AIR QUALITY
IN HONG KONG 2017

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) (2017)

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Security Classification	:	Unrestricted

Summary

This report summarises the 2017 air quality monitoring data collected by the Environmental Protection Department's monitoring network comprising 13 general stations and 3 roadside stations.

The overall air quality in Hong Kong has been showing progressive improvement in recent years.

As a result of the wide range of local emission control measures implemented by the Hong Kong Special Administrative Region (HKSAR) Government and the collaboration with the Guangdong Provincial Government in cutting emissions in the Pearl River Delta (PRD) Region, concentrations of major air pollutants including respirable suspended particulates (RSP), fine suspended particulates (FSP), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) at both roadside and in ambient air have been reduced substantially over the past decade.

Although roadside NO_2 is on a downward trend and has dropped from a peak in 2011, its level is still high. Meanwhile, ambient ozone (O_3), which is formed by photochemical reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOC) in the presence of sunlight, is on a rising trend in recent years. Ozone is a regional air pollution problem. The HKSAR government will strengthen its collaboration with the Guangdong Provincial Government to alleviate the photochemical smog and ozone problems in the region, and continue to implement vehicular and other control measures to reduce local emissions.

As in previous years, concentrations of carbon monoxide and lead in 2017 remain at levels well below their respective Air Quality Objectives limits.

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1. Introduction

In 2017, the Environmental Protection Department (EPD) operates a network of 16 air quality monitoring stations for measuring concentrations of major air pollutants. It consists of thirteen general stations for monitoring ambient air quality and three roadside stations for monitoring roadside 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 Central/Western and Tsuen Wan monitoring stations since 1997.

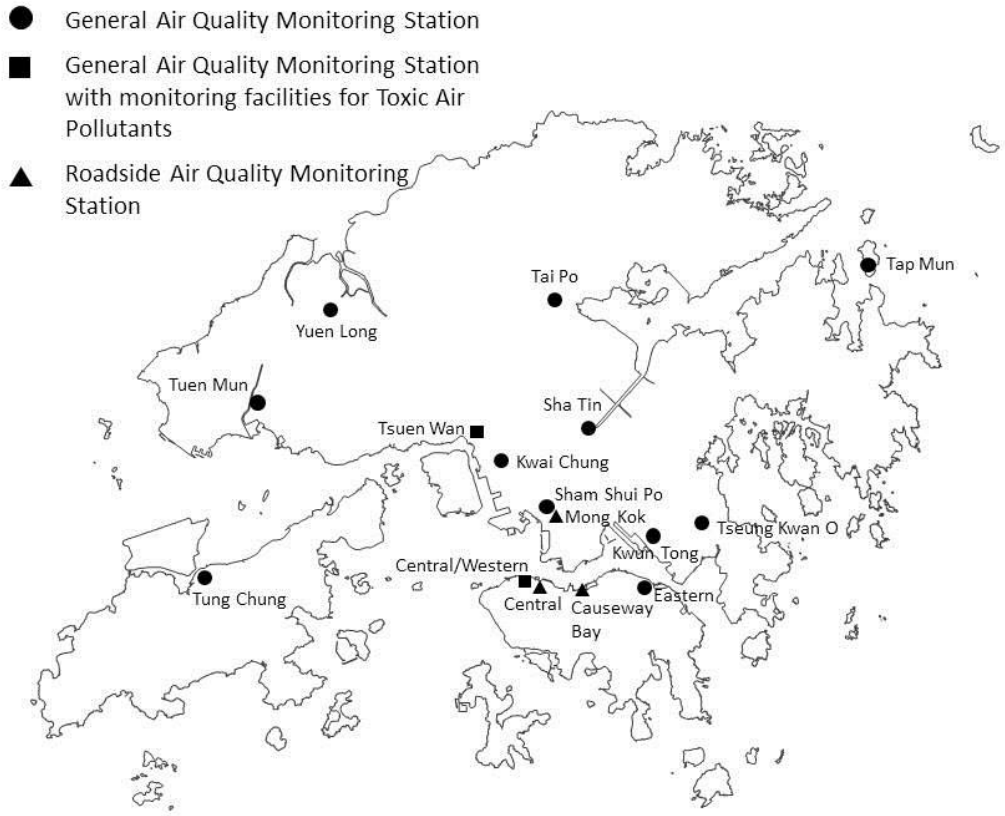


Figure 1: Location of EPD's Air Quality Monitoring Stations (2017)

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 can be found on the power companies' web sites at the following links:

HEC:
https://www.hkelectric.com/en/corporate-social-responsibility/caring-for-our-environment/how-we-care-for-our-environment/air-quality-monitoring-statistics-annual-summary

CLP:
https://www.clp.com.hk/en/about-clp/power-generation/cleaner-generation/air-quality-monitoring-statistics

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 sources 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. Even at lower levels, prolonged exposure may also increase the risk of developing chronic respiratory diseases.

Figure 2a: Sulphur Dioxide Monitoring 2017
(10-Minute Average Statistics)

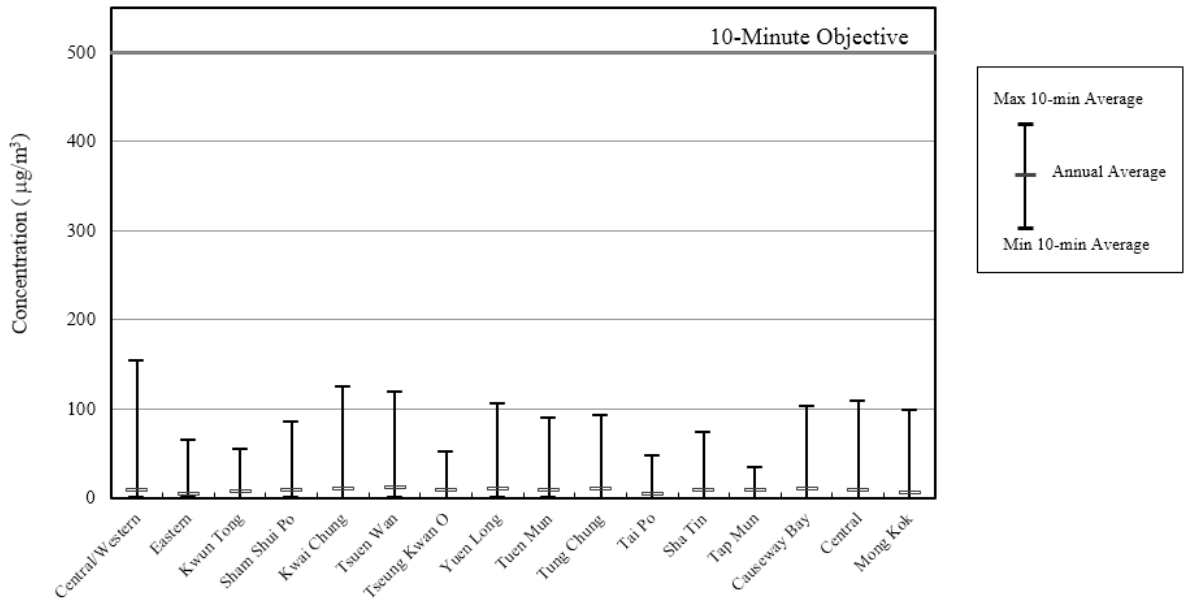
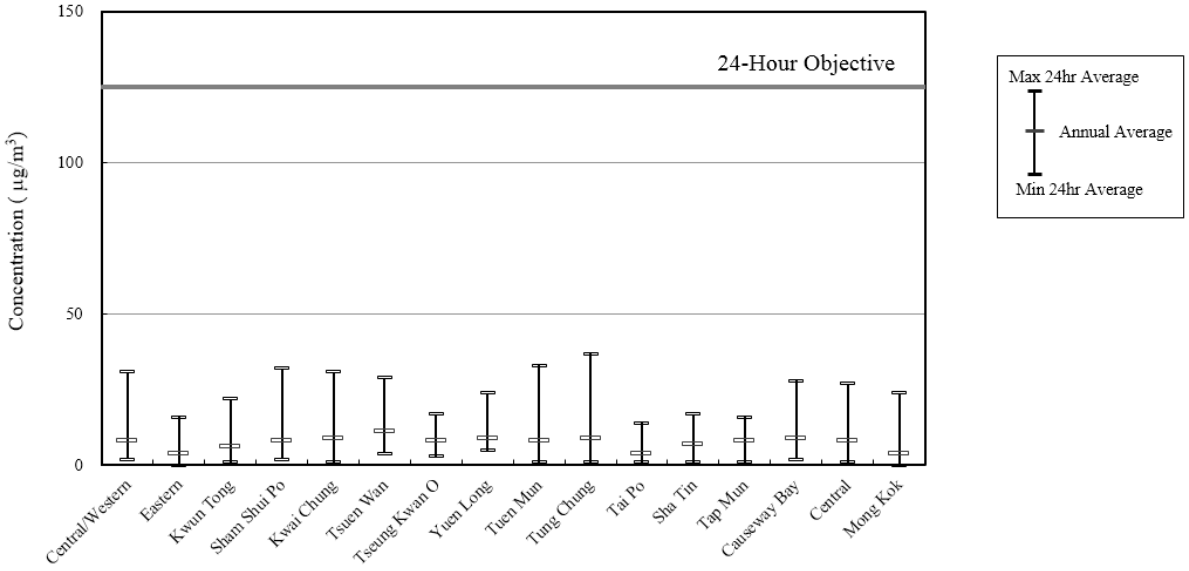


Figure 2b: Sulphur Dioxide Monitoring 2017
(24-Hour Average Statistics)



Sulphur dioxide was measured at all the 16 monitoring stations in 2017. As in previous years, SO_2 concentrations remained low throughout the territory. All monitoring stations

complied with the relevant Hong Kong Air Quality Objectives[1] (AQOs) for SO_2. The highest 10-minute average (153 μg/m^3) was measured at Central/Western general station and 24-hour average (37 μg/m^3) was measured at Tung Chung general station. Both were well below the respective AQO limits.

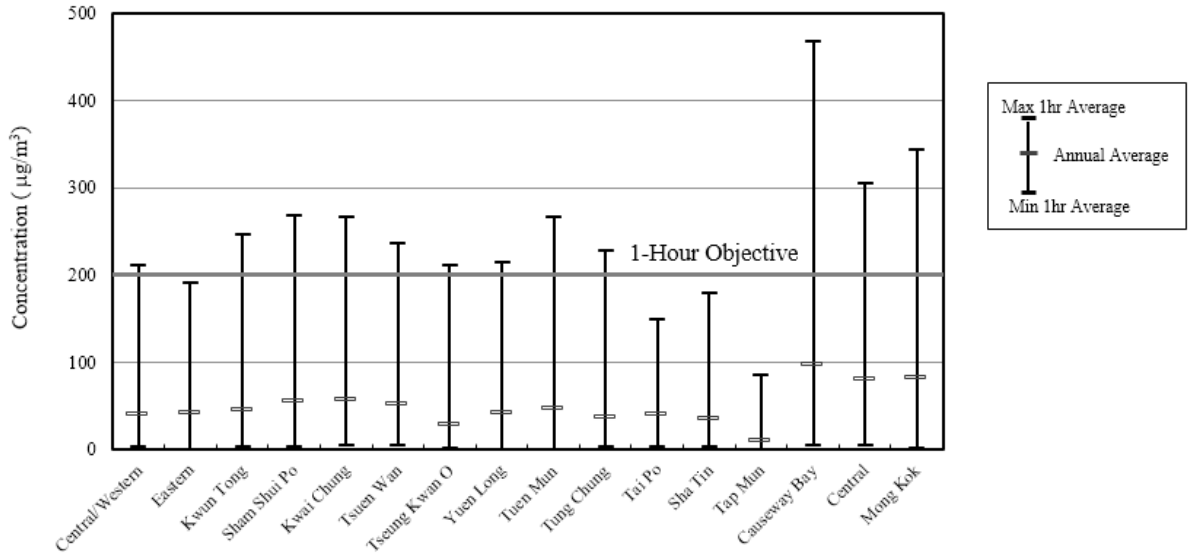
2.2 Nitrogen Oxides (NOx) and Nitrogen Dioxide (NO_2)

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.

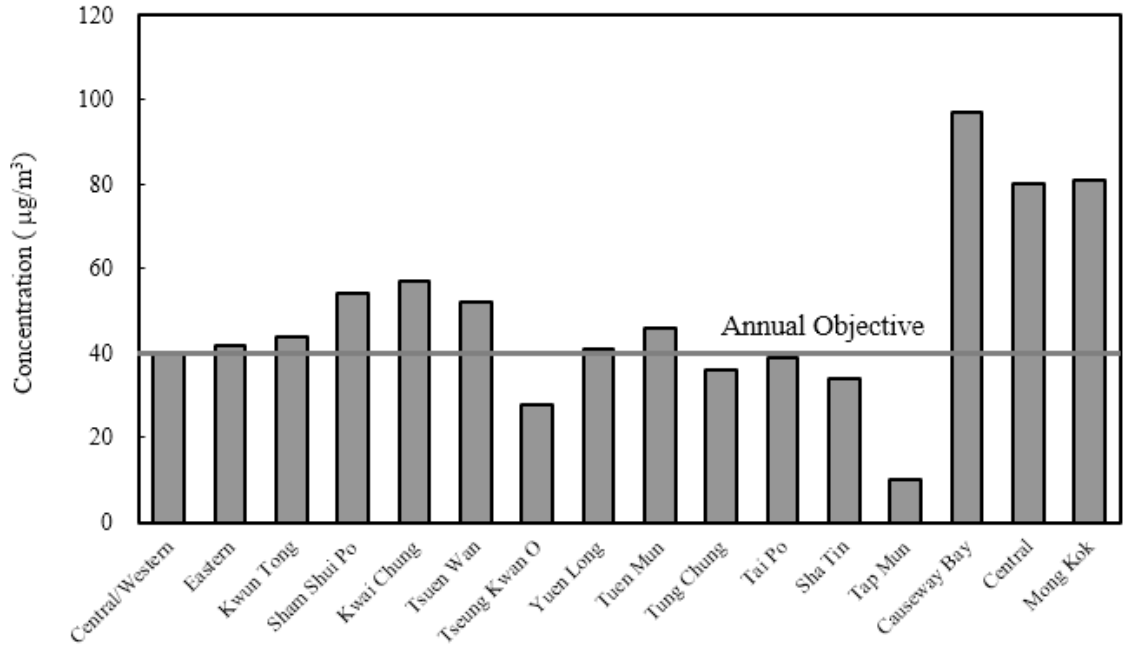
NO_2 was measured at all the 16 monitoring stations in 2017 and the highest 1-hour average (466 μg/m^3) and the highest annual average (97 μg/m^3) were both recorded at the Causeway Bay roadside station. As regards the 1-hour AQO (200 μg/m^3) with allowance of exceedance of AQO limit value for eighteen occasions per year, all general stations (except Kwai Chung general station) were in compliance with the respective AQO in 2017. For the annual AQO (40 μg/m^3), only 6 general stations including Central/Western, Tseung Kwan O, Tung Chung, Tai Po, Sha Tin and Tap Mun were in compliance. Non-compliance with the 1-hour and annual AQOs for NO_2 were recorded at all the three roadside stations.

Figure 3a: Nitrogen Dioxide Monitoring 2017
(1-Hour Average Statistics)



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

Figure 3b: Nitrogen Dioxide Monitoring 2017
(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 more a regional air pollution problem.

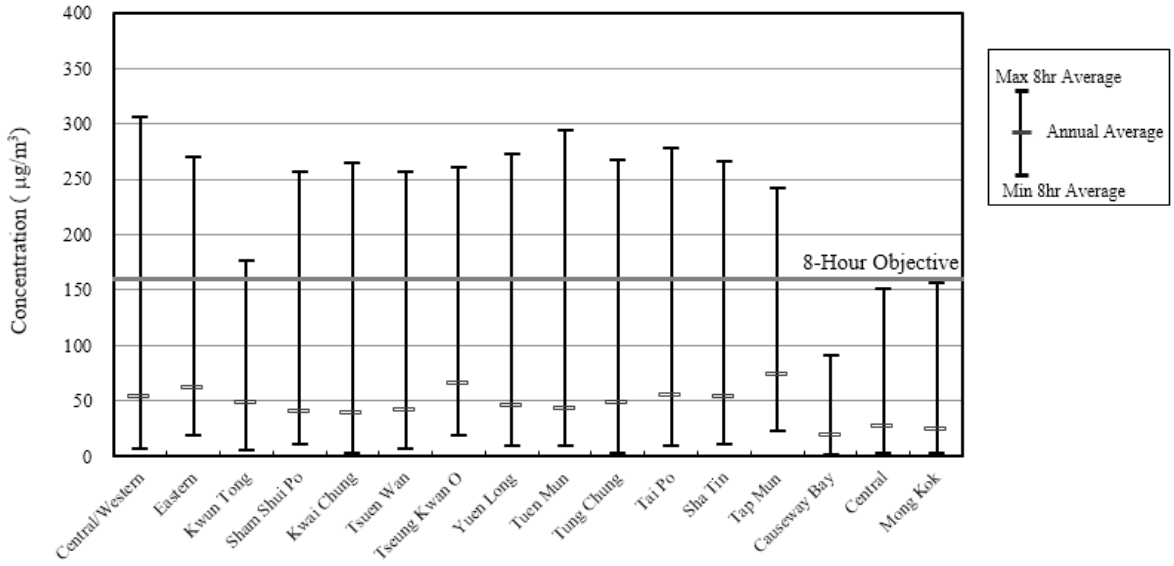
Being a strong oxidant, ozone can cause irritation to the eyes, nose and throat even at low concentrations. At elevated levels, it can increase a person's susceptibility to respiratory infections and aggravate pre-existing respiratory illnesses such as asthma.

Ozone was monitored at all the general and roadside stations in 2017. Among the 13 general stations, Tseung Kwan O, Yuen Long, Tuen Mun, Tung Chung, Tai Po, Sha Tin and Tap Mun recorded non-compliance with the 8-hour AQO in 2017 (i.e. the 8-hour AQO limit of 160 $\mu g/m^3$ was exceeded more than nine times in the year). The highest 8-hour average (305 $\mu g/m^3$) was recorded at Central/Western general station.

All the three roadside stations complied with the 8-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, episode days are mostly associated with very hot, fine and calm weather conditions in the region, which favour the formation and accumulation of ozone via photochemical reactions. Such weather conditions mostly occur in summer and autumn, especially when Hong Kong and the Pearl River Delta Region are under the influence of subsiding air induced by a tropical cyclone located in the Western Pacific Ocean near Taiwan.

Figure 4a: Ozone Monitoring 2017
(Maximum 8-Hour Average Statistics)

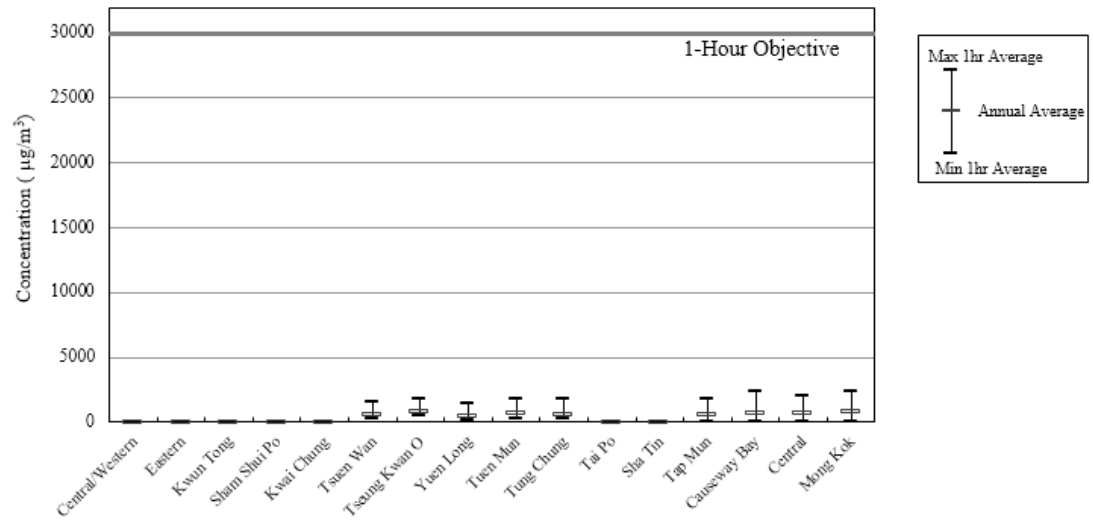


2.4 Carbon Monoxide (CO)

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.

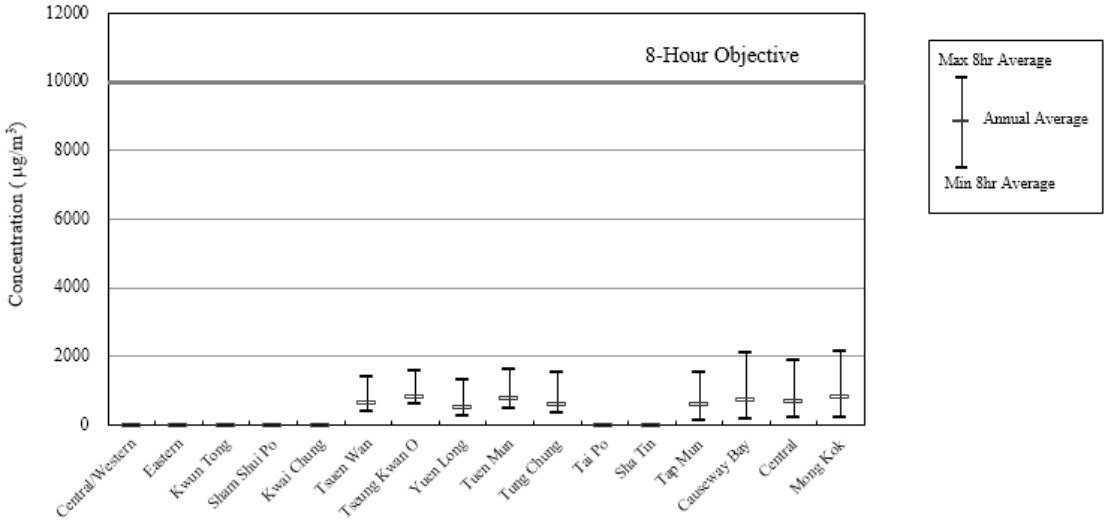
Carbon monoxide was monitored at nine stations including six general stations and three roadside stations in 2017. Similar to previous years, both the ambient and roadside CO concentrations remained very low throughout the year. All the monitoring stations complied with the 1-hour (30,000 µg/m^3) and 8-hour (10,000 µg/m^3) AQOs for CO. In 2017, the highest 1-hour average (2,420 µg/m^3) was recorded at Causeway Bay roadside station and the highest 8-hour average (2,156 µg/m^3) was recorded at Mong Kok roadside station, both were well below the respective AQO limits.

Figure 5a: Carbon Monoxide Monitoring 2017
(1-Hour Average Statistics)



Note: CO was only monitored at Tsuen Wan, Tseung Kwan O, Yuen Long, Tuen Mun, Tung Chung and Tap Mun general stations and Causeway Bay, Central and Mong Kok roadside stations.

Figure 5b: Carbon Monoxide Monitoring 2017
(8-Hour Average Statistics)



Note: CO was only monitored at Tsuen Wan, Tseung Kwan O, Yuen Long, Tuen Mun, Tung Chung and Tap Mun general stations and Causeway Bay, Central and Mong Kok roadside stations.

3. Suspended Particulates

3.1 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 vehicles and power plants, are the major regional and local sources of ambient RSP. Besides, RSP can also 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. In Hong Kong, RSP is contributed mainly by the regional sources.

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 uplifted if high RSP levels are associated with higher levels of other pollutants, such as SO_2.

RSP was measured at all 16 monitoring stations in 2017. Ten of these stations were also equipped with high-volume sampler to collect particulate samples for chemical analysis.

In 2017, all general and roadside stations complied with the 24-hour AQO for RSP (100 $\mu g/m^3$ with allowance of nine exceedances of AQO limit value per year). The highest 24-hour average (134 $\mu g/m^3$) was recorded at Tuen Mun general station. For the annual AQO (50 $\mu g/m^3$) , all general and roadside monitoring stations also complied with the standard and the highest annual average (46 $\mu g/m^3$) was recorded at Causeway Bay roadside station.

Figure 6a: RSP Monitoring 2017
(24-Hour Average Statistics)

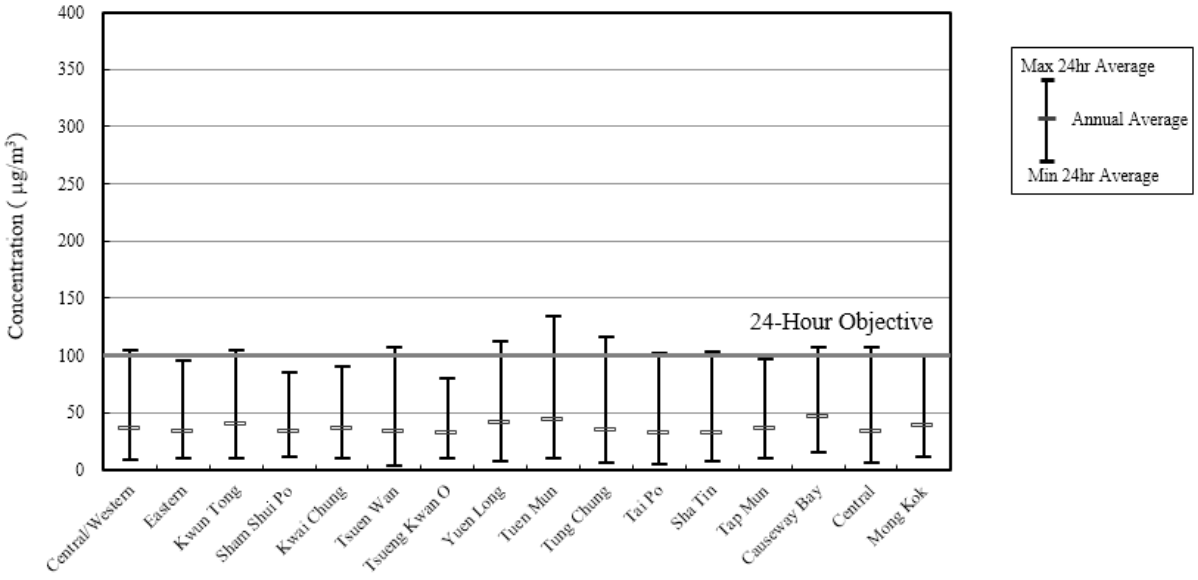
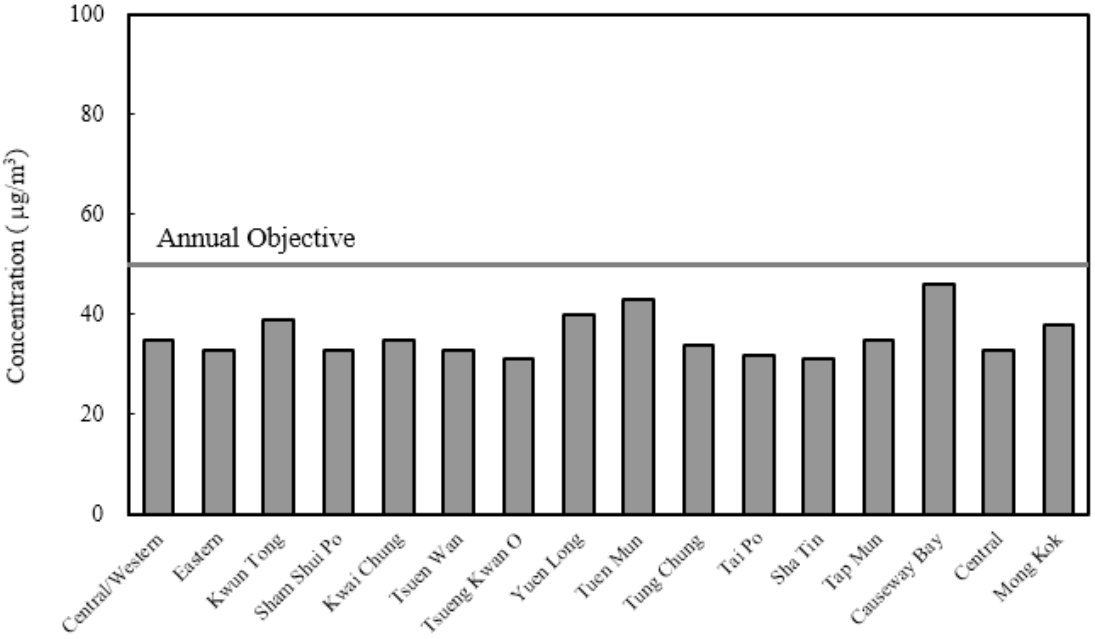


Figure 6b: RSP Monitoring 2017
(Annual Average)



3.2 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 has the same emission sources as RSP, which is also mainly contributed by regional sources. 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.

In 2017, full compliance was observed for both the 24-hour AQO (75 µg/m^3 with allowance of nine exceedances of AQO limit value per year) and the annual AQO (35 µg/m^3) for FSP at all general and roadside stations, with the highest 24-hour average (90

μg/m^3) recorded at Sha Tin general station and annual average (31μg/m^3) recorded at the Causeway Bay roadside station.

Figure 7a: FSP Monitoring 2017
(24-Hour Average Statistics)

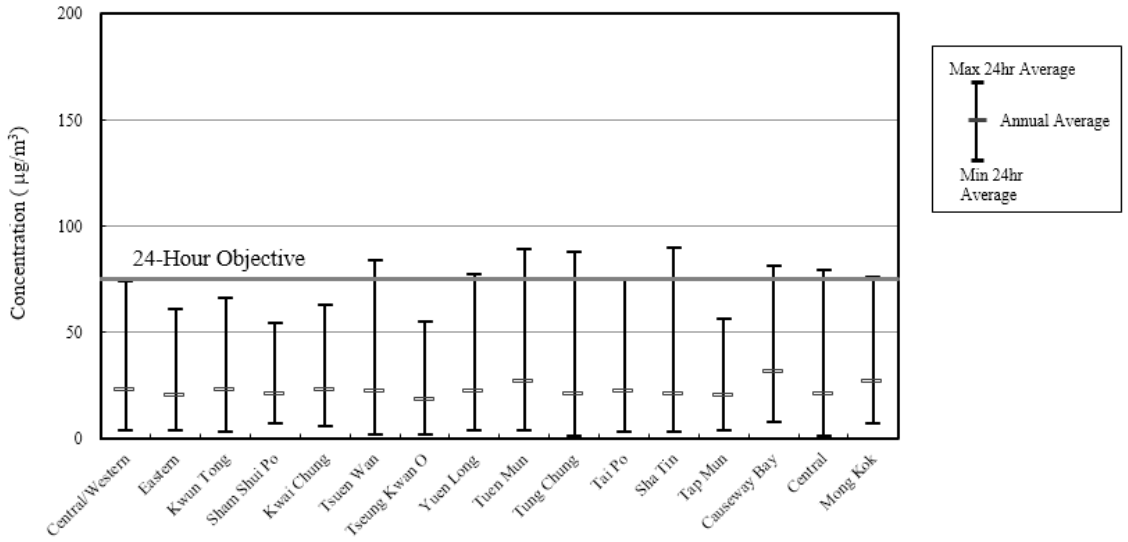
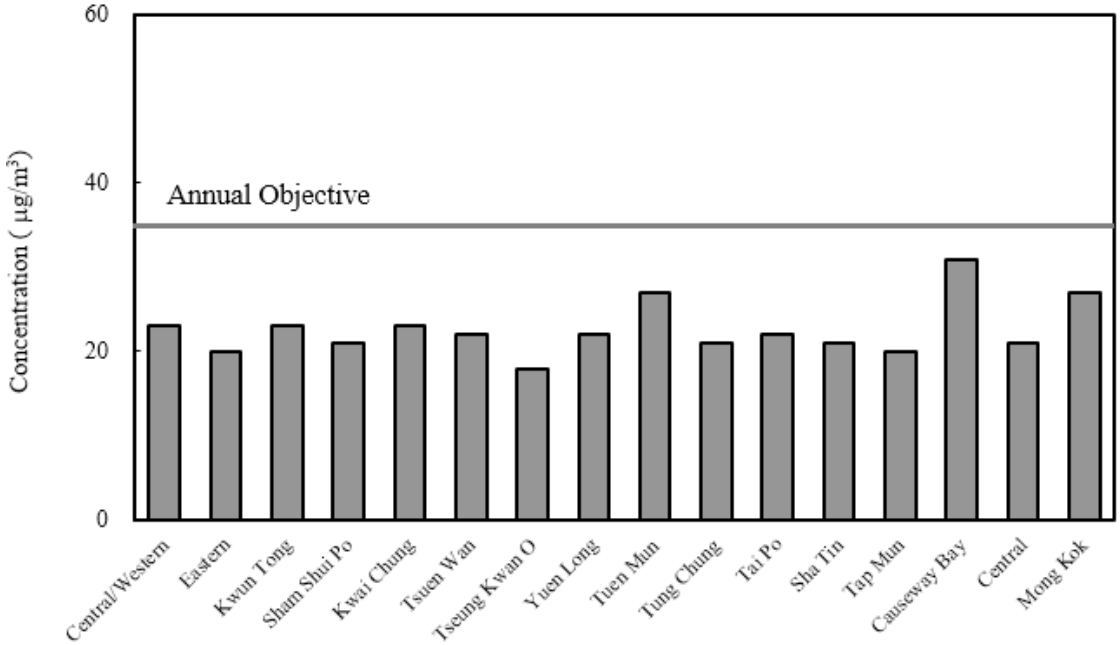


Figure 7b: FSP Monitoring 2017
(Annual Average)



3.3 Lead (Pb)

Lead is the only criteria pollutant included in the AQOs 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 2017. The overall annual averages, ranging from 17 ng/m^3 (at Central/Western, Tung Chung and Tseung Kwan O) to 19 ng/m^3 (at Kwun Tong, Yuen Long and Mong Kok), were well below the respective annual AQO of 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 of 1997. Among the various TAPs monitored in 2017, eight of them are considered more important in terms of their health impacts and their annual averages are summarised in Table C6. Detailed description of the TAPs monitoring operation is given in Appendix B4.

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, RSP and FSP 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 8: 2017 Diurnal variations of NO_2

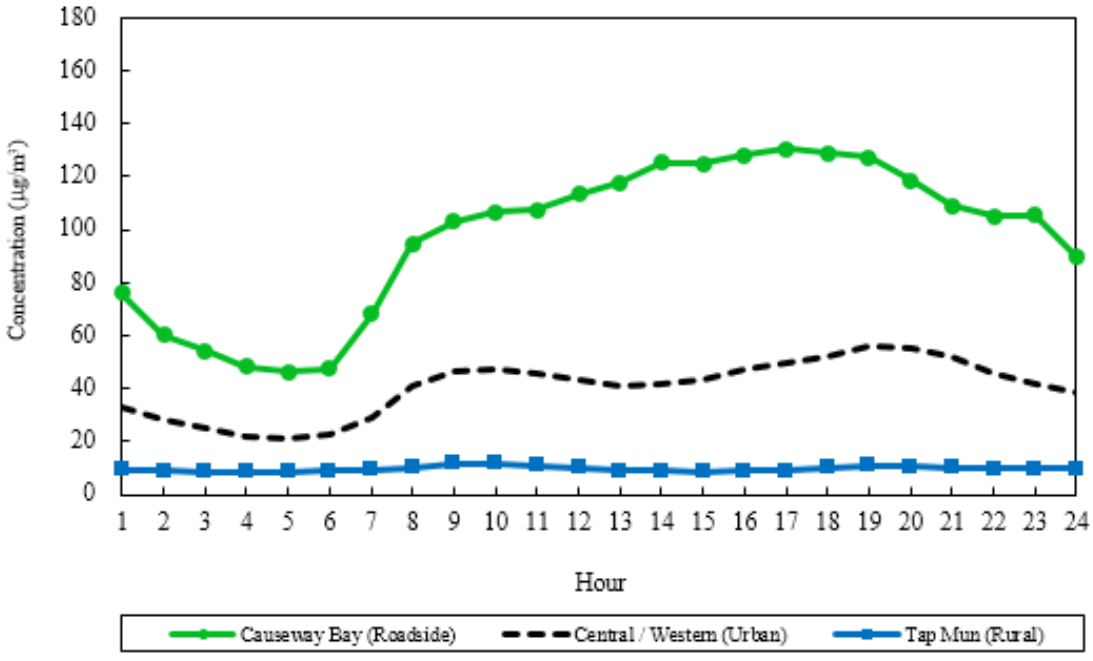


Figure 9: 2017 Diurnal variations of RSP

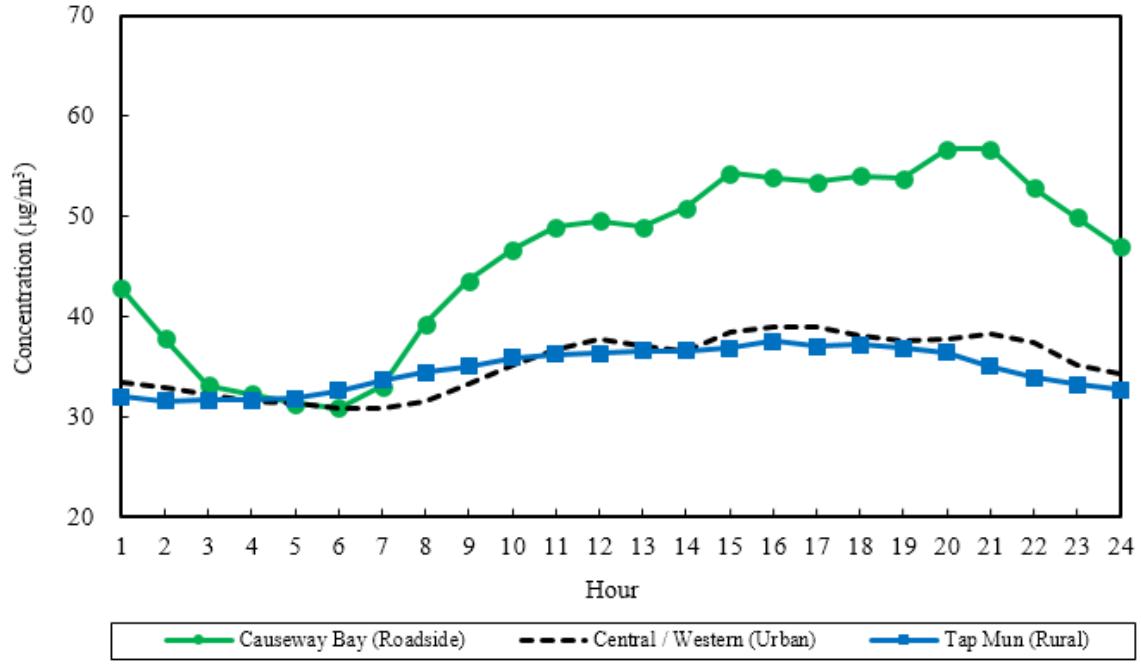
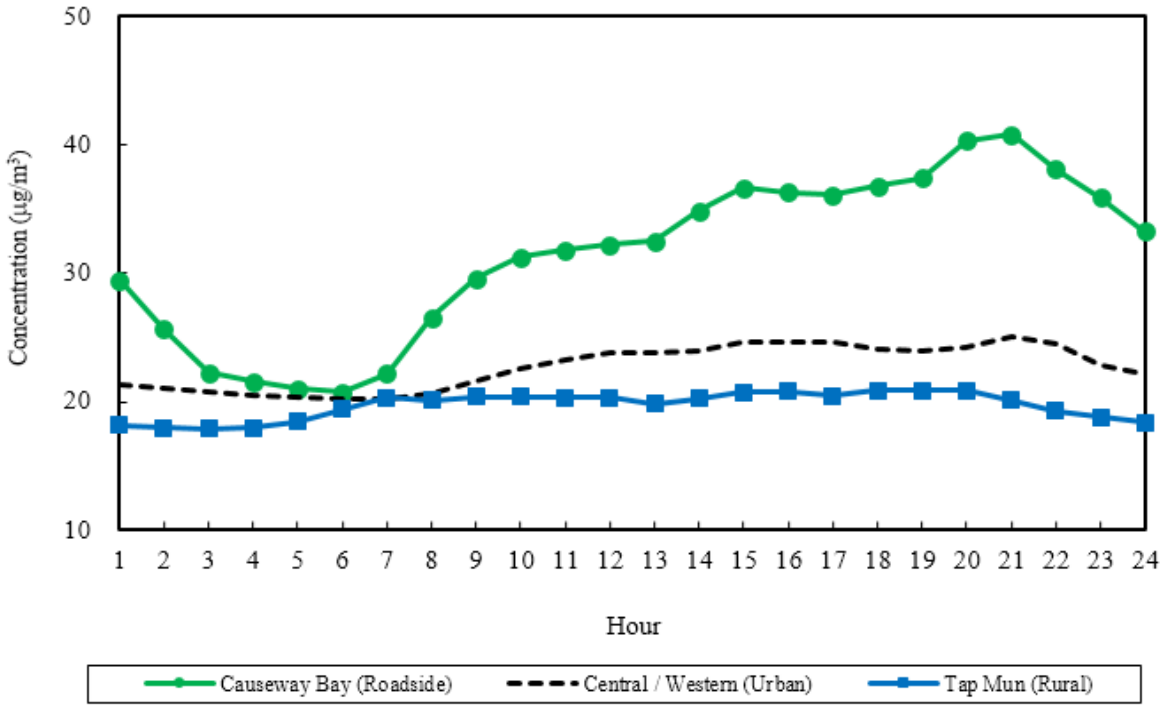
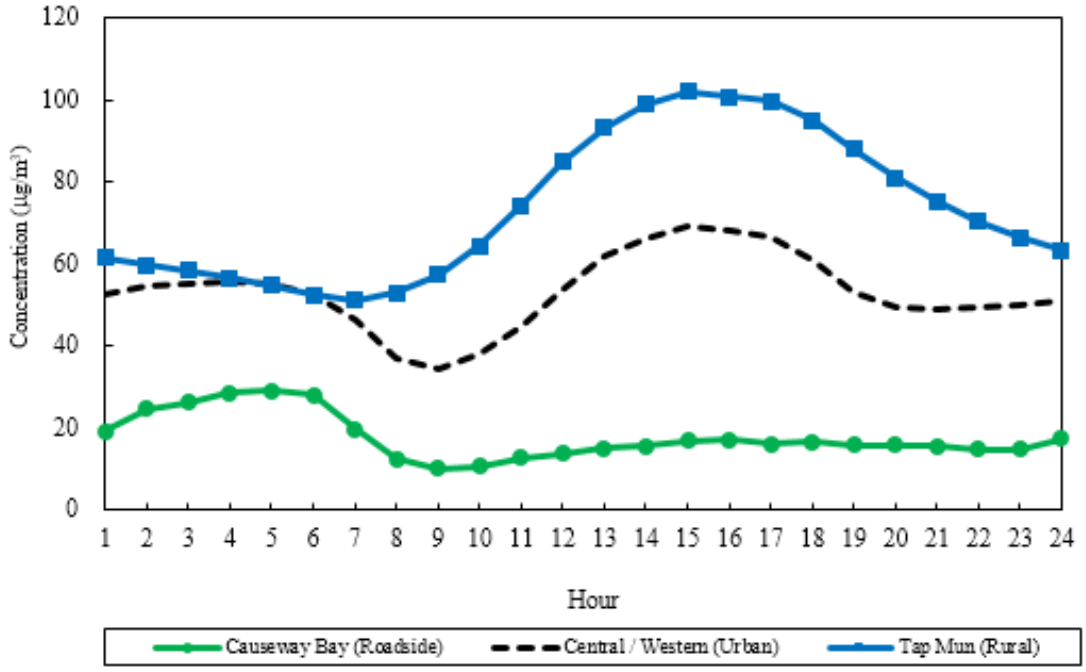


Figure 10: 2017 Diurnal variations of FSP



The diurnal pattern of O_3 is different from that of NO_2, RSP and FSP. 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: 2017 Diurnal variations of O_3

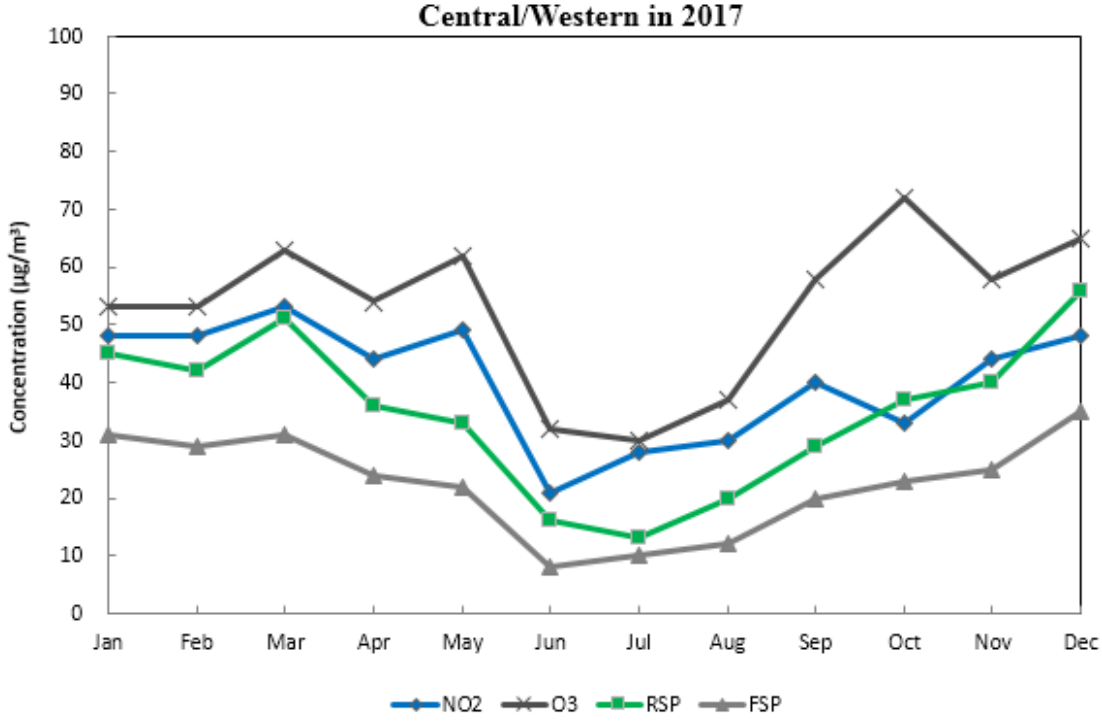


5.2 Over a Year

Concentrations of NO_2, RSP and FSP are in general lower in summer 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.

As regards O_3, the highest monthly concentrations usually occur in September or October with more favourable meteorological conditions (such as strong solar radiation, less amount of clouds, low wind speed etc.) for formation of ozone via photochemical reactions.

Figure 12: Monthly variations of NO_2, O_3, RSP and FSP at Central/Western in 2017



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 average pollutant concentrations over several years.

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, Kwun Tong, Sham Shui Po, Kwai Chung, Tsuen Wan and Tseung Kwan O
New Town	Mainly residential areas	Yuen Long, Tuen Mun, Tung Chung, Tai Po and Sha Tin
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

The long term trends of most air pollutants are decreasing in the general and roadside stations.

As compared to 2016, the annual average concentrations of SO_2, NO_2 and CO at general stations decreased by 11%, 15% and 11%, respectively. Whereas, the annual average concentration of FSP recorded at general stations remained at 2016 level. Only the annual average concentrations of RSP and O_3 recorded at general stations increased by 3% and 31%, respectively.

As for roadside stations, the annual average concentration of CO decreased by 12% in 2017. Whereas, FSP and SO_2 remained at the same level as in 2016, but NO_2, RSP and O_3 increased by 5%, 3% and 21%, respectively, in the same period.

Compared to 2016, 2017 had a less favourable meteorological condition with less rainfall, more hours of sunshine and higher mean air temperature, which would have enhanced the formation of ambient O_3. The rise in ambient O_3 level would also promote the conversion of vehicle-generated nitrogen oxides (NO_x) to NO_2, resulting in a higher roadside NO_2 level. While year-to-year fluctuation in air quality can be more susceptible to

meteorological factors, the long-term air quality trends shall be studied to understand the effectiveness of emission control efforts

5.3.1 Sulphur Dioxide (SO_2)

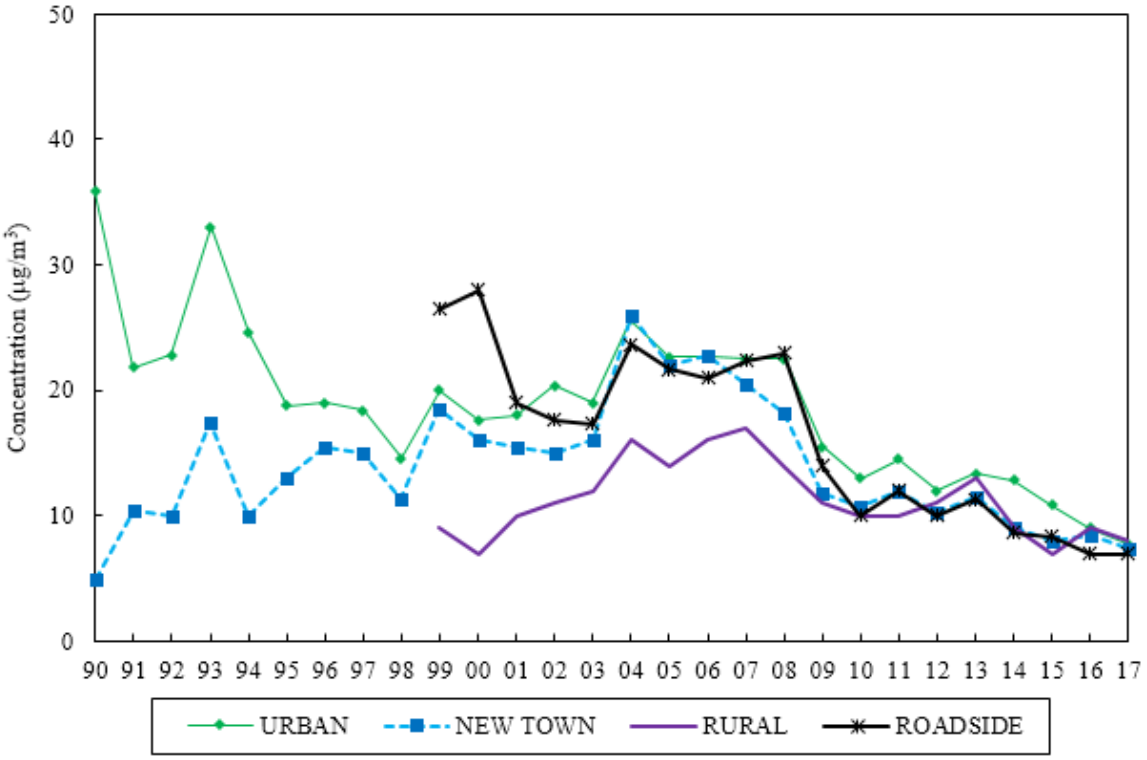
Since the implementation of the Air Pollution Control (Fuel Restriction) Regulations in 1990 for restricting sulphur content of industrial fuels, the Air Pollution Control (Motor Vehicle Fuel) Regulations in 1995 for controlling motor vehicle fuel quality, introduction of ultra-low sulphur diesel for vehicle fleet in late 2000 and the subsequent introduction of Euro V motor diesel in Dec 2007, SO_2 concentrations in Hong Kong have remained at levels well below the AQO limits.

In April 2014 and July 2015, the Air Pollution Control (Marine Light Diesel) Regulation and the Air Pollution Control (Ocean Going Vessels) (Fuel at Berth) Regulation were also introduced to further reduce SO_2 emissions.

On the regional front, the Governments in Guangdong Province and Hong Kong have been working together by introducing a wide range of control measures, 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., to reduce the emissions in the Pearl River Delta (PRD) region.

As a result of the implementation of various fuel control measures, both the ambient and roadside SO_2 concentrations in 2017 remained low at 8 μg/m^3 and 7 μg/m^3, respectively.

Figure 13: SO_2 long term trend



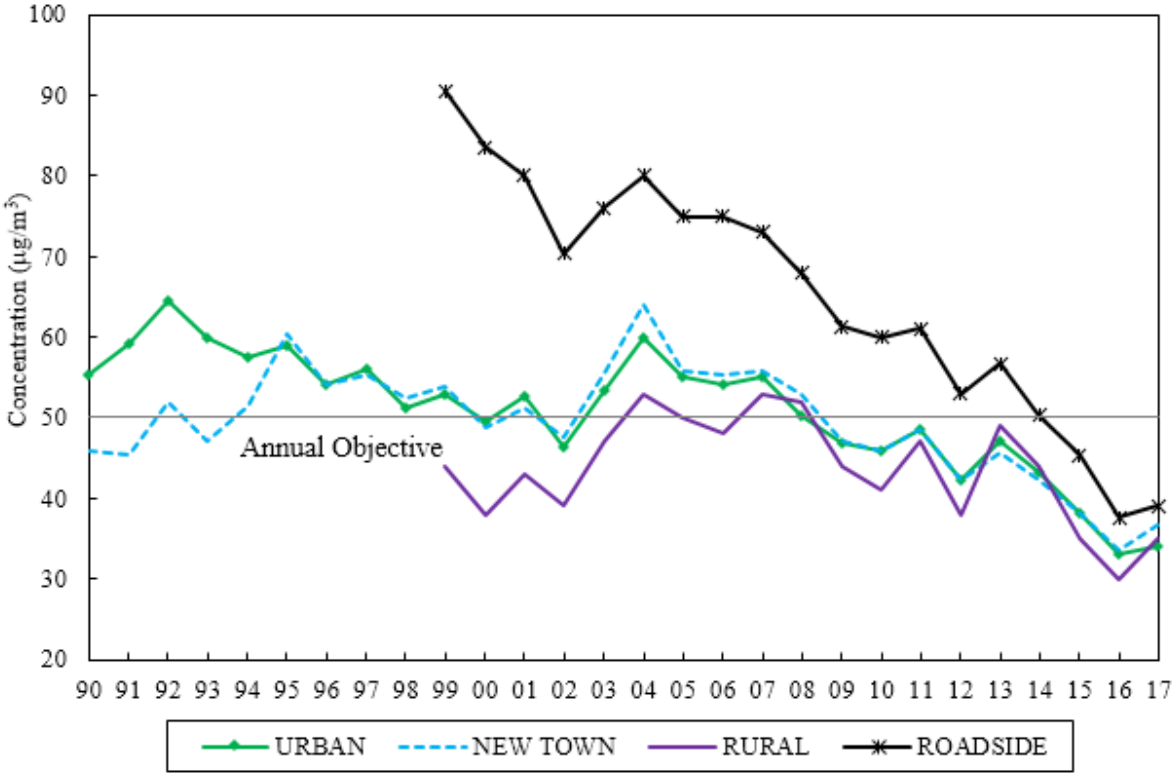
5.3.2 Respirable Suspended Particulates (RSP)

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 ambient RSP concentrations then

continuously dropped to a level below the annual AQO limit from 2009 onwards, reflecting a reduction in regional background RSP levels in the past few years.

As a result of the implementation of various vehicle emission control measures in the past decades, the annual average of RSP concentration at roadside in 2017 had been significantly reduced by 57% when compared with the 1999[1] value and remained below the annual AQO limit since 2015.

Figure 14: RSP long term trend



5.3.3 Fine Suspended Particulates (FSP)

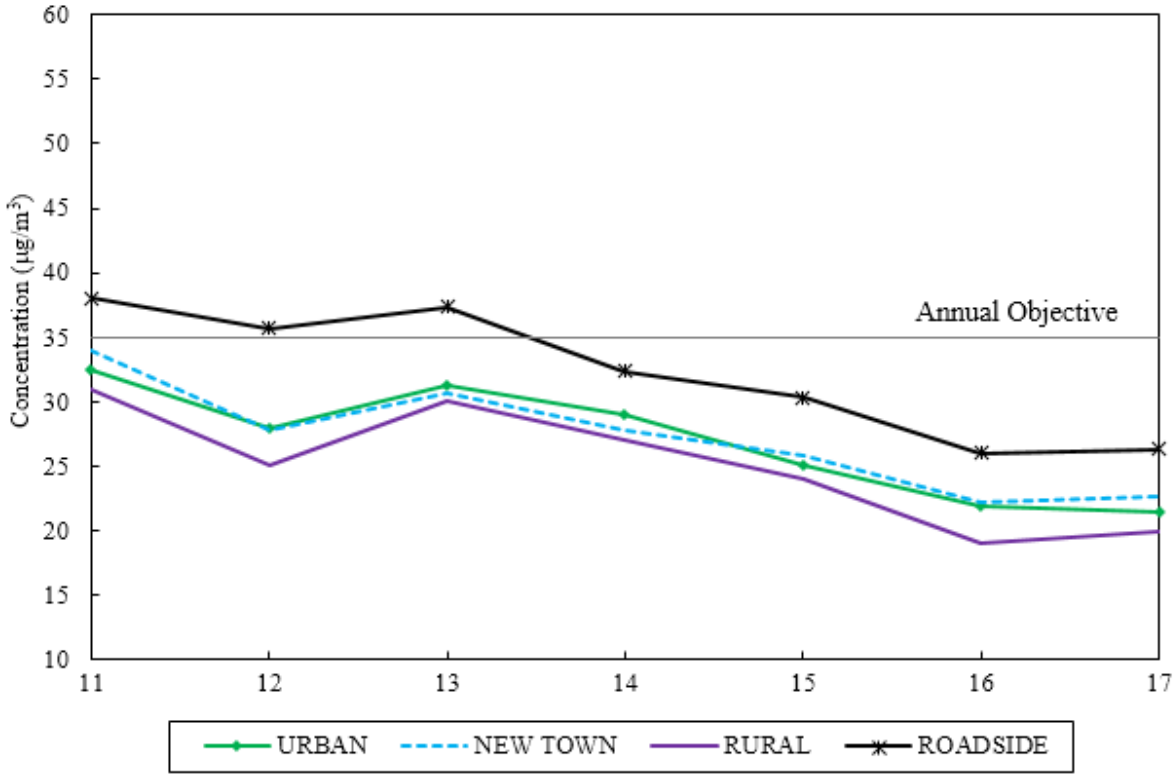
We started to monitor FSP at all our monitoring stations in 2011[2]. Same as RSP, the ambient concentrations of FSP in the territory showed an overall downward trend between 2011 and 2017, reflecting a reduction in regional background FSP levels in the past few years.

The roadside FSP levels also showed a discernible improvement in recent years. In 2017, the annual average of FSP concentration at roadside reduced by about 32% when compared with the 2011 value and its level has compiled with the annual AQO since 2014.

[1] 1999 is selected for comparison as this was the year when the Government started to implement a list of measures to cut vehicular emissions.

[2] FSP were only monitored at four to five air quality monitoring stations between 1999 and 2010.

Figure 15: FSP long term trend



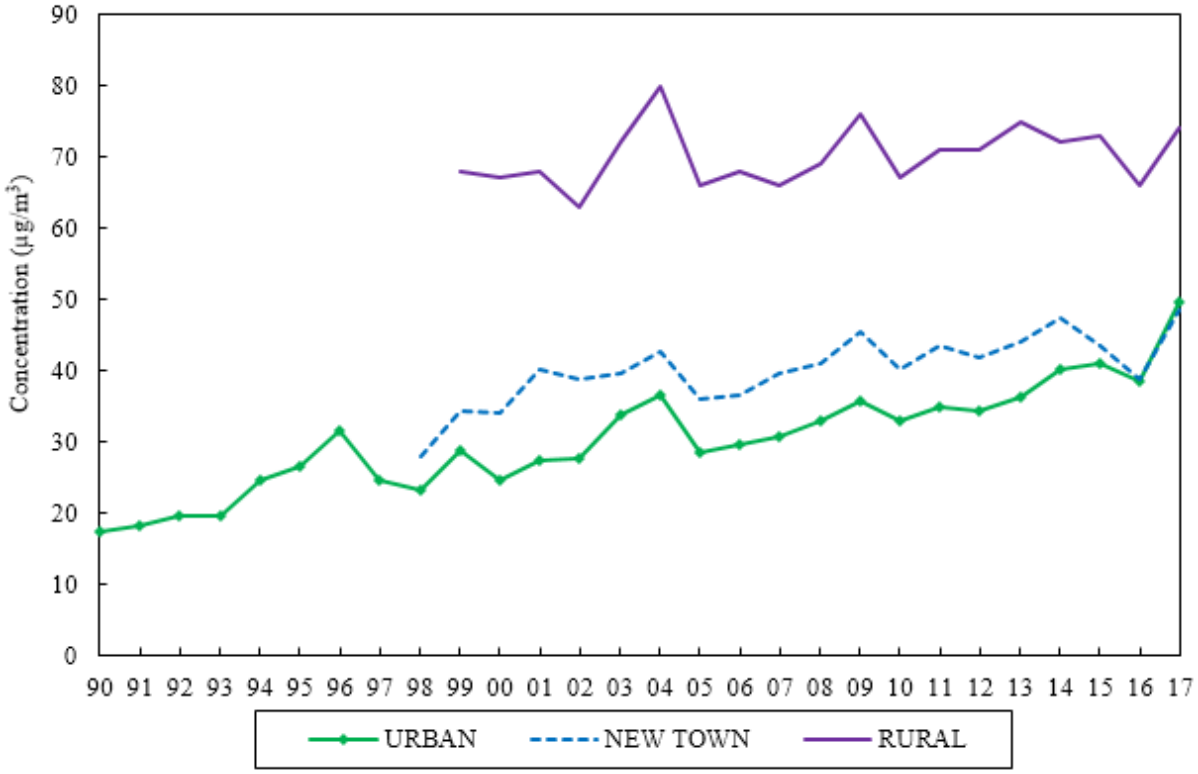
5.3.4 Ozone (O_3)

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 about twice the O_3 levels measured in urban areas since the commencement of monitoring at rural area in 1998.

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 have been implementing a regional air quality management plan to, among others, alleviate photochemical smog problem by reducing O_3 precursors levels in the PRD region.

Figure 16: O_3 long term trend

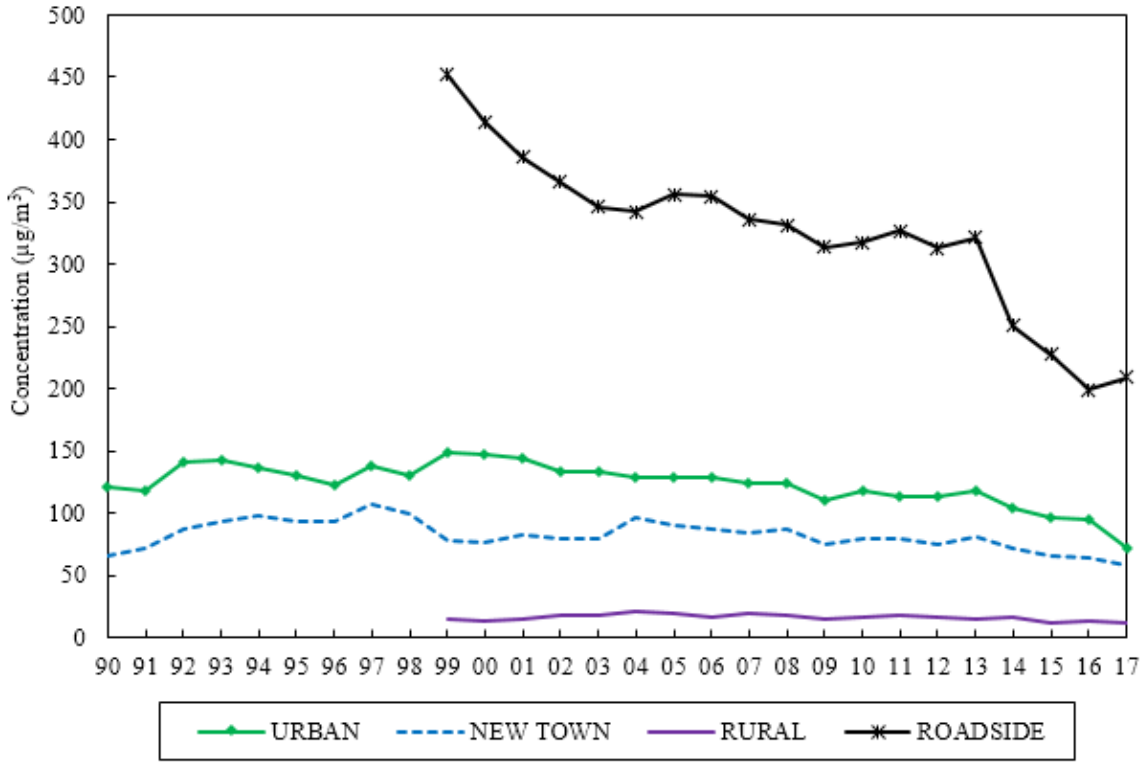


5.3.5 Nitrogen Oxides (NOx) and Nitrogen Dioxide (NO_2)

The annual average of NOx in urban areas exhibited a gradual declining trend between 1999 and 2017. During the same period, the roadside NOx concentration showed a more distinct descending trend, reflecting the effectiveness of various vehicle emission control measures implemented over the past decades. The roadside NOx concentration in 2017 was 54% lower than that in 1999[1].

[1] 1999 is selected for comparison as this was the year when the Government started to implement a list of measures to cut vehicular emissions.

Figure 17: NOx long term trend

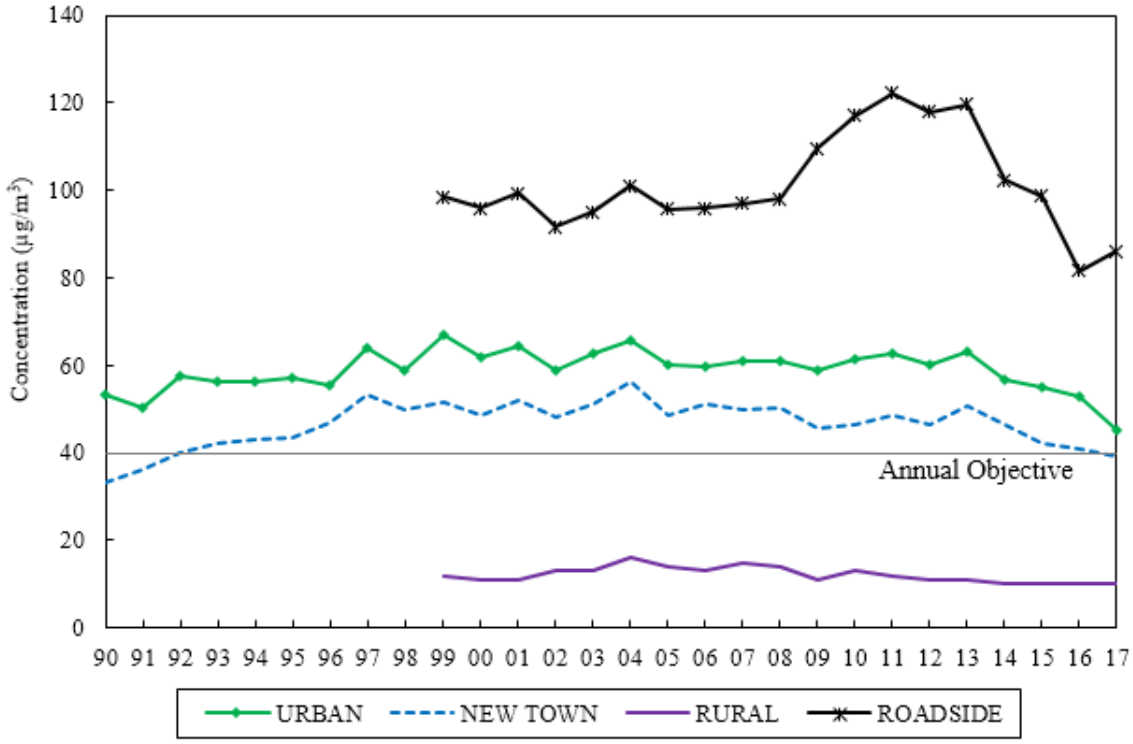


NO_2, a major component of NO_x, is mainly formed from the oxidation of nitric oxide. The oxidation can be promoted by the presence of more ozone and VOCs in the ambient air. The ambient NO_2 levels have exhibited slow ascending trends between 1990 and 2004 and levelled off from 2005 to 2012, but the trends have started to decline progressively since 2013.

Roadside NO_2 levels have been more difficult to reduce. However, the increasing trend of its 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 stabilised and started to drop from its peak in 2011. The annual NO_2 concentration at roadside recorded in 2017 had reduced by 13% when compared with the 1999 level.

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, , stepping up the control on emissions from petrol and liquefied petroleum gas vehicles, providing incentives to accelerate the phasing out of old and polluting diesel commercial vehicles, as well as tightening the emission standards of newly registered motor vehicles.

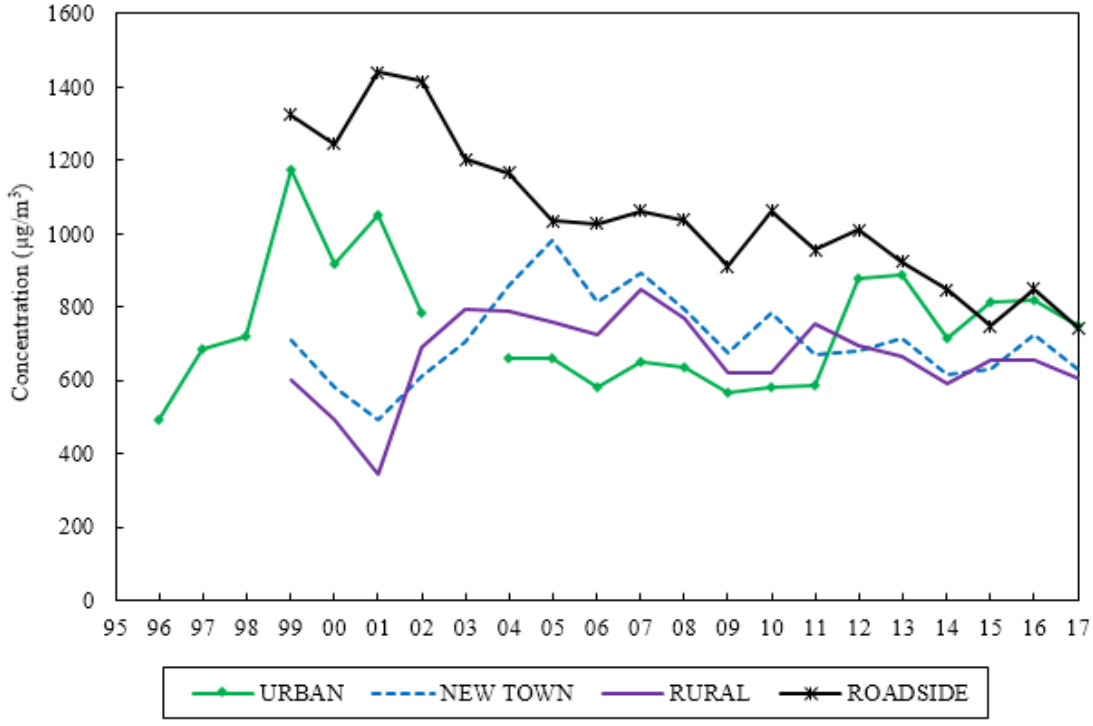
Figure 18: NO_2 long term trend



5.3.6 Carbon Monoxide (CO)

The ambient concentrations of CO in Hong Kong remained at very low levels in the last decade. Even at the roadside close to the vehicular emission sources, the CO levels were low and close to the ambient CO concentrations in 2017.

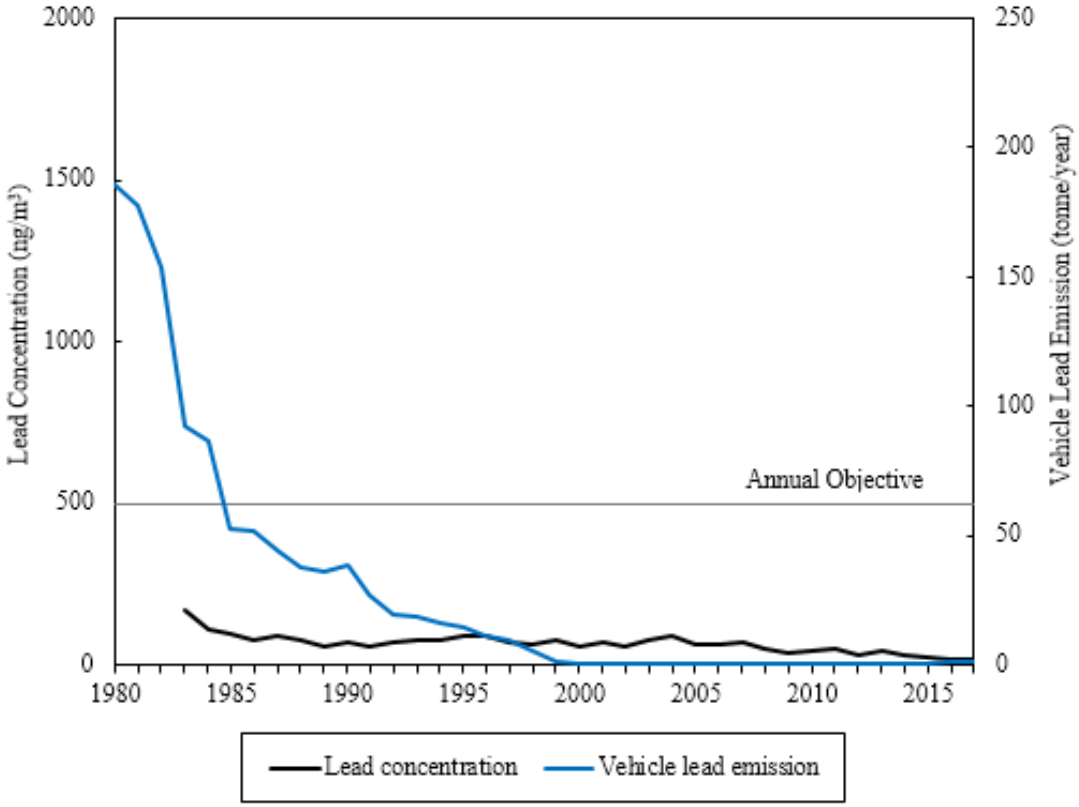
Figure 19: CO long term trend



5.3.7 Lead (Pb)

The ambient lead concentrations have been lingering at very low levels over the years with 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 20: Vehicle lead emission and lead concentration



Appendix A

Air Quality Objectives and their Compliance Status

Hong Kong Air Quality Objectives (AQOs) for seven major air pollutants were set at levels to protect public health in 1987. This set of AQOs was reviewed and updated with effect on 1 January 2014. The updated set of AQOs is given in Table A1. The compliance status of the new AQOs has been used as the indicator of air quality in different districts in Hong Kong.

Table A1: Hong Kong Air Quality Objectives (AQOs)

Pollutant	Averaging time	Concentration limit [i] ($\mu g/m^3$)	Number of exceedances of limit allowed
Sulphur dioxide	10-minute	500	3
	24-hour	125	3
Respirable suspended particulates (PM_{10}) [ii]	24-hour	100	9
	Annual	50	Not applicable
Fine suspended particulates ($PM_{2.5}$)[iii]	24-hour	75	9
	Annual	35	Not applicable
Nitrogen dioxide	1-hour	200	18
	Annual	40	Not applicable
Ozone	8-hour	160	9
Carbon monoxide	1-hour	30,000	0
	8-hour	10,000	0
Lead	Annual	0.5	Not applicable

Notes:

[i] All measurements of the concentration of gaseous air pollutants, i.e. sulphur dioxide, nitrogen dioxide, ozone and carbon monoxide, are adjusted to a reference temperature of 293 Kelvin and a reference pressure of 101.325 kPa.

[ii] Respirable suspended particulates mean suspended particles in air with a nominal aerodynamic diameter of 10 µm or less.

[iii] Fine suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 2.5 µm or less.

Compliance with the short-term AQOs

Table A2 shows the compliance status with the short-term AQOs (i.e. 10-min, 1-hour, 8-hour and 24-hour AQOs) recorded at each monitoring station in 2017. Six general stations and all three roadside stations complied with the 8 hour AQO for O_3, whereas other seven general stations could not comply with the respective AQO for O_3. For compliance status of other criteria pollutants, twelve general stations complied with the 1-hour AQO for NO_2, while all general and roadside stations complied with the short-term AQO for RSP, FSP, SO_2 and CO.

Table A2: Compliance Status of Short-Term Air Quality Objectives in 2017

Station		O_3	NO_2	RSP	FSP	SO_2		CO	
		8-hr	1-hr	24-hr	24-hr	10-min	24-hr	1-hr	8-hr
General Station	Central/Western	✓	✓	✓	✓	✓	✓	--	--
	Eastern	✓	✓	✓	✓	✓	✓	--	--
	Kwun Tong	✓	✓	✓	✓	✓	✓	--	--
	Sham Shui Po	✓	✓	✓	✓	✓	✓	--	--
	Kwai Chung	✓	×	✓	✓	✓	✓	--	--
	Tsuen Wan	✓	✓	✓	✓	✓	✓	✓	✓
	Tseung Kwan O	×	✓	✓	✓	✓	✓	✓	✓
	Yuen Long	×	✓	✓	✓	✓	✓	✓	✓
	Tuen Mun	×	✓	✓	✓	✓	✓	✓	✓
	Tung Chung	×	✓	✓	✓	✓	✓	✓	✓
	Tai Po	×	✓	✓	✓	✓	✓	--	--
	Sha Tin	×	✓	✓	✓	✓	✓	--	--
	Tap Mun	×	✓	✓	✓	✓	✓	✓	✓
Roadside Station	Causeway Bay	✓	×	✓	✓	✓	✓	✓	✓
	Central	✓	×	✓	✓	✓	✓	✓	✓
	Mong Kok	✓	×	✓	✓	✓	✓	✓	✓

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

Compliance with the long-term AQO

Table A3 shows the compliance status of the long-term (annual) AQO for all monitoring stations in 2017. All stations complied with the annual AQO for RSP and FSP whereas seven general and three roadside stations could not comply with the annual AQO for NO_2 in 2017. For lead, all nine monitoring stations achieved full compliance with the long term AQO in 2017.

Table A3: Compliance Status of Long-Term (Annual) Air Quality Objectives in 2017

Station		Annual			
		NO_2	**RSP**	**FSP**	**Lead**
General Station	Central/Western	✓	✓	✓	✓
	Eastern	×	✓	✓	--
	Kwun Tong	×	✓	✓	✓
	Sham Shui Po	×	✓	✓	✓
	Kwai Chung	×	✓	✓	✓
	Tsuen Wan	×	✓	✓	✓
	Tseung Kwan O	✓	✓	✓	✓
	Yuen Long	×	✓	✓	✓
	Tuen Mun	×	✓	✓	--
	Tung Chung	✓	✓	✓	✓
	Tai Po	✓	✓	✓	--
	Sha Tin	✓	✓	✓	--
	Tap Mun	✓	✓	✓	--
Roadside Station	Causeway Bay	×	✓	✓	--
	Central	×	✓	✓	--
	Mong Kok	×	✓	✓	✓

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

Appendix B

Air Quality Monitoring Operation

B.1 Network Operation

The Air Science Group of the Environmental Protection Department operates the Air Quality Monitoring Network which had 16 monitoring stations in 2017. Table B1 shows the station site information. The measurement of respirable suspended particulates (RSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3) and carbon monoxide (CO) concentrations have been accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS) since August 1995. In addition, the measurement of fine suspended particulates (FSP) concentration has been accredited by HOKLAS since August 2016.

In order to provide good representation of the air quality in areas of high population density, the locations of the 16 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 concentrations 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 RSP concentrations. The concentrations of lead are determined in the subsequent elemental analysis of the RSP samples by Government Laboratory using Inductively Coupled Plasma Optical Emission Spectroscopy. 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: conductivity, 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 broadband data lines for further processing. After careful checking and validation, the monitoring data are disseminated to the public in the following manner:-

- Hourly Air Quality Health Index [##] (AQHI) reporting for individual station
- Monthly release of the AQHI 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"*

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

- 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

The reporting and forecast of AQHI 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. Performance goal of ±15% and ±20% are adopted for suspended particulates (RSP and FSP) and gaseous pollutants respectively. In 2017, 371 audit checks were carried out on the stations' analysers and samplers. Based on the 95% probability limits, the accuracy varied from -6.6 % to 6.7 % for gases, and from -6.7 % to 8.2 % for particulates. All parameters were well within the specified performance goal 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 2017, 2943 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 -5.4% and 5.3%, which was again within the performance goal of ±15% for both particulates (RSP and FSP) and gaseous pollutants.

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		Date Start Operation
			Above P.D.H.K.	Above Ground	
Central/Western (Sai Ying Pun Community Complex)	2 High Street, Sai Ying Pun	Urban: Mixed residential/ commercial	82m	16m (5 floors)	Nov 1983[1]
Eastern (Sai Wan Ho Fire Station)	20 Wai Hang Street, Sai Wan Ho	Urban: Residential	28m	15m (4 floors)	Jan 1999
Kwun Tong (Yue Wah Mansion)	407-431 Kwun Tong Road, Kwun Tong	Urban: Mixed residential/ commercial/industrial	37m	25m (7 floors)	Jul 1983[2]
Sham Shui Po (Sham Shui Po Police Station)	37A Yen Chow Street, Sham Shui Po	Urban: Mixed residential/ commercial	21m	17m (4 floors)	Jul 1984
Kwai Chung (Kwai Chung Police Station)	999 Kwai Chung Road, Kwai Chung	Urban: Mixed residential/ commercial/industrial	19m	13m (2 floors)	Jul 1988[3]
Tsuen Wan (Princess Alexandra Community Centre)	60 Tai Ho Road, Tsuen Wan	Urban: Mixed residential/ commercial/industrial	21m	17m (4 floors)	Aug 1988
Tseung Kwan O (Tseung Kwan O Sports Centre)	9 Wan Lung Road, Tseung Kwan O, Sai Kung	Urban: Residential	23m	16m (2 floors)	Mar 2016
Yuen Long (Yuen Long District Office Bldg.)	269 Castle Peak Road, Yuen Long	New Town: Residential	31m	25m (6 floors)	Jul 1995
Tuen Mun (Tuen Mun Public Library)	1 Tuen Hi Road, Tuen Mun	New Town: Residential	31m	27m (4 floors)	Dec 2013
Tung Chung (Tung Chung Health Centre)	6 Fu Tung Street, Tung Chung	New Town: Residential	34.5m	27.5m (4 floors)	Apr 1999
Tai Po (Tai Po Govt. Offices Bldg.)	1 Ting Kok Road, Tai Po	New Town: Residential	31m	28m (6 floors)	Feb 1990
Sha Tin (Sha Tin Govt. Secondary School)	11-17 Man Lai Road, Tai Wai, Sha Tin	New Town: Residential	31m	25m (6 floors)	Jul 1991
Tap Mun	Tap Mun Police Post	Background: Rural	26m	11m (3 floors)	Apr 1998
Causeway Bay	1 Yee Woo Street, Causeway Bay	Urban Roadside: Mixed commercial/ residential area surrounded by tall buildings	6.5m[4] / 7m[5]	3m[4] / 3.5m[5]	Jan 1998
Central	Junction of Des Voeux Road Central and Chater Road, Central	Urban Roadside: Busy commercial/ financial area surrounded by tall buildings	8.5m	4.5m	Oct 1998

Monitoring Station	Address	Area Type	Sampling Height		Date Start Operation
			Above P.D.H.K.	Above Ground	
Mong Kok	Junction of Nathan Road and Lai Chi Kok Road, Mong Kok	Urban Roadside: Mixed commercial/ residential area surrounded by tall buildings	8.5m[4] / 10.9m[5]	3m[4] / 5.4m[5]	Apr 1991[6]

Notes: P.D. = Principal Datum
[1] Central/Western station was relocated to the current address on October 2009.
[2] Kwun Tong station was relocated to the current address on April 2012.
[3] Kwai Chung station was relocated to the current address on January 1999.
[4] Sampling height for gaseous pollutants.
[5] Sampling height for suspended particulates.
[6] Mong Kok station was relocated to the current address on January 2001.

Table B2: Summary of the Parameters Monitored in the Network (2017)

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

Notes:
[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	T-API 100E, T-API T100, T-API T100U, TECO 43A, TECO 43i
NO, NO_2, NO_x	Chemiluminescence	T-API 200A, T-API T200, TECO 42i
O_3	UV absorption	T-API 400, T-API 400A, T-API T400
SO_2, NO_2, O_3	Differential Optical Absorption Spectroscopy	Opsis AR 500 System
CO	Non-dispersive infra-red absorption with gas filter correlation	T-API 300, T-API T300, TECO 48C
RSP (PM_{10})	a) Gravimetric b) Oscillating microbalance c) Beta Attenuation	Graseby Andersen PM10, Tisch PM10+, R&P TEOM Series 1400a-AB-PM10, Thermo Scientific TEOM 1405-DF, Met One BAM 1020, T-API 602 Beta Plus
FSP ($PM_{2.5}$)	a) Gravimetric b) Oscillating microbalance c) Beta Attenuation	Thermo Scientific Partisol-Plus 2025, R&P TEOM Series 1400a-AB-PM2.5, Thermo Scientific TEOM 1405-DF, Met One BAM1020, T-API 602 Beta Plus

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 / ATEC 2200	Canister	Twice per month	24 hours
Perchloro-ethylene	USEPA Method TO-14A	Xontech 910A / RM 910A / ATEC 2200	Canister	Twice per month	24 hours
1,3-Butadiene	USEPA Method TO-14A	Xontech 910A / RM 910A / ATEC 2200	Canister	Twice per month	24 hours
Formaldehyde	USEPA Method TO-11A	Xontech 925/ RM 925 / ATEC 2200	DNPH coated Sep-Pak 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 924	Bicarbonate Impregnated Filter	Once per month	24 hours

Figure B1: Accuracy of Air Quality Monitoring Network, 2017

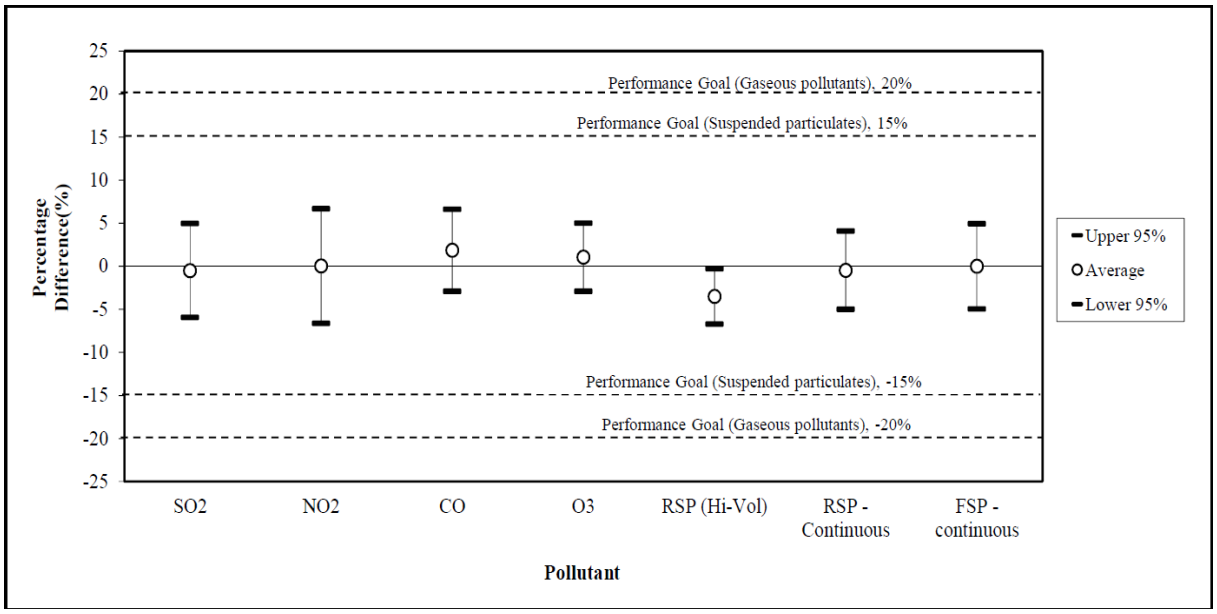
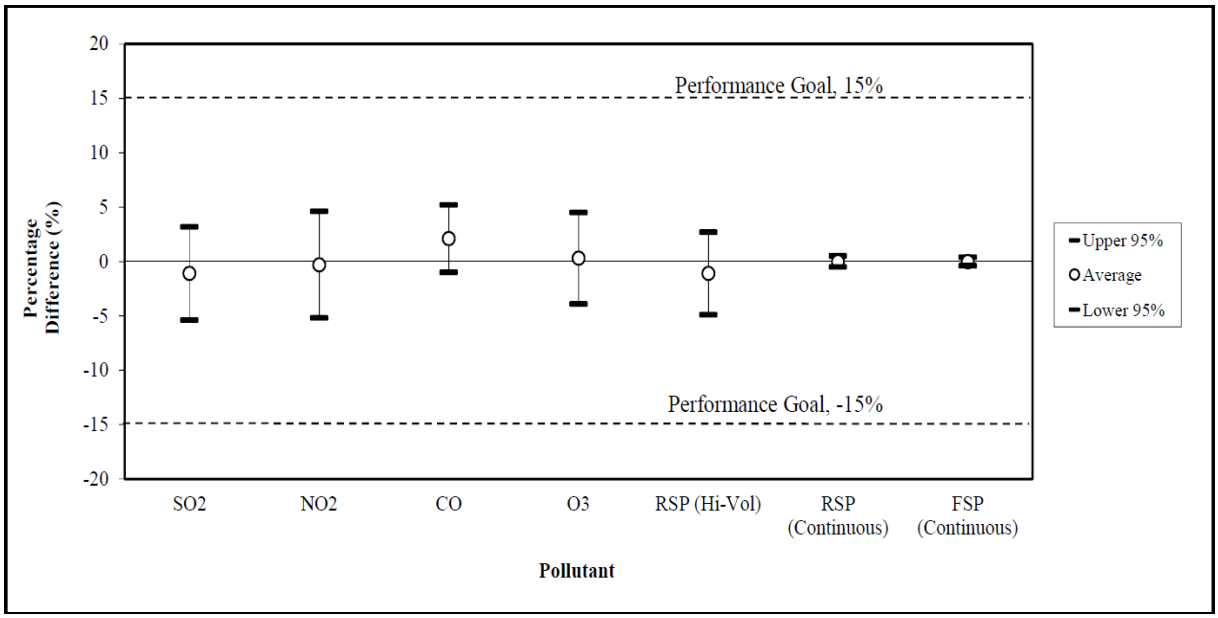


Figure B2: Precision of Air Quality Monitoring Network, 2017



Appendix C

Tables of Air Quality Data

Table C1: 2017 Exceedance of Short-Term Limit Values of Air Quality Objectives

Pollutant: Sulphur Dioxide

(10-minute limit value = 500 μg/m^3 ; allowable no. of exceedance of limit value = 3)

Station	No. of exceedance of limit vaue	1st High	2nd High	3rd High	4th High
Central/Western	0	153	130	127	125
Eastern	0	64	60	57	54
Kwun Tong	0	55	54	54	53
Sham Shui Po	0	85	80	77	76
Kwai Chung	0	125	118	95	93
Tsuen Wan	0	118	110	106	105
Tseung Kwan O	0	52	50	45	39
Yuen Long	0	105	96	80	80
Tuen Mun	0	89	89	89	88
Tung Chung	0	92	87	87	87
Tai Po	0	47	45	44	39
Sha Tin	0	73	62	55	53
Tap Mun	0	34	33	33	32
Causeway Bay	0	102	100	98	95
Central	0	108	104	94	91
Mong Kok	0	98	91	90	83

Pollutant: Carbon Monoxide

(1-hour limit value = 30,000 μg/m^3 ; allowable no. of exceedance of limit value = 0)

Station	No. of exceedance of limit vaue	1st High
Tsuen Wan	0	1610
Tseung Kwan O	0	1830
Yuen Long	0	1450
Tuen Mun	0	1740
Tung Chung	0	1810
Tap Mun	0	1770
Causeway Bay	0	2420
Central	0	2050
Mong Kok	0	2390

Pollutant: Sulphur Dioxide

(24-hour limit value = 125 μg/m^3 ; allowable no. of exceedance of limit value = 3)

Station	No. of exceedance of limit vaue	1st High	2nd High	3rd High	4th High
Central/Western	0	31	30	29	29
Eastern	0	16	15	14	14
Kwun Tong	0	22	22	22	19
Sham Shui Po	0	32	27	26	25
Kwai Chung	0	31	28	25	24
Tsuen Wan	0	29	27	25	24
Tseung Kwan O	0	17	17	15	15
Yuen Long	0	24	22	21	20
Tuen Mun	0	33	30	28	26
Tung Chung	0	37	27	21	21
Tai Po	0	14	10	10	9
Sha Tin	0	17	16	16	16
Tap Mun	0	16	15	14	14
Causeway Bay	0	28	26	26	25
Central	0	27	25	25	24
Mong Kok	0	24	20	20	20

Pollutant: Carbon Monoxide

(8-hour limit value = 10,000 μg/m^3 ; allowable no. of exceedance of limit value = 0)

Station	No. of exceedance of limit vaue	1st High
Tsuen Wan	0	1414
Tseung Kwan O	0	1574
Yuen Long	0	1324
Tuen Mun	0	1630
Tung Chung	0	1544
Tap Mun	0	1543
Causeway Bay	0	2090
Central	0	1879
Mong Kok	0	2156

Pollutant: Nitrogen Dioxide (1-hour limit value = 200 μg/m^3 ; allowable no. of exceedance of limit value = 18)

Station	No. of exceedance of limit vaue	1st High	2nd High	3rd High	4th High	5th High	6th High	7th High	8th High	9th High	10th High	11th High	12th High	13th High	14th High	15th High	16th High	17th High	18th High	19th High
Central/Western	1	211	193	188	187	187	179	178	176	176	174	173	173	170	169	168	167	167	167	164
Eastern	0	191	187	183	164	161	157	156	154	152	151	145	144	142	142	142	140	140	140	139
Kwun Tong	18	245	240	235	233	228	227	226	225	220	216	216	210	209	208	206	204	203	202	199
Sham Shui Po	15	267	259	236	228	227	225	221	218	218	215	213	212	204	204	202	198	197	196	194
Kwai Chung	20	265	265	264	258	250	246	241	241	237	230	228	225	220	218	217	216	209	209	204
Tsuen Wan	8	236	230	215	209	207	202	202	201	200	198	196	195	193	192	192	190	190	181	179
Tseung Kwan O	2	211	201	198	193	192	191	188	185	185	177	175	173	170	169	168	167	167	166	165
Yuen Long	2	214	204	196	192	174	170	169	167	164	163	163	160	159	159	158	158	158	157	156
Tuen Mun	12	265	248	240	239	234	233	225	219	217	207	201	201	200	199	197	195	194	191	188
Tung Chung	2	227	222	196	189	186	165	163	162	161	160	155	151	149	148	147	147	145	145	144
Tai Po	0	148	147	141	139	138	137	136	135	134	131	131	130	130	129	128	128	128	128	127
Sha Tin	0	178	168	163	163	159	157	156	154	154	150	150	150	150	150	150	147	145	145	144
Tap Mun	0	85	75	73	69	65	62	60	60	59	58	56	56	54	54	54	54	53	53	52
Causeway Bay	272	466	445	424	411	394	382	379	379	371	362	357	349	340	337	336	336	336	333	325
Central	126	304	303	302	299	299	297	295	292	288	288	281	279	275	275	273	272	268	268	267
Mong Kok	90	342	332	302	296	293	293	290	284	280	279	276	275	273	270	265	260	260	258	257

Table C1 (Cont.): 2017 Exceedance of Short-Term Limit Values of Air Quality Objectives

Pollutant: Ozone (Daily maximum 8-hour limit value = 160 μg/m^3 ; allowable no. of exceedance of limit value = 9)

Station	No. of exceedance of limit value	1st High	2nd High	3rd High	4th High	5th High	6th High	7th High	8th High	9th High	10th High
Central/Western	9	305	281	226	226	197	196	191	173	162	159
Eastern	8	270	222	205	198	195	171	162	161	160	160
Kwun Tong	2	176	167	160	159	144	142	142	138	137	135
Sham Shui Po	3	256	250	187	155	144	134	133	133	131	130
Kwai Chung	4	264	215	194	174	158	156	143	142	138	129
Tsuen Wan	7	256	252	201	175	168	167	163	156	145	141
Tseung Kwan O	22	260	224	214	203	187	186	177	176	175	175
Yuen Long	13	272	255	253	252	214	210	194	185	184	175
Tuen Mun	20	293	272	257	242	237	218	206	184	181	176
Tung Chung	14	267	240	234	229	219	218	205	200	196	187
Tai Po	17	278	263	254	253	243	206	194	189	185	181
Sha Tin	14	265	256	241	232	197	183	175	171	169	167
Tap Mun	37	242	235	223	215	211	210	207	201	199	192
Causeway Bay	0	90	86	85	85	84	82	81	79	79	78
Central	0	151	151	128	118	117	114	112	107	105	103
Mong Kok	0	156	140	106	104	100	99	96	95	94	91

Pollutant: Respirable Suspended Particulates (PM_{10}) (24-hour limit value = 100 μg/m^3 ; allowable no. of exceedance of limit value = 9)

Station	No. of exceedance of limit value	1st High	2nd High	3rd High	4th High	5th High	6th High	7th High	8th High	9th High	10th High
Central/Western	1	104	100	96	93	92	89	88	86	85	84
Eastern	0	95	93	89	89	87	86	78	75	75	74
Kwun Tong	1	104	100	96	95	93	87	86	85	84	84
Sham Shui Po	0	85	79	77	77	75	75	73	73	73	72
Kwai Chung	0	90	89	86	80	79	78	77	76	74	74
Tsuen Wan	3	107	105	102	98	90	85	85	84	81	77
Tseung Kwan O	0	79	79	79	79	76	74	69	66	66	65
Yuen Long	2	111	101	99	91	90	90	90	88	88	87
Tuen Mun	9	134	129	122	117	115	113	112	106	103	99
Tung Chung	5	116	115	106	105	103	94	90	87	85	81
Tai Po	1	101	98	92	92	86	85	84	84	82	82
Sha Tin	1	103	89	83	81	81	79	79	77	72	72
Tap Mun	0	96	88	82	82	78	77	76	74	74	74
Causeway Bay	2	107	105	99	99	98	97	96	95	93	90
Central	2	107	104	98	92	92	89	89	87	87	84
Mong Kok	0	100	96	94	92	92	88	87	87	86	84

Pollutant: Fine Suspended Particulates ($PM_{2.5}$) (24-hour limit value = 75 μg/m^3 ; allowable no. of exceedance of limit value = 9)

Station	No. of exceedance of limit value	1st High	2nd High	3rd High	4th High	5th High	6th High	7th High	8th High	9th High	10th High
Central/Western	0	74	72	68	68	67	64	62	60	60	59
Eastern	0	61	58	57	55	54	54	50	49	49	49
Kwun Tong	0	66	64	62	61	59	57	55	54	54	53
Sham Shui Po	0	54	53	53	53	50	50	49	49	48	46
Kwai Chung	0	63	62	62	58	54	53	52	51	50	49
Tsuen Wan	3	84	82	76	75	67	65	63	56	56	52
Tseung Kwan O	0	55	55	52	51	48	45	45	45	44	43
Yuen Long	2	77	77	63	63	61	58	57	54	52	52
Tuen Mun	3	89	88	85	75	74	72	71	68	66	65
Tung Chung	2	88	76	74	73	68	67	62	61	57	57
Tai Po	0	75	73	66	66	65	63	61	59	59	55
Sha Tin	1	90	69	68	67	64	59	57	57	56	54
Tap Mun	0	56	50	49	47	47	46	45	44	44	43
Causeway Bay	4	81	80	79	77	73	73	70	70	66	65
Central	1	79	73	73	70	68	67	60	60	58	56
Mong Kok	1	76	73	71	69	68	65	63	63	61	57

Notes:

1. All concentration units are in microgram per cubic metre (μg/m^3).
2. Shaded no. of exceedance of limit value respresents exceedance of the respective air quality objective.
3. Shaded concentration is above the respective limit value of air qualtiy objectives.

Table C2: 2017 Monthly and Annual Averages of Air Pollutants

Pollutant: Sulphur Dioxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	7	9	7	11	12	5	7	11	9	8	8	8	8
Eastern	4	4	4	5	5	2	2	4	5	3	3	5	4
Kwun Tong	7	6	6	6	8	7	6	9	6	3	5	7	6
Sham Shui Po	8	9	6	7	9	8	7	10	11	7	5	8	8
Kwai Chung	7	6	6	10	9	13	9	16	13	7	6	7	9
Tsuen Wan	12	12	13	10	8	8	8	10	11	9	10	15	11
Tseung Kwan O	8	8	7	8	9	6	7	8	9	7	7	6	8
Yuen Long	10	10	9	10	10	7	7	9	10	8	9	12	9
Tuen Mun	6	6	7	8	10	6	7	9	10	7	8	12	8
Tung Chung	10	10	10	12	11	4	7	8	10	6	8	12	9
Tai Po	4	3	3	4	4	3	4	5	5	3	3	5	4
Sha Tin	8	7	6	6	9	8	5	7	8	7	6	9	7
Tap Mun	10	10	10	11	6	4	4	6	7	8	8	10	8
Causeway Bay	9	8	9	9	11	7	5	9	10	10	10	10	9
Central	5	6	6	7	10	8	9	12	9	6	7	10	8
Mong Kok	4	4	4	3	5	3	3	3	6	4	5	7	4

Pollutant: Nitrogen Oxides

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	64	67	71	61	66	32	42	46	57	41	56	62	55
Kwun Tong	61	71	56	78	81	112	72	107	93	48	63	69	76
Sham Shui Po	88	92	94	79	96	67	72	79	95	59	74	81	81
Kwai Chung	89	90	97	118	103	139	95	130	122	74	79	94	102
Tsuen Wan	87	87	91	91	79	78	68	68	77	51	66	79	77
Tseung Kwan O	33	37	31	45	52	54	41	56	62	30	32	34	42
Yuen Long	76	69	64	66	65	50	54	54	59	46	60	68	61
Tuen Mun	88	79	83	71	69	50	54	60	67	54	79	84	70
Tung Chung	68	60	51	50	50	28	33	38	47	40	66	77	51
Tai Po	57	52	54	55	54	56	48	49	60	48	55	62	54
Sha Tin	52	55	42	57	55	47	41	58	62	39	45	46	50
Tap Mun	15	12	18	16	11	8	6	10	11	7	11	14	12
Causeway Bay	241	242	260	271	277	331	271	330	343	247	287	325	286
Central	172	190	175	166	184	175	156	173	189	152	174	205	176
Mong Kok	162	165	157	166	180	172	171	182	196	124	144	155	164

Pollutant: Nitrogen Dioxide (Annual limit value = 40 µg/m^3)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	48	48	53	44	49	21	28	30	40	33	44	48	40
Eastern	49	49	55	48	50	24	29	30	43	36	42	44	42
Kwun Tong	43	44	37	44	47	49	36	53	54	33	41	45	44
Sham Shui Po	64	63	66	55	65	38	39	45	58	45	56	59	54
Kwai Chung	57	55	61	61	63	55	42	57	64	50	52	64	57
Tsuen Wan	62	58	61	57	58	43	39	44	52	41	50	60	52
Tseung Kwan O	25	26	24	31	33	28	23	32	38	24	23	26	28
Yuen Long	51	46	49	44	45	25	26	31	37	37	44	53	41
Tuen Mun	55	49	54	44	50	29	29	38	47	44	56	62	46
Tung Chung	44	40	36	33	38	18	21	24	33	34	48	58	36
Tai Po	41	38	41	40	39	31	29	33	41	39	43	48	39
Sha Tin	36	36	32	38	39	27	24	36	39	33	36	38	34
Tap Mun	13	10	14	14	9	6	5	8	8	6	10	13	10
Causeway Bay	93	95	103	100	104	81	75	87	110	99	100	117	97
Central	84	86	92	80	89	58	57	64	85	82	84	98	80
Mong Kok	86	86	90	84	93	59	64	71	92	74	81	89	81

Pollutant: Carbon Monoxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tsuen Wan	853	718	840	846	811	583	591	532	482	519	593	705	672
Tseung Kwan O	817	818	877	908	934	737	743	716	815	791	811	912	824
Yuen Long	655	718	831	799	499	285	362	364	439	454	517	561	539
Tuen Mun	932	863	902	910	919	624	628	547	663	748	694	750	764
Tung Chung	902	603	626	575	537	421	410	518	482	612	635	759	591
Tap Mun	933	869	525	411	559	418	282	463	658	649	713	805	608
Causeway Bay	929	920	981	880	826	713	505	503	408	444	576	999	725
Central	1047	956	927	653	649	460	421	511	459	471	725	963	687
Mong Kok	1000	924	844	860	893	747	790	729	616	714	777	921	818

Table C2 (Cont.): 2017 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	53	53	63	54	62	32	30	37	58	72	58	65	53
Eastern	61	64	69	63	69	39	38	43	61	76	67	76	61
Kwun Tong	53	57	66	50	56	14	25	22	43	69	56	66	48
Sham Shui Po	41	44	47	41	46	16	19	20	38	60	45	54	39
Kwai Chung	45	49	52	35	46	8	17	15	37	58	50	57	39
Tsuen Wan	42	46	54	39	50	15	21	25	42	64	48	57	42
Tseung Kwan O	72	75	90	66	76	25	34	35	57	86	78	86	65
Yuen Long	42	50	50	41	54	21	26	32	47	64	50	63	45
Tuen Mun	36	42	40	41	57	23	28	32	53	67	44	53	43
Tung Chung	34	40	60	55	75	35	32	36	51	62	43	48	48
Tai Po	54	63	70	54	65	23	32	39	55	68	57	68	54
Sha Tin	56	60	74	54	62	24	30	25	51	70	59	72	53
Tap Mun	78	86	89	71	86	36	43	45	70	100	81	95	74
Causeway Bay	21	25	30	22	22	5	7	6	13	24	18	21	18
Central	33	34	35	29	33	11	11	13	22	36	30	32	27
Mong Kok	24	26	33	23	26	7	9	11	21	41	31	38	24

Pollutant: Respirable Suspended Particulates (PM_{10}) (Annual limit value = 50 $\mu g/m^3$)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	45	42	51	36	33	16	13	20	29	37	40	56	35
Eastern	41	39	48	30	29	16	16	19	27	37	39	54	33
Kwun Tong	48	42	53	42	36	21	20	26	34	44	45	60	39
Sham Shui Po	41	38	46	36	33	19	19	23	29	34	34	44	33
Kwai Chung	42	39	44	37 *	32	26	22	28	34	37	37	49	35
Tsuen Wan	37	38	42	33	32	16	16	21	32	36	40	54	33
Tseung Kwan O	36	33	43	33	29	18	17	21	28	34	35	47	31
Yuen Long	54	46	48	40	36	17	17	22	32	47	54	59	40
Tuen Mun	59	50	52	40	40	18	20	22	34	47	57	78	43
Tung Chung	54	42	41	30	29	13	16	19	26	35	45	60	34
Tai Po	42	37	44	35	30	13	14	18	27	33	41	55	32
Sha Tin	41	33	41	32	27	16	15	18	28	34	36	53	31
Tap Mun	39	40	48	35	28	17	19	22	29	42	40	54	35
Causeway Bay	57	51	58	45	45	29	28	30	45	47	52	64	46
Central	42	41	48	35	30	14	14	18	30	31	35	56	33
Mong Kok	48	43	55	39	36	20	23	25	38	38	41	55	38

Pollutant: Fine Suspended Particulates ($PM_{2.5}$) (Annual limit value = 35 $\mu g/m^3$)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	31	29	31	24	22	8	10	12	20	23	25	35	23
Eastern	28	26	28	20	20	8	9	10	18	21	23	31	20
Kwun Tong	30	27	31	26	23	12	11	13	21	23	25	33	23
Sham Shui Po	29	26	29	23	22	11	12	14	20	21	22	29	21
Kwai Chung	30	28	30	25	22	15	15	18	23	23	24	30	23
Tsuen Wan	28	27	28	23	23	8	10	13	22	24	27	35	22
Tseung Kwan O	24	22	26	21	19	7	8	10	17	19	21	27	18
Yuen Long	28	25	25	21	20	10	12	14	20	24	26	38	22
Tuen Mun	39	35	33	26	27	10	12	14	21	28	35	45	27
Tung Chung	37	27	23	18	19	6	10	11	16	21	28	36	21
Tai Po	31	27	28	23	21	8	10	12	19	21	27	36	22
Sha Tin	29	25	27	21	19	9	10	12	20	22	25	36	21
Tap Mun	26	24	25	21	18	9	10	11	17	22	22	28	20
Causeway Bay	41	36	38	31	32	19	19	21	32	30	35	42	31
Central	28	28	28	21	19	6	10	12	22	19	23	36	21
Mong Kok	36	32	37	28	27	13	16	17	28	26	27	37	27

Notes:

1. All concentration units are in microgram per cubic metre ($\mu g/m^3$).
2. Shaded annual average represents exceedance of the respective air quality objective.
3. Monthly average marked with an asterisk denotes the data for calculation could not meet the data capture target of 480 hours in a month.

Table C3: 2017 Hourly Statistics of Air Pollutants

Pollutant: Sulphur Dioxide

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles---------->									Arithmetic mean	Highest 1-hour
			10	25	50	75	90	95	97.5	99	99.8		
Central/Western	8561	97.7	4	5	7	9	14	20	27	37	51	8	110
Eastern	8586	98.0	1	1	3	5	7	10	13	18	28	4	51
Kwun Tong	8495	97.0	2	4	6	8	11	13	17	24	36	6	51
Sham Shui Po	8637	98.6	4	5	6	9	13	19	25	35	49	8	68
Kwai Chung	8613	98.3	3	4	6	10	19	25	31	39	55	9	88
Tsuen Wan	8384	95.7	5	7	10	12	16	21	27	36	49	11	93
Tseung Kwan O	8384	95.7	5	6	7	9	11	12	15	18	25	8	36
Yuen Long	8402	95.9	6	7	8	10	14	17	20	26	35	9	68
Tuen Mun	8631	98.5	3	4	6	10	14	19	24	34	54	8	73
Tung Chung	8404	95.9	4	6	8	10	13	17	23	32	55	9	71
Tai Po	8622	98.4	2	2	3	5	7	8	10	13	18	4	36
Sha Tin	8537	97.5	3	5	6	9	12	15	17	21	28	7	40
Tap Mun	8303	94.8	4	5	7	10	12	14	15	17	21	8	27
Causeway Bay	8626	98.5	4	6	8	11	14	18	23	29	44	9	97
Central	8657	98.8	3	5	7	9	14	18	23	30	43	8	84
Mong Kok	8558	97.7	1	2	3	5	8	12	17	28	44	4	83

Pollutant: Nitrogen Oxides

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles---------->									Arithmetic mean	Highest 1-hour
			10	25	50	75	90	95	97.5	99	99.8		
Central/Western	8656	98.8	15	24	43	67	107	142	185	269	416	55	603
Kwun Tong	8537	97.5	21	33	57	97	160	205	241	291	377	76	602
Sham Shui Po	8632	98.5	26	45	72	101	136	179	232	308	474	81	805
Kwai Chung	8616	98.4	28	52	86	137	198	239	274	318	420	102	623
Tsuen Wan	8331	95.1	24	47	67	94	132	166	207	276	386	77	614
Tseung Kwan O	8458	96.6	15	19	26	47	91	131	170	213	300	42	393
Yuen Long	8400	95.9	24	35	51	75	108	134	161	204	310	61	414
Tuen Mun	8577	97.9	21	35	58	91	131	161	195	246	381	70	531
Tung Chung	8435	96.3	15	23	38	68	102	126	150	191	297	51	451
Tai Po	8666	98.9	22	33	48	68	92	109	129	158	212	54	349
Sha Tin	8569	97.8	17	23	37	61	104	137	166	194	233	50	362
Tap Mun	8234	94.0	3	6	10	15	21	27	34	45	68	12	89
Causeway Bay	8578	97.9	87	147	241	388	542	645	728	840	1076	286	1411
Central	8659	98.8	49	88	152	234	336	402	464	549	747	176	1109
Mong Kok	8620	98.4	59	102	157	210	271	321	372	439	571	164	847

Pollutant: Nitrogen Dioxide (1-hour limit value = 200 µg/m^3; allowable no. of exceedance of limit value = 18)

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles---------->									Arithmetic mean	Highest 1-hour	No. of exceedance of limit value
			10	25	50	75	90	95	97.5	99	99.8			
Central/Western	8656	98.8	13	20	36	53	74	91	108	130	166	40	211	1
Eastern	8586	98.0	17	26	39	54	68	79	92	110	140	42	191	0
Kwun Tong	8537	97.5	15	24	38	56	77	95	117	153	202	44	245	18
Sham Shui Po	8632	98.5	22	33	49	70	91	107	123	147	195	54	267	15
Kwai Chung	8616	98.4	22	36	52	70	94	119	139	166	208	57	265	20
Tsuen Wan	8331	95.1	21	34	48	64	87	105	122	146	184	52	236	8
Tseung Kwan O	8458	96.6	10	14	20	31	56	78	100	124	166	28	211	2
Yuen Long	8400	95.9	17	24	36	51	70	85	100	119	157	41	214	2
Tuen Mun	8577	97.9	17	26	40	60	85	103	118	146	191	46	265	12
Tung Chung	8435	96.3	11	18	30	47	68	83	99	120	145	36	227	2
Tai Po	8666	98.9	17	25	36	49	64	74	85	99	128	39	148	0
Sha Tin	8569	97.8	12	18	28	43	64	83	102	122	145	34	178	0
Tap Mun	8234	94.0	2	5	8	13	18	23	29	38	53	10	85	0
Causeway Bay	8578	97.9	42	62	93	121	155	180	211	262	332	97	466	272
Central	8659	98.8	31	48	73	103	134	159	182	216	268	80	304	126
Mong Kok	8620	98.4	38	54	76	102	127	147	167	204	258	81	342	90

Pollutant: Carbon Monoxide (1-hour limit value = 30,000 µg/m^3 ; allowable no. of exceedance of limit value = 0)

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles---------->									Arithmetic mean	Highest 1-hour	No. of exceedance of limit value
			10	25	50	75	90	95	97.5	99	99.8			
Tsuen Wan	8380	95.7	440	530	650	800	940	1040	1120	1220	1380	672	1610	0
Tseung Kwan O	8458	96.6	650	700	800	900	1040	1130	1250	1380	1571	824	1830	0
Yuen Long	8419	96.1	260	340	500	720	870	970	1050	1150	1320	539	1450	0
Tuen Mun	8634	98.6	530	610	740	890	1030	1140	1230	1350	1570	764	1740	0
Tung Chung	8438	96.3	370	430	540	690	860	1010	1200	1306	1510	591	1810	0
Tap Mun	8284	94.6	280	420	620	770	900	1010	1120	1360	1470	608	1770	0
Causeway Bay	8364	95.5	290	500	710	920	1160	1300	1450	1620	1980	725	2420	0
Central	8598	98.2	300	440	650	890	1130	1260	1350	1500	1708	687	2050	0
Mong Kok	8591	98.1	600	680	790	920	1080	1220	1340	1520	1910	818	2390	0

Table C3 (Cont.): 2017 Hourly Statistics of Air Pollutants

Pollutant: Ozone

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles----------> 10	25	50	75	90	95	97.5	99	99.8	Arithmetic mean	Highest 1-hour
Central/Western	8565	97.8	11	25	45	76	103	120	135	161	265	53	408
Eastern	8586	98.0	23	34	53	82	106	120	134	157	224	61	371
Kwun Tong	8486	96.9	7	17	42	73	97	109	121	138	173	48	245
Sham Shui Po	8603	98.2	5	14	31	58	84	100	113	135	200	39	381
Kwai Chung	8569	97.8	3	9	30	61	87	103	116	135	219	39	364
Tsuen Wan	8294	94.7	5	14	32	63	89	106	122	148	239	42	368
Tseung Kwan O	8431	96.2	12	28	59	97	124	139	158	178	233	65	396
Yuen Long	8387	95.7	6	15	34	65	95	118	147	189	268	45	407
Tuen Mun	8623	98.4	6	14	31	61	94	117	145	192	303	43	434
Tung Chung	8430	96.2	7	19	38	67	97	118	138	177	294	48	382
Tai Po	8643	98.7	7	20	45	80	111	129	151	186	270	54	334
Sha Tin	8452	96.5	5	19	43	82	111	128	147	173	258	53	350
Tap Mun	8274	94.5	23	39	66	104	133	152	172	194	230	74	355
Causeway Bay	8569	97.8	1	3	10	27	45	58	69	83	97	18	140
Central	8640	98.6	2	5	17	40	67	83	94	109	144	27	214
Mong Kok	8553	97.6	2	6	17	36	57	73	84	99	123	24	279

Pollutant: Respirable Suspended Particulates (PM_{10})

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles----------> 10	25	50	75	90	95	97.5	99	99.8	Arithmetic mean	Highest 1-hour
Central/Western	8352	95.3	12	18	31	48	64	76	87	103	135	35	186
Eastern	8497	97.0	11	17	29	45	62	71	81	94	113	33	139
Kwun Tong	8376	95.6	14	22	35	52	71	81	91	104	123	39	167
Sham Shui Po	8347	95.3	13	19	29	44	59	68	76	86	112	33	152
Kwai Chung	8062	92.0	14	21	31	46	62	72	83	95	123	35	165
Tsuen Wan	8480	96.8	10	17	28	45	62	74	87	110	145	33	256
Tseung Kwan O	8570	97.8	12	17	27	41	56	65	74	85	99	31	135
Yuen Long	8470	96.7	12	20	36	54	74	85	95	113	132	40	164
Tuen Mun	8540	97.5	13	21	38	58	82	96	111	135	167	43	214
Tung Chung	8548	97.6	9	15	27	47	68	83	98	122	165	34	268
Tai Po	8638	98.6	9	16	28	45	61	71	85	99	128	32	172
Sha Tin	7779	88.8	10	16	27	42	59	70	81	93	113	31	156
Tap Mun	8351	95.3	13	19	30	47	64	73	80	88	103	35	117
Causeway Bay	8484	96.8	20	29	42	59	76	88	101	116	149	46	172
Central	8398	95.9	9	15	28	46	64	77	92	110	139	33	184
Mong Kok	8337	95.2	15	22	34	51	67	79	91	106	135	38	182

Pollutant: Fine Suspended Particulates ($PM_{2.5}$)

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles----------> 10	25	50	75	90	95	97.5	99	99.8	Arithmetic mean	Highest 1-hour
Central/Western	8409	96.0	6	10	19	31	43	52	63	75	100	23	133
Eastern	8498	97.0	5	10	17	28	39	46	53	61	73	20	92
Kwun Tong	8463	96.6	7	12	20	31	42	49	58	67	76	23	102
Sham Shui Po	8334	95.1	8	12	19	29	39	45	51	59	73	21	108
Kwai Chung	8068	92.1	10	14	20	30	41	49	56	67	84	23	102
Tsuen Wan	8483	96.8	6	10	18	31	43	52	63	79	105	22	210
Tseung Kwan O	8580	97.9	5	9	16	26	36	43	49	57	66	18	89
Yuen Long	8456	96.5	7	11	19	29	42	50	59	68	88	22	106
Tuen Mun	8553	97.6	8	13	24	37	51	62	73	86	110	27	153
Tung Chung	8545	97.5	4	8	15	29	44	55	67	83	109	21	209
Tai Po	8638	98.6	6	10	19	30	42	50	60	73	91	22	139
Sha Tin	7779	88.8	5	10	18	29	41	51	64	78	93	21	126
Tap Mun	8441	96.4	6	10	17	27	37	43	48	53	64	20	72
Causeway Bay	8482	96.8	13	19	28	40	54	63	74	88	113	31	139
Central	8399	95.9	4	9	17	30	43	54	65	79	105	21	136
Mong Kok	8337	95.2	10	15	23	35	48	57	66	77	102	27	141

Notes:

1. All concentration units are in microgram per cubic metre ($\mu g/m^3$).
2. Shaded no. of exceedance of limit value represents exceedance of the respective air quality objective.

Table C4: 2017 Diurnal Variations of Air Pollutants

Pollutant: Sulphur Dioxide

Station	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23	Hr24
Central/Western	8	8	8	8	8	8	8	9	10	9	10	9	9	9	8	8	8	8	8	9	9	8	8	8
Eastern	4	4	4	3	3	3	4	5	4	4	4	3	3	3	3	3	4	4	4	4	6	4	4	4
Kwun Tong	6	6	6	10	7	6	6	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Sham Shui Po	8	7	7	12	8	7	7	8	8	8	8	8	8	8	7	8	8	8	8	8	8	7	7	7
Kwai Chung	8	8	7	8	7	7	7	8	9	9	9	9	10	10	10	12	12	11	11	10	9	8	8	8
Tsuen Wan	10	10	9	10	10	9	9	10	10	11	11	11	11	12	12	13	13	13	12	11	11	10	10	10
Tseung Kwan O	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	7
Yuen Long	9	9	9	9	8	8	8	9	9	9	9	9	9	9	9	9	10	10	10	10	10	10	10	9
Tuen Mun	7	7	7	6	6	6	7	8	8	8	8	8	8	8	9	9	9	9	9	9	8	8	8	8
Tung Chung	8	8	7	8	8	8	7	8	9	10	10	10	11	10	10	11	10	10	9	8	8	8	8	8
Tai Po	3	3	3	3	3	3	3	4	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4
Sha Tin	7	7	7	9	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	7	7	7	7	7
Tap Mun	7	7	7	8	7	7	7	8	9	9	9	9	8	8	8	8	8	8	8	8	7	7	7	7
Causeway Bay	7	7	7	6	7	7	8	10	11	11	10	10	10	10	10	10	10	10	10	10	9	9	9	8
Central	7	6	6	6	6	6	7	9	10	9	9	8	8	8	8	8	8	9	10	10	9	8	7	7
Mong Kok	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	6	5	5	4	4	4

Pollutant: Nitrogen Oxides

Station	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23	Hr24
Central/Western	46	38	32	28	28	31	41	64	77	77	71	62	57	57	58	61	61	64	69	70	67	61	56	53
Kwun Tong	59	41	35	32	32	43	76	106	112	104	93	84	81	77	80	83	90	99	104	96	81	73	71	69
Sham Shui Po	67	51	43	41	40	48	69	91	106	103	94	88	86	89	92	96	103	107	109	101	88	82	81	76
Kwai Chung	81	60	50	44	47	53	81	119	143	136	123	114	111	115	120	130	138	138	139	126	107	99	95	90
Tsuen Wan	61	41	33	31	29	35	60	87	100	99	91	86	83	86	88	91	97	104	107	99	87	78	76	72
Tseung Kwan O	46	41	33	32	33	40	59	59	44	37	34	33	30	31	33	34	37	44	49	54	53	50	51	51
Yuen Long	55	46	40	34	35	43	67	88	75	64	56	53	50	52	55	59	67	72	76	79	74	71	69	65
Tuen Mun	59	50	42	35	36	43	62	88	88	86	81	73	65	65	67	71	76	85	94	94	88	81	77	68
Tung Chung	44	37	32	31	28	33	43	55	61	59	60	60	60	59	59	58	57	57	58	56	54	51	48	47
Tai Po	49	40	32	30	32	37	60	88	82	64	55	50	47	48	49	52	58	64	67	66	61	56	57	55
Sha Tin	55	44	37	33	32	36	51	68	67	55	47	42	39	37	39	42	48	53	59	63	62	62	62	60
Tap Mun	11	10	10	10	10	10	11	12	15	16	15	13	11	11	10	11	11	12	12	12	11	11	11	11
Causeway Bay	207	147	129	110	103	107	185	303	370	366	346	355	360	380	360	358	382	385	379	357	307	304	317	258
Central	119	91	81	72	70	77	116	184	262	251	231	215	203	189	215	228	221	243	274	233	184	165	156	143
Mong Kok	127	93	82	74	74	76	112	156	192	195	194	191	194	204	200	206	228	233	239	208	179	171	171	158

Pollutant: Nitrogen Dioxide

Station	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23	Hr24
Central/Western	33	28	25	22	21	23	29	41	46	47	45	43	41	42	44	47	50	52	56	55	52	46	42	39
Eastern	35	29	25	23	23	25	37	48	50	48	45	43	42	43	45	48	52	54	54	52	50	46	42	40
Kwun Tong	37	26	23	21	21	26	41	51	53	50	46	45	45	45	48	51	56	61	63	58	51	46	44	42
Sham Shui Po	46	36	31	28	28	32	43	54	59	58	56	56	57	60	63	67	72	77	78	73	65	60	56	52
Kwai Chung	46	36	31	28	29	32	43	56	63	62	61	60	62	66	71	77	81	81	79	72	63	58	55	51
Tsuen Wan	44	31	26	25	23	27	42	52	56	55	53	52	54	57	60	64	68	74	77	71	63	57	54	51
Tseung Kwan O	30	26	22	20	21	24	30	32	27	23	21	20	20	21	22	24	28	33	38	40	38	36	35	33
Yuen Long	38	33	29	26	26	29	36	42	41	38	35	34	34	36	38	43	49	54	57	57	52	49	46	43
Tuen Mun	41	36	32	27	27	30	38	46	47	47	46	44	42	44	47	51	56	64	69	67	61	56	51	46
Tung Chung	31	27	24	22	21	24	28	32	35	36	38	39	41	42	44	45	45	45	45	43	40	37	34	33
Tai Po	37	31	26	25	25	28	38	47	46	40	36	34	33	34	36	39	43	49	53	52	48	44	43	41
Sha Tin	37	30	26	23	23	25	32	39	40	35	31	28	27	26	28	31	36	41	46	48	46	44	42	40
Tap Mun	9	9	9	9	9	9	9	10	12	12	11	10	9	9	8	9	9	10	11	11	10	10	10	10
Causeway Bay	76	60	54	48	46	47	68	95	103	107	107	113	118	125	125	128	130	129	127	119	109	105	105	90
Central	59	48	44	40	39	41	54	74	93	94	92	93	92	92	103	108	107	110	115	105	90	80	74	69
Mong Kok	66	52	46	43	43	43	57	71	80	83	86	89	94	100	101	105	111	113	112	103	92	88	84	78

Pollutant: Carbon Monoxide

Station	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23	Hr24
Tsuen Wan	639	598	573	569	572	591	647	702	717	694	677	658	655	662	662	664	677	702	748	763	758	739	721	687
Tseung Kwan O	846	826	812	769	787	794	827	839	823	807	797	789	785	785	786	788	797	819	862	880	883	884	885	875
Yuen Long	558	531	524	500	487	491	535	567	550	525	512	505	504	502	497	504	520	544	575	602	609	605	595	583
Tuen Mun	751	731	719	701	721	727	744	793	777	772	779	758	752	749	743	743	750	767	810	831	834	820	799	774
Tung Chung	582	565	557	557	550	553	569	583	588	583	584	588	597	604	607	600	605	613	626	628	622	612	604	595
Tap Mun	603	598	593	595	596	605	615	623	626	619	618	617	617	617	613	608	607	605	603	600	602	602	603	607
Causeway Bay	728	720	717	712	659	629	618	634	682	726	747	748	759	758	744	737	738	746	765	802	810	786	730	697
Central	651	604	593	564	547	557	579	629	691	730	733	708	710	723	726	712	718	740	800	821	802	769	708	669
Mong Kok	816	828	795	743	761	726	719	747	795	801	787	774	786	838	854	855	880	904	939	922	885	848	822	816

Table C4 (Cont.): 2017 Diurnal Variations of Air Pollutants

Pollutant: Ozone

Station	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23	Hr24
Central/Western	52	55	55	56	55	53	46	37	35	38	45	54	62	66	69	68	66	61	53	50	49	50	50	51
Eastern	58	61	62	62	61	58	47	41	42	49	56	64	71	75	76	75	72	68	65	62	58	57	57	57
Kwun Tong	45	50	50	50	49	45	36	31	32	38	45	52	56	60	62	62	58	52	47	46	47	46	45	44
Sham Shui Po	38	44	46	46	45	41	33	26	25	29	36	43	48	52	53	51	45	38	33	33	35	35	35	36
Kwai Chung	38	44	45	46	45	41	33	25	25	29	36	42	47	48	49	47	42	38	35	35	37	36	36	37
Tsuen Wan	38	45	48	47	47	42	31	26	28	34	41	48	54	57	60	58	52	44	35	33	34	35	33	34
Tseung Kwan O	54	55	55	52	54	50	45	45	52	61	70	78	85	89	92	93	89	81	71	64	60	57	55	55
Yuen Long	35	36	37	38	37	33	27	24	29	38	50	61	71	77	80	76	65	55	43	37	35	33	32	32
Tuen Mun	37	39	41	42	41	37	29	24	27	33	41	52	63	71	75	72	64	49	37	32	32	32	33	35
Tung Chung	41	43	44	44	43	39	35	32	34	39	45	52	59	66	72	72	69	60	47	42	41	41	41	41
Tai Po	43	45	47	45	43	39	31	28	34	47	59	70	80	86	87	84	78	67	57	52	49	48	44	43
Sha Tin	41	44	46	46	44	41	35	33	37	47	58	67	75	82	83	81	76	67	56	49	46	43	41	41
Tap Mun	62	60	59	57	55	53	51	53	57	65	74	85	93	99	102	101	100	95	88	81	75	70	67	64
Causeway Bay	19	25	26	29	29	28	20	13	10	11	13	14	15	16	17	17	16	17	16	16	16	15	15	17
Central	31	36	38	39	39	35	27	18	13	15	18	22	27	30	28	27	26	23	20	20	23	25	27	28
Mong Kok	24	31	33	34	34	33	24	16	15	16	20	24	27	29	30	29	24	21	18	19	20	20	20	20

Pollutant: Respirable Suspended Particulates (PM_{10})

Station	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23	Hr24
Central/Western	34	33	32	32	31	31	31	32	33	35	37	38	37	36	38	39	39	38	38	38	38	37	35	34
Eastern	33	32	32	31	31	30	29	29	30	30	31	32	32	31	32	34	36	36	36	37	38	37	36	34
Kwun Tong	38	37	36	35	34	34	34	35	37	39	41	42	42	41	42	43	42	43	43	43	43	42	40	39
Sham Shui Po	30	29	28	28	28	28	29	30	30	31	32	32	33	35	36	38	39	39	40	40	39	36	34	32
Kwai Chung	31	30	30	29	29	29	30	31	35	37	38	36	35	39	42	43	43	41	41	39	38	36	35	33
Tsuen Wan	30	29	28	27	27	26	27	28	29	32	34	35	35	36	40	41	40	39	38	37	36	35	32	31
Tseung Kwan O	31	30	29	29	28	27	27	27	28	29	29	30	30	30	31	33	36	36	36	35	35	34	32	31
Yuen Long	37	35	35	34	33	33	34	36	38	41	42	43	43	43	44	45	45	44	44	43	43	42	40	38
Tuen Mun	40	39	37	37	36	36	36	37	40	42	44	45	46	45	47	49	50	50	49	49	49	47	45	43
Tung Chung	31	30	29	29	28	28	28	29	30	33	36	37	38	40	43	44	43	41	38	36	35	33	32	32
Tai Po	32	32	31	30	30	30	30	31	32	33	33	33	33	33	33	33	33	33	34	35	35	34	33	33
Sha Tin	31	30	30	29	29	29	29	30	31	32	31	31	31	32	31	33	34	33	33	33	33	32	32	31
Tap Mun	32	32	32	32	32	33	34	34	35	36	36	36	37	37	37	38	37	37	37	36	35	34	33	33
Causeway Bay	43	38	33	32	31	31	33	39	44	47	49	50	49	51	54	54	53	54	54	57	57	53	50	47
Central	33	30	29	28	28	27	28	29	32	35	34	33	33	34	36	37	37	37	36	37	37	36	34	33
Mong Kok	36	34	32	31	30	30	31	34	36	38	40	40	40	41	43	43	43	43	43	46	47	44	40	38

Pollutant: Fine Suspended Particulates ($PM_{2.5}$)

Station	Hr01	Hr02	Hr03	Hr04	Hr05	Hr06	Hr07	Hr08	Hr09	Hr10	Hr11	Hr12	Hr13	Hr14	Hr15	Hr16	Hr17	Hr18	Hr19	Hr20	Hr21	Hr22	Hr23	Hr24
Central/Western	21	21	21	20	20	20	20	21	22	23	23	24	24	24	25	25	25	24	24	24	25	24	23	22
Eastern	20	19	19	19	19	18	19	19	19	19	19	19	20	20	20	20	21	21	21	22	23	23	22	20
Kwun Tong	22	21	21	21	21	21	21	22	22	23	24	23	23	23	24	24	24	24	25	25	26	25	24	23
Sham Shui Po	20	19	18	18	18	19	20	20	21	21	21	20	20	21	22	23	24	24	25	26	26	24	22	21
Kwai Chung	21	20	20	20	20	20	21	22	24	24	24	23	22	24	26	26	27	26	26	26	26	25	24	22
Tsuen Wan	21	20	19	19	19	18	18	19	20	21	22	23	23	24	25	26	26	26	25	26	26	25	23	21
Tseung Kwan O	19	18	18	17	17	17	17	17	18	18	18	18	18	18	18	19	20	20	20	20	20	20	19	19
Yuen Long	20	20	19	19	19	19	20	22	22	22	22	22	22	22	23	24	24	24	25	25	25	24	22	21
Tuen Mun	26	25	24	24	24	24	24	25	26	26	27	27	27	27	28	29	30	30	30	30	31	31	29	28
Tung Chung	19	18	18	18	17	17	17	18	19	20	21	22	22	24	26	26	26	24	23	22	22	21	20	20
Tai Po	22	21	21	20	20	20	21	21	22	22	22	22	22	22	22	22	22	23	23	24	24	23	23	22
Sha Tin	21	20	20	20	20	20	20	21	22	22	21	21	21	22	21	22	23	22	22	22	22	22	22	21
Tap Mun	18	18	18	18	18	19	20	20	20	20	20	20	20	20	21	21	20	21	21	21	20	19	19	18
Causeway Bay	29	26	22	22	21	21	22	27	30	31	32	32	33	35	37	36	36	37	37	40	41	38	36	33
Central	21	19	19	18	18	18	18	19	21	22	21	21	21	22	23	23	23	23	23	24	24	23	22	21
Mong Kok	25	23	22	22	21	21	22	24	26	27	27	27	27	29	29	29	29	29	30	33	34	32	29	27

Note:

1. All concentration units are in microgram per cubic metre ($\mu g/m^3$).

Table C5: 2017 Total Wet and Dry Deposition

(a) Wet Deposition

	Monitoring Station	Central/Western	Kwun Tong	Yuen Long
	Wet Deposition (tonne/ha)	28552	27975	21814
	Weighted Mean pH (based on volume-weighted mean hydrogen ion concentrations ($[H^+]$)	4.99	4.97	5.01
	Weighted Mean pH (based on volume-weighted mean pH)	5.18	5.25	5.25
	Number of Samples	104	104	96
Filtrate (Kg/Ha)	**NH_4^+**	6.26	6.54	5.75
	NO_3^-	19.83	21.70	17.40
	SO_4^{2-}	30.48	27.80	15.64
	Cl^-	71.92	59.61	18.07
	F^-	0.92	0.91	0.72
	Na^+	41.57	34.07	11.37
	K^+	7.91	7.32	5.42
	Formate	5.33	5.14	4.68
	Acetate	5.87	4.92	4.63
	Ca^{2+}	4.84	4.39	3.02
	Mg^{2+}	4.87	3.86	1.40

** 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	25	26
Filtrate (Kg/Ha)	**NH_4^+**	0.25	0.57	0.12
	NO_3^-	8.07	9.03	7.06
	SO_4^{2-}	4.94	5.36	3.84
	Cl^-	7.56	7.11	3.87
	F^-	0.052	0.046	0.062
	Na^+	4.95	4.72	2.45
	K^+	0.49	0.38	0.40
	Formate	0.16	0.16	0.19
	Acetate	0.24	0.20	0.24
	Ca^{2+}	4.49	3.79	4.52
	Mg^{2+}	0.68	0.63	0.39

Table C6: 2017 Ambient levels of toxic air pollutants

Toxic Air Pollutants	Concentration Unit	Annual Averages [1]	
		Tsuen Wan [2]	Central/Western
Heavy Metals			
Hexavalent chromium	ng/m^3	0.11	0.11
Lead [3]	ng/m^3	18	17
Organic Substances			
Benzene [4]	$\mu g/m^3$	1.01	0.82
Benzo[a]pyrene	ng/m^3	0.09	0.06
1,3-Butadiene [4]	$\mu g/m^3$	0.09	0.05
Formaldehyde [4]	$\mu g/m^3$	4.39	-
Perchloroethylene [4]	$\mu g/m^3$	0.43	0.51
Dioxins [5]	$pgI\text{-}TEQ/m^3$	0.025	0.035

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] Due to the influence from renovation works at Princess Alexandra Community Centre and nearby buildings of Tsuen Wan Station, the measurements of carbonyl compounds (formaldehyde) and volatile organic compounds (benzene, 1,3-butadiene and perchloroethylene) at Tsuen Wan Station were temporary relocated to Kwai Chung Station since January 2015. From late September to early December 2017, the benzene measurement at Kwai Chung Station was influenced by the construction works of the adjacent Kwai Tsui Estate. Hence, the benzene data during this period is not reported.

[3] For lead the reported figures are the respective 2017 annual average concentrations in the elemental analysis of respirable suspended particulates.

[4] In 2017, the formaldehyde measurement at Central/Western Station was influenced by the construction works at Sai Ying Pun Community Complex. From late October to end of Dec 2017, the VOC (including Benzene, 1,3-Butadiene and Perchloroethylene) measurement at Central/Western Station was influenced by the re-roofing work outside the Station. Hence, the affected measurement results during these periods are not reported.

[5] 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).