Tung Chung	8497	97.0	12	23	41	67	95	114	138	154	49	210	140
Yuen Long	8603	98.2	26	35	48	67	91	108	133	149	54	230	129
Tap Mun	8408	96.0	3	5	9	14	21	28	39	49	11	109	53
Causeway Bay	8508	97.1	55	80	112	151	199	232	270	295	121	454	287
Central	8636	98.6	55	80	114	155	199	227	271	304	122	468	277
Mong Kok	8520	97.3	57	83	112	145	179	200	230	251	116	434	260

Table C4 (Cont.): 2013 Hourly Statistics of Air Pollutants

Pollutant: Carbon Monoxide

Station	No. of hours	Data capture rate %	<----------Percentiles---------->								Arithmetic mean	Highest 1 hour	Highest 8 hour
			10	25	50	75	90	95	98	99			
Tsuen Wan	8433	96.3	660	750	870	1000	1150	1280	1380	1460	888	2070	1699
Tung Chung	8567	97.8	380	480	620	790	1010	1150	1310	1390	665	1810	1640
Yuen Long	8585	98.0	470	550	700	920	1160	1320	1520	1682	767	2690	1950
Tap Mun	8370	95.5	400	480	610	830	980	1090	1280	1330	664	1530	1441
Causeway Bay	8328	95.1	540	690	910	1230	1580	1840	2150	2380	1004	4070	2860
Central	8627	98.5	330	480	670	910	1160	1327	1520	1680	717	2680	2226
Mong Kok	8529	97.4	750	860	1020	1200	1380	1510	1680	1804	1048	2550	2044

Pollutant: Ozone

Station	No. of hours	Data capture rate %	<----------Percentiles---------->								Arithmetic mean	Highest 1 hour	Highest 24 hour
			10	25	50	75	90	95	98	99			
Central / Western	8537	97.5	5	15	32	61	89	105	127	141	41	258	128
Eastern	8656	98.8	11	20	33	52	73	88	106	116	39	192	110
Kwai Chung	8587	98.0	3	7	21	47	70	83	100	113	30	219	101
Kwun Tong	8512	97.2	6	14	38	67	92	105	120	132	44	207	126
Sham Shui Po	8588	98.0	6	11	23	45	68	85	106	119	31	223	102
Tsuen Wan	8470	96.7	5	10	24	48	74	89	106	123	33	245	96
Sha Tin	8601	98.2	4	13	38	74	106	123	144	166	48	293	139
Tai Po	8488	96.9	8	19	39	69	97	117	142	160	47	213	119
Tung Chung	8545	97.5	5	15	37	62	93	113	146	179	44	314	129
Yuen Long	8595	98.1	6	11	27	53	83	102	134	162	37	254	110
Tap Mun	8456	96.5	28	45	69	102	131	147	165	182	75	263	172
Causeway Bay	8429	96.2	2	4	8	20	35	44	57	65	14	120	51
Central	8591	98.1	3	5	10	23	42	57	72	81	17	124	69
Mong Kok	8296	94.7	2	4	7	15	31	43	58	70	12	121	71

Pollutant: Respirable Suspended Particulates (PM10)

Station	No. of hours	Data capture rate %	<----------Percentiles---------->								Arithmetic mean	Highest 1 hour	Highest 24 hour
			10	25	50	75	90	95	98	99			
Central / Western	8548	97.6	15	23	43	67	92	108	136	154	49	251	153
Eastern	8524	97.3	13	21	38	60	81	97	115	129	43	180	133
Kwai Chung	8583	98.0	15	24	39	61	87	104	133	146	46	231	151
Kwun Tong	8544	97.5	19	28	43	67	99	118	142	159	52	212	171
Sham Shui Po	8627	98.5	17	25	39	61	86	101	126	143	46	214	148
Tsuen Wan	8630	98.5	18	25	40	60	87	104	127	140	47	200	141
Sha Tin	8604	98.2	12	19	35	58	85	102	125	138	42	198	144
Tai Po ^	5991	68.4	14	21	36	56	83	99	127	145	43	205	145
Tung Chung	8632	98.5	10	17	33	60	86	104	124	137	42	234	133
Yuen Long	8641	98.6	20	28	44	76	111	133	160	176	56	242	184
Tap Mun	8628	98.5	14	23	40	67	96	114	133	154	49	256	175
Causeway Bay	8263	94.3	30	42	59	80	105	123	150	165	64	227	170
Central	8484	96.8	23	33	50	74	98	115	139	154	56	252	158
Mong Kok	8412	96.0	20	30	44	64	87	103	131	148	50	276	181

Pollutant: Fine Suspended Particulates (PM2.5)

Station	No. of hours	Data capture rate %	<----------Percentiles---------->								Arithmetic mean	Highest 1 hour	Highest 24 hour
			10	25	50	75	90	95	98	99			
Central / Western	8549	97.6	9	14	28	45	65	80	104	120	33	198	120
Eastern	8556	97.7	8	12	25	38	54	66	84	98	28	128	109
Kwai Chung	8656	98.8	8	15	25	42	65	82	105	118	32	197	127
Kwun Tong	8555	97.7	10	17	27	42	62	77	99	116	33	160	122
Sham Shui Po	8597	98.1	11	16	26	40	57	72	93	107	31	153	116
Tsuen Wan	8534	97.4	10	16	26	41	60	73	91	103	31	131	111
Sha Tin	8604	98.2	5	10	22	39	61	79	99	111	29	171	118
Tai Po ^	5968	68.1	7	13	24	40	62	76	97	109	30	178	112
Tung Chung	8632	98.5	5	9	20	36	57	71	88	98	26	158	93
Yuen Long	8574	97.9	10	16	29	50	75	94	117	133	37	191	140
Tap Mun	8313	94.9	5	12	25	40	60	75	94	113	30	176	127
Causeway Bay	7206	82.3	19	29	40	55	74	89	115	129	45	175	134
Central	7950	90.8	14	20	31	45	59	70	84	98	34	155	107
Mong Kok	8412	96.0	12	18	28	42	61	78	101	113	33	234	147

Notes:

1. All concentration units are in microgram per cubic metre.
2. ^ Tai Po Station - PM10 and PM2.5 data have not met the representative requirement of no less than 2/3 representative period in a quarter.

Table C5: 2013 Diurnal Variations of Air Pollutants

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
Central / Western	10	10	10	11	10	9	10	12	12	12	12	11	11	11	10	10	10	10	10	12	12	11	10	10
Eastern	7	7	7	7	7	7	7	9	8	8	8	8	7	7	7	7	7	7	7	8	10	8	8	7
Kwai Chung	18	18	16	17	15	15	16	17	18	19	21	23	22	23	23	24	25	26	26	24	21	19	19	18
Kwun Tong	11	11	11	13	12	11	12	12	12	12	12	12	12	12	11	12	12	11	11	12	12	12	12	11
Sham Shui Po	14	14	13	15	13	14	13	13	13	13	13	13	13	13	13	13	13	13	14	15	15	15	15	14
Tsuen Wan	14	14	13	14	12	12	13	14	16	17	18	18	18	18	18	18	19	18	18	17	15	15	14	14
Sha Tin	11	10	10	12	10	10	10	11	11	12	12	12	12	12	12	12	13	13	14	13	12	12	11	11
Tai Po	8	8	8	8	8	8	8	8	9	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9
Tung Chung	12	12	12	15	12	12	12	13	16	17	17	17	17	17	17	16	16	15	14	13	13	13	13	12
Yuen Long	11	11	10	13	11	10	10	11	12	13	12	12	12	12	12	12	13	13	13	13	12	12	12	11
Tap Mun	12	12	12	14	13	13	13	14	15	16	15	15	14	14	14	13	13	13	12	12	12	12	12	12
Causeway Bay	9	9	9	9	9	9	9	10	12	12	11	11	10	10	10	10	10	10	10	10	10	10	10	9
Central	11	10	10	11	10	9	10	13	15	14	13	12	12	12	12	11	12	12	13	14	13	13	12	11
Mong Kok	12	11	11	11	10	11	11	11	11	12	11	11	11	11	12	12	12	12	12	13	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
Central / Western	83	71	56	49	47	45	58	99	125	128	121	107	92	93	96	99	103	106	108	111	109	107	105	96
Kwai Chung	129	98	83	68	69	78	125	171	203	192	163	152	144	143	150	160	171	175	189	179	154	147	149	147
Kwun Tong	103	72	60	54	52	62	108	146	163	153	131	117	103	107	115	122	132	141	147	136	120	114	118	120
Sham Shui Po	121	86	73	67	64	69	111	147	168	159	142	135	128	131	134	142	153	163	171	166	155	147	146	142
Tsuen Wan	99	67	56	45	43	50	89	125	146	150	137	125	113	114	120	125	135	144	148	138	125	117	120	120
Sha Tin	90	75	63	54	50	56	78	102	98	77	63	56	52	49	50	54	61	73	89	102	102	102	105	102
Tung Chung	81	63	50	43	43	51	73	87	85	77	75	74	72	70	70	69	72	78	85	89	87	84	82	85
Yuen Long	102	88	77	59	55	62	91	124	119	98	88	79	74	78	80	86	98	106	116	121	121	120	118	117
Tap Mun	14	15	15	14	14	14	15	16	18	19	18	16	15	14	14	13	14	14	14	15	15	15	15	14
Causeway Bay	287	216	198	159	148	145	222	329	401	405	378	356	342	355	355	357	353	373	393	384	361	358	370	344
Central	271	206	173	151	145	144	223	361	483	453	418	368	348	351	354	361	384	417	448	423	375	357	334	324
Mong Kok	294	177	161	142	136	137	239	322	383	381	343	340	349	373	381	393	418	438	443	394	351	359	381	357

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
Central / Western	19	18	12	10	10	8	12	28	40	41	37	31	23	22	22	21	21	20	20	23	23	25	26	23
Kwai Chung	44	31	26	19	20	24	45	68	84	78	60	54	48	45	46	49	53	55	63	60	49	47	50	51
Kwun Tong	31	20	16	14	13	16	36	54	63	58	47	39	31	31	34	36	39	41	44	40	35	33	36	39
Sham Shui Po	36	23	19	18	17	18	33	49	60	55	46	42	37	37	36	38	41	44	47	46	43	41	43	42
Tsuen Wan	27	16	12	9	7	10	25	41	52	54	47	40	33	31	32	32	35	38	39	36	33	31	33	35
Sha Tin	25	20	16	13	11	13	22	33	31	21	15	13	11	10	9	9	10	12	16	23	25	27	30	29
Tung Chung	21	14	9	7	7	10	20	26	25	20	19	17	15	13	12	10	11	12	15	18	18	18	19	21
Yuen Long	32	27	22	15	13	17	31	47	42	30	25	20	18	18	18	19	21	23	28	32	34	36	37	38
Tap Mun	2	2	2	2	2	2	2	3	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	2
Causeway Bay	119	90	81	63	57	55	87	138	175	173	160	146	137	139	136	136	132	144	153	152	145	145	150	143
Central	112	82	65	57	52	53	88	158	220	198	181	151	139	139	136	137	149	167	183	175	156	150	140	137
Mong Kok	124	68	61	52	49	49	99	141	173	170	147	143	144	153	155	159	171	182	187	163	144	150	164	153

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
Central / Western	53	44	37	33	32	32	41	57	64	66	64	60	57	60	63	67	71	75	76	76	73	69	65	60
Eastern	56	45	38	34	31	35	50	64	66	64	61	57	56	57	60	64	71	75	75	73	72	68	65	61
Kwai Chung	62	50	44	39	39	42	56	68	74	73	71	70	71	74	79	85	90	91	93	88	79	75	72	69
Kwun Tong	55	42	36	33	32	37	52	64	68	65	60	58	55	59	63	67	73	78	80	75	68	63	63	61
Sham Shui Po	67	50	44	40	39	42	60	72	76	75	71	71	72	75	78	84	90	95	98	96	89	84	81	78
Tsuen Wan	57	43	37	32	31	34	51	62	67	68	65	64	63	67	71	75	82	86	87	82	75	70	68	66
Sha Tin	51	44	38	34	33	36	45	51	51	45	40	37	35	34	36	40	46	55	64	66	64	61	60	57
Tai Po	54	48	41	37	37	40	50	60	58	52	46	42	41	42	44	48	56	66	74	73	68	64	62	59
Tung Chung	49	42	36	31	32	35	43	47	47	46	47	48	49	50	52	53	56	60	62	62	59	56	53	52
Yuen Long	53	48	43	36	34	37	44	53	55	52	50	48	47	50	52	57	65	71	74	73	69	65	62	59
Tap Mun	11	12	11	11	11	11	11	11	12	13	13	12	11	10	10	10	10	11	11	12	12	12	11	11
Causeway Bay	105	79	73	62	61	60	89	119	133	141	133	133	133	143	147	148	151	153	159	151	140	136	141	126
Central	99	80	73	64	65	64	89	120	147	150	141	137	136	138	146	151	156	163	168	156	136	128	120	114
Mong Kok	104	74	68	63	61	63	88	106	118	120	119	122	129	139	143	150	156	159	158	145	131	130	130	123

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	864	819	796	767	773	800	866	908	921	919	915	886	870	874	873	875	890	919	968	986	982	964	949	920
Tung Chung	667	654	641	639	636	637	650	667	672	661	656	657	669	673	677	673	670	666	671	687	689	688	683	680
Yuen Long	807	772	746	697	688	692	729	786	780	744	733	719	711	711	709	721	747	772	821	859	872	868	865	844
Tap Mun	665	663	664	661	664	665	675	680	679	682	678	671	672	665	661	659	658	657	651	651	654	655	656	659
Causeway Bay	1076	1162	1147	1035	970	922	827	846	905	964	1064	1043	1026	1025	1003	988	948	963	1005	1052	1086	1066	995	1001
Central	696	663	580	547	481	494	533	638	744	811	849	768	739	807	760	740	731	765	825	853	865	836	755	734
Mong Kok	1068	1097	1062	973	972	931	890	926	983	1022	1018	992	986	1055	1078	1087	1117	1132	1197	1186	1160	1124	1067	1033

Table C5 (Cont.): 2013 Diurnal Variations of Air Pollutants

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
Central / Western	39	45	49	50	50	48	39	28	25	28	34	42	50	54	55	53	49	42	38	34	33	34	34	36
Eastern	35	39	41	42	43	39	31	24	25	29	35	42	48	52	53	51	46	42	38	37	35	34	34	34
Kwai Chung	27	36	37	40	38	35	25	19	18	22	29	34	38	41	40	38	33	29	23	22	24	25	24	25
Kwun Tong	42	48	50	50	50	45	34	29	29	34	42	48	55	58	57	54	49	44	40	40	41	42	40	39
Sham Shui Po	29	39	42	43	43	39	26	20	19	24	30	36	41	43	43	40	35	28	23	21	22	23	23	24
Tsuen Wan	28	39	41	44	43	39	25	20	21	25	31	38	43	46	48	45	39	32	25	22	24	25	24	24
Sha Tin	38	41	43	44	43	38	31	28	33	42	53	62	70	76	78	75	68	57	45	39	37	36	35	34
Tai Po	38	39	41	42	41	38	32	29	34	44	54	63	70	74	75	71	65	55	45	41	40	39	38	37
Tung Chung	35	39	41	43	42	37	30	28	30	36	42	49	58	66	72	72	66	55	44	37	35	35	35	34
Yuen Long	26	29	30	35	35	31	25	21	24	32	41	51	61	66	67	63	55	44	33	28	26	25	24	24
Tap Mun	65	63	62	60	59	57	56	56	60	67	75	85	93	98	100	102	101	95	88	82	77	72	69	68
Causeway Bay	13	16	18	21	22	22	15	10	8	9	11	12	14	15	15	14	14	14	13	12	12	12	12	12
Central	18	23	27	29	28	26	19	12	9	10	12	15	18	18	18	18	16	14	12	12	13	14	15	15
Mong Kok	10	18	19	22	23	23	13	8	7	9	11	13	14	14	14	12	10	8	7	7	8	8	8	8

Pollutant: Respirable Suspended Particulates (PM10)

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
Central / Western	47	46	45	44	44	43	43	44	47	50	51	51	50	49	52	54	53	53	52	52	53	53	51	49
Eastern	41	40	40	39	39	39	40	41	43	44	45	44	43	44	46	46	47	47	47	48	47	46	44	42
Kwai Chung	44	43	42	41	40	40	41	43	45	47	47	47	47	48	49	51	51	51	51	52	52	49	47	45
Kwun Tong	49	47	46	46	45	45	45	47	50	54	56	57	55	54	57	57	56	58	57	56	55	54	51	51
Sham Shui Po	43	42	40	40	40	40	42	44	45	47	47	46	46	47	50	50	50	52	53	55	54	50	48	45
Tsuen Wan	41	39	38	38	38	38	40	42	46	50	51	49	47	50	54	55	54	55	54	53	52	48	45	43
Sha Tin	43	42	41	40	40	39	40	41	42	42	42	42	42	41	42	42	43	43	45	46	46	46	45	44
Tai Po	43	42	41	41	40	39	40	41	42	43	43	45	44	44	44	43	43	44	46	48	47	47	45	45
Tung Chung	39	39	38	37	37	37	37	38	39	41	43	43	45	47	49	50	49	47	45	43	42	42	41	40
Yuen Long	53	51	50	49	48	49	49	51	54	57	57	58	58	59	59	60	62	63	62	61	61	59	58	56
Tap Mun	47	47	47	47	47	46	48	48	48	50	50	50	50	50	50	51	51	51	49	49	49	48	48	47
Causeway Bay	58	50	46	45	44	45	50	57	62	68	68	66	67	72	73	73	74	77	79	81	78	73	70	66
Central	52	50	48	48	48	47	50	54	60	60	60	57	53	56	60	60	61	63	64	64	64	62	58	55
Mong Kok	48	45	43	42	41	40	41	44	47	50	52	52	52	53	56	56	55	55	56	59	59	57	53	51

Pollutant: Fine Suspended Particulates (PM2.5)

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
Central / Western	32	31	30	30	30	30	29	30	32	34	34	34	33	33	36	36	35	36	35	36	36	36	35	34
Eastern	26	26	26	26	26	26	27	28	29	29	29	28	28	28	29	29	30	30	31	31	31	30	29	27
Kwai Chung	31	30	29	28	27	27	29	30	32	33	32	33	33	33	34	35	35	35	36	36	36	35	33	32
Kwun Tong	31	29	29	30	29	29	30	31	33	34	34	34	33	33	34	34	34	35	36	36	36	35	34	33
Sham Shui Po	29	28	27	27	27	28	29	31	31	32	31	30	30	31	32	32	32	34	35	36	36	34	32	30
Tsuen Wan	27	26	26	25	26	27	28	30	33	34	33	32	31	32	34	35	35	35	35	36	35	33	31	29
Sha Tin	29	28	28	28	27	27	27	28	29	28	28	28	28	27	28	28	28	28	29	31	31	31	31	30
Tai Po	30	29	29	29	28	27	28	29	30	30	29	31	30	30	30	30	29	30	32	33	32	33	32	31
Tung Chung	25	24	23	23	23	23	23	24	24	25	26	26	27	28	30	31	30	29	28	27	27	27	26	25
Yuen Long	36	36	35	34	33	33	33	34	36	37	37	38	38	38	38	38	38	39	39	39	39	38	38	37
Tap Mun	29	28	29	30	30	30	30	30	31	31	31	30	29	29	30	30	30	30	29	29	29	29	29	29
Causeway Bay	41	34	31	31	31	31	35	41	45	47	46	45	45	49	49	49	50	53	55	58	57	53	51	47
Central	30	29	29	30	30	30	32	35	38	37	35	33	31	33	35	36	37	38	39	40	40	39	35	33
Mong Kok	32	29	28	27	27	26	27	30	32	34	34	34	34	36	37	37	36	36	38	40	41	39	36	34

Note: All concentration units are in microgram per cubic metre.

Table C6: 2013 Total Wet and Dry Deposition

(a) Wet Deposition

	Monitoring Station	Central/Western	Kwun Tong	Yuen Long
	Wet Deposition (tonne/ha)	27906	28711	23848
	Weighted Mean pH (based on volume-weighted mean hydrogen ion concentrations ($[H^+]$))	4.72	4.71	4.77
	Weighted Mean pH (based on volume-weighted mean pH)	5.09	5.03	5.04
	Number of Samples	108	115	107
Filtrate (Kg/Ha)	**NH_4^+**	9.97	11.21	8.52
	NO_3^-	28.58	31.08	23.37
	$SO_4^=$	37.93	40.03	24.99
	Cl^-	38.33	42.87	15.03
	F-	0.74	0.75	0.62
	Na^+	21.08	24.36	9.26
	K^+	6.98	7.28	5.94
	Formate	6.51	6.66	6.16
	Acetate	5.44	5.49	5.26
	Ca^{++}	7.93	4.58	4.09
	Mg^{++}	3.20	3.18	1.59

** Note: The weighted mean pH is calculated from the pH values measured by the Government Laboratory.*

(b) Dry Deposition

	Monitoring Station	Central/Western	Kwun Tong	Yuen Long
	Number of Samples	26	26	26
Filtrate (Kg/Ha)	**NH_4^+**	0.23	1.43	0.21
	NO_3^-	8.78	15.14	8.08
	$SO_4^=$	8.23	11.81	5.77
	Cl^-	11.20	17.20	5.47
	F-	0.082	0.125	0.098
	Na^+	6.68	11.08	3.27
	K^+	0.64	0.79	0.44
	Formate	0.20	0.18	0.21
	Acetate	0.17	0.17	0.20
	Ca^{++}	10.68	9.66	8.68
	Mg^{++}	1.40	2.26	1.37

Table C7: 2013 Ambient Levels of Toxic Air Pollutants

Toxic Air Pollutants	Concentration Unit	Annual Averages [1]	
		Tsuen Wan	Central/Western
Heavy Metals			
Hexavalent chromium	ng/m^3	0.10	0.10
Lead [2]	ng/m^3	40	38
Organic Substances			
Benzene	$\mu g/m^3$	1.81	1.62
Benzo[a]pyrene	ng/m^3	0.15	0.12
1,3-Butadiene	$\mu g/m^3$	0.06	0.06
Formaldehyde [4]	$\mu g/m^3$	-	5.21
Perchloroethylene	$\mu g/m^3$	0.60	0.57
Dioxins [3]	$pgI\text{-}TEQ/m^3$	0.040	0.047

Notes:

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

[2] For lead the reported figures are the respective 2013 annual average concentrations in the elemental analysis of total suspended particulates.

[3] The ambient level of dioxins is expressed here as toxic equivalent (I-TEQ) concentration of 2,3,7,8-Tetrachlorodibenzodioxin (TCDD) based on the International Toxic Equivalent Factors (I-TEF) of the North Atlantic Treaty Organisation (NATO/CCMS).

[4] The measurement of formaldehyde was affected by influence from renovation works at Princess Alexandra Community Centre and the nearby buildings of Tsuen Wan Station. Hence, only formaldehyde concentration at the Central/Western station is reported in 2013.

Appendix D

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

Figure D: Location of HEC's & CLP's Air Quality Monitoring Stations for Sulphur Dioxide and Nitrogen Dioxide

D.1 The Hongkong Electric Co. Ltd. (HEC)

Air Quality Monitoring Station	Annual Mean Concentration [1] [6]	Range of Monthly Mean Concentrations [1] [6]
Sulphur Dioxide (SO_2) [2]		
Victoria Peak	7	2 - 23
Chung Hom Kok	6	1 - 19
Victoria Road	10	5 - 17
Queen Mary Hospital *(Jan to Oct)* [3]	9 [3]	4 - 17
Ap Lei Chau	11	5 - 17
Cheung Chau	9	2 - 18
Nitrogen Dioxide (NO_2) [2]		
Victoria Peak	29	14 - 60
Chung Hom Kok	19	12 - 31
Victoria Road	31	15 - 53
Queen Mary Hospital *(Jan to Oct)* [3]	21 [3]	8 - 49
Ap Lei Chau	29	11 - 53
Cheung Chau	25	5 - 55

D.2 CLP Power Hong Kong Ltd. (CLP)

Air Quality Monitoring Station	Annual Mean Concentration [1] [6]	Range of Monthly Mean Concentrations [1] [6]
Sulphur Dioxide (SO_2) [2]		
Tuen Mun Clinic	9	5 - 16
Tin Shui Wai	11	7 - 23
Butterfly Estate	10	6 - 16
Lung Kwu Tan	9	4 - 17
Lau Fau Shan	4	1 - 10
Nitrogen Dioxide (NO_2)		
Tuen Mun Clinic [4]	63	34 - 97
Tin Shui Wai	45	22 - 76
Butterfly Estate [5]	47	24 - 80
Lung Kwu Tan	28	11 - 55
Lau Fau Shan	30	15 - 58

Notes:

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

[2] There was no exceedance of AQO limit for the pollutants in 2013.

[3] Ambient air monitoring at Queen Mary Hospital was temporarily suspended since 1 November 2013. The annual means so calculated cannot meet the minimum requirement of representativeness.

[4] 1-hr and 24-hr AQO limit for NO_2 have been exceeded for one time and four times respectively at Tuen Mun Clinic.

[5] 24-hr AQO limit for NO_2 has been exceeded for one time at Butterfly Estate.

[6] The data are provided by the power companies. For details of monitoring results, please refer to their websites as follows:

HEC: http://www.hkelectric.com/web/CorporateSocialResponsibilities/CaringForTheEnvironment/HowWeCareForOurEnvironment/AmbAirSummary_en.htm

CLP: https://www.clpgroup.com/poweru/eng/air_quality/airQuality_monitoring_detail.aspx