AIR QUALITY
IN HONG KONG 2018

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) (2018)

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Summary

This report summarises the 2018 air quality monitoring data collected by the Environmental Protection Department's monitoring network comprising 13 general stations and 3 roadside stations.

The air quality in Hong Kong has showed discernible improvement in recent years. The Hong Kong Special Administrative Region (HKSAR) Government have implemented a wide range of measures targeting different local emission sources including motor vehicles, power plants and vessels. On the regional front, the HKSAR Government has worked closely with the Guangdong Provincial Government in cutting emissions in the Pearl River Delta (PRD) Region

As a result of the various emission control measures implemented over the years, the 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 reduced substantially.

Although roadside NO_2 is on a downward trend and has dropped from a peak in 2011, its level remains 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 still on a rise. Ozone is a regional air pollution problem. The HKSAR Government will strengthen its collaboration with Guangdong to further reduce emissions in the region to alleviate the regional photochemical smog and ozone problems, and continue its efforts to take forward additional measures to reduce local emissions.

As in previous years, concentrations of carbon monoxide and lead in 2018 remain at levels well below their respective Air Quality Objectives limits.

C O N T E N T S

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1. Introduction

In 2018, 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.

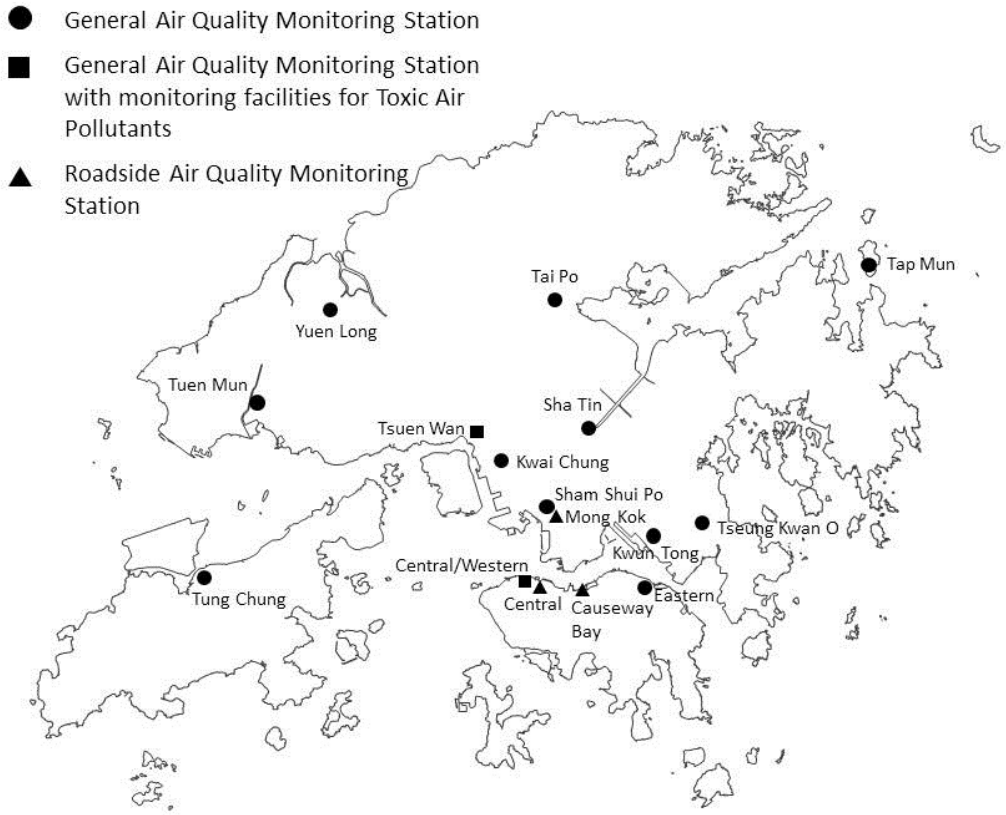


Figure 1: Location of EPD's Air Quality Monitoring Stations (2018)

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 2018
(10-Minute Average Statistics)

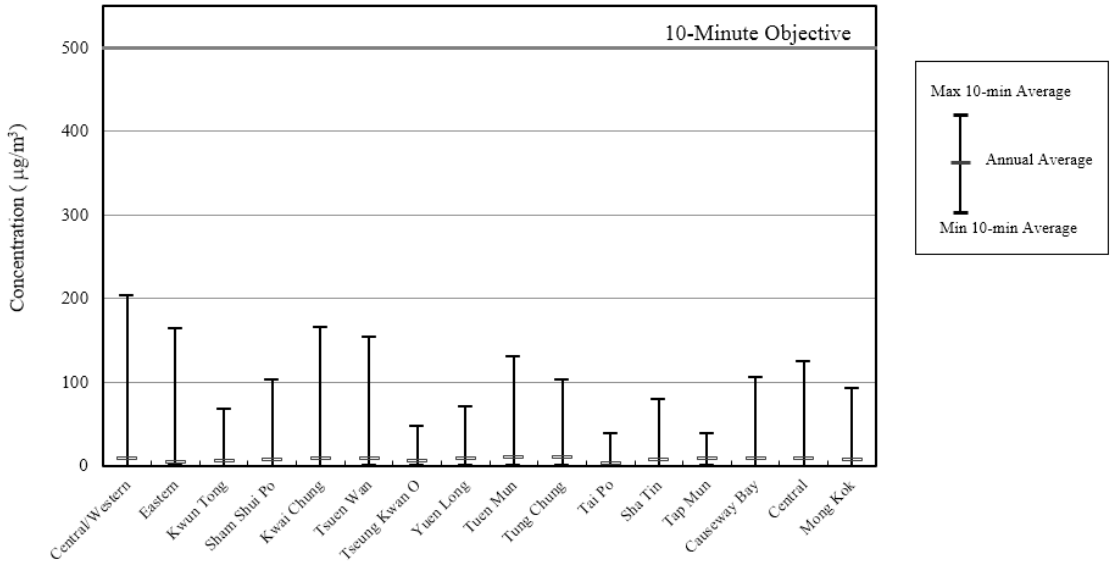
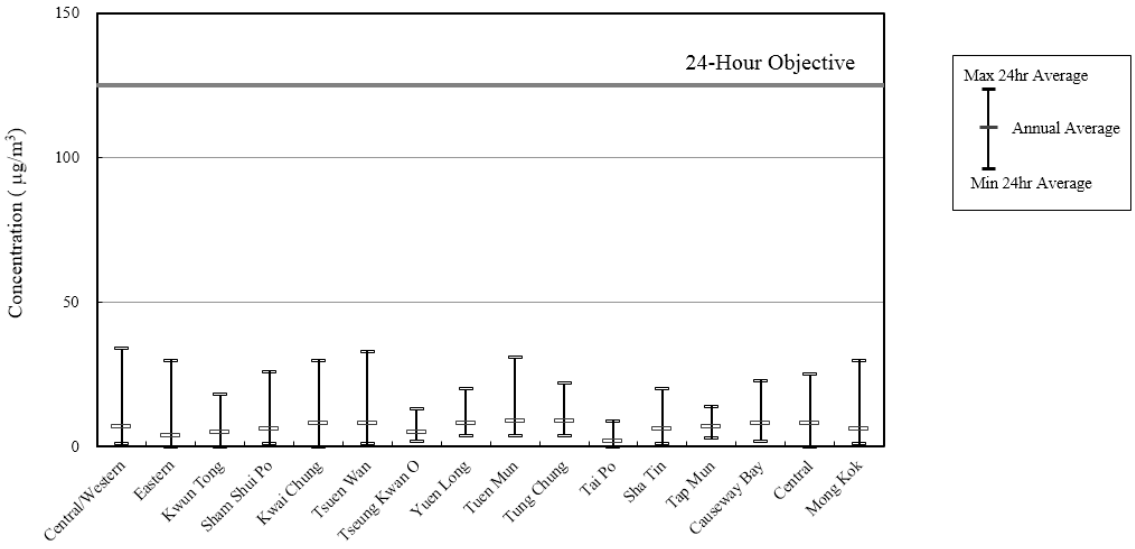


Figure 2b: Sulphur Dioxide Monitoring 2018
(24-Hour Average Statistics)



Sulphur dioxide was measured at all the 16 monitoring stations in 2018. 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 (203 μg/m^3) and 24-hour average (34 μg/m^3) were measured at Central/Western general station. Both were well below their respective AQO limits.

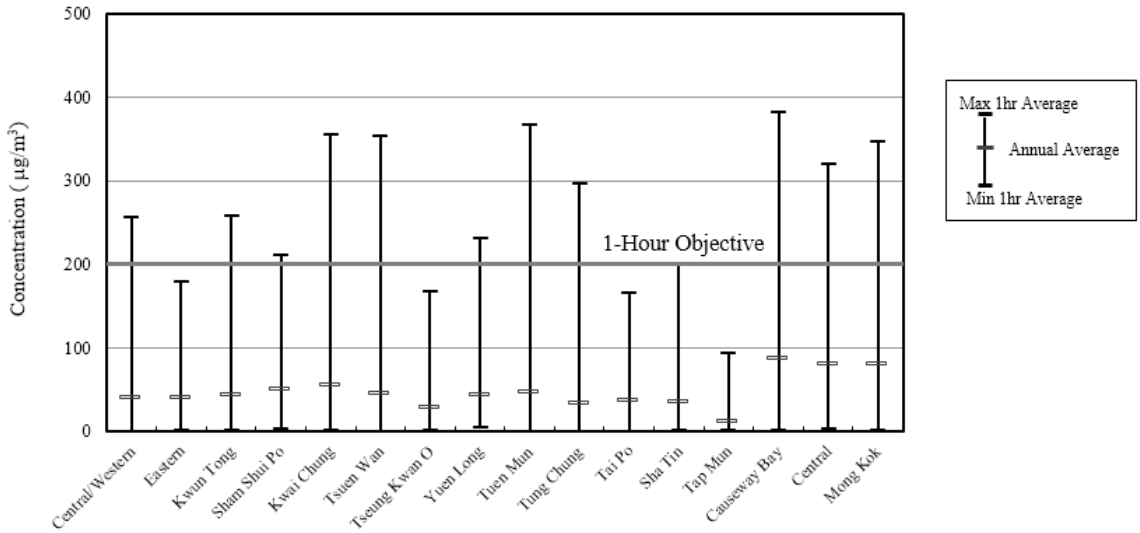
2.2 Nitrogen Oxides (NOx) and Nitrogen Dioxide (NO_2)

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.

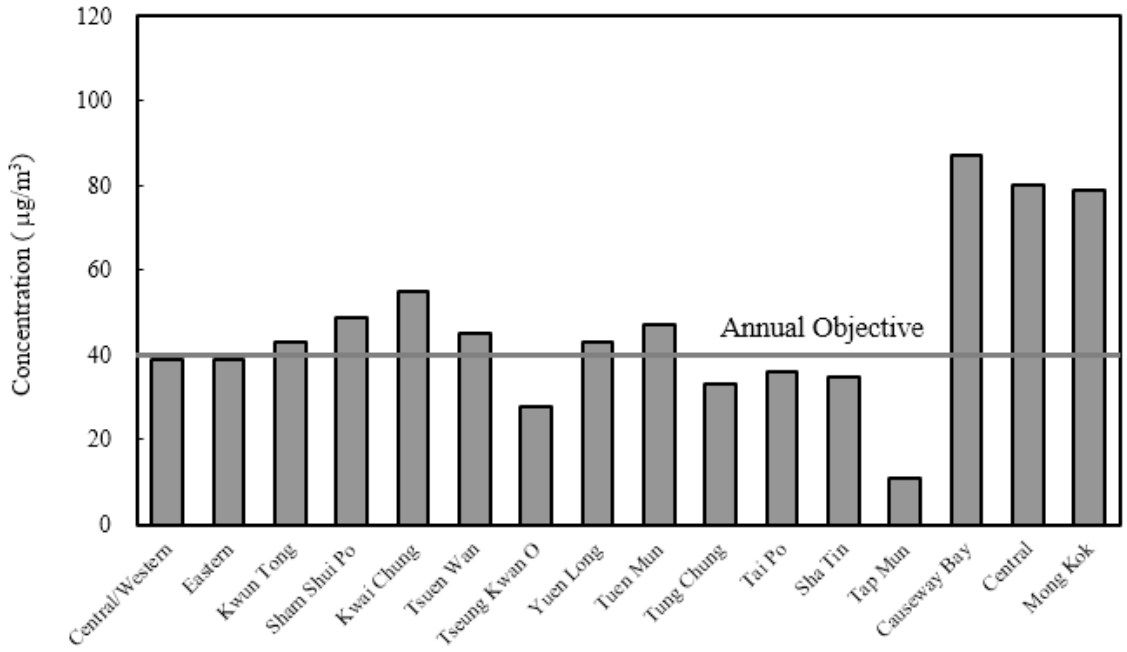
NO_2 was measured at all the 16 monitoring stations in 2018 and the highest 1-hour average (381 μg/m^3) and the highest annual average (87 μg/m^3) were both recorded at the Causeway Bay roadside station. As regards the 1-hour AQO (200 μg/m^3) with allowance of exceedance of AQO limit value for eighteen occasions per year, all general stations complied with the respective AQO in 2018. For the annual AQO (40 μg/m^3), only 7 general stations including Central/Western, Eastern, Tseung Kwan O, Tung Chung, Tai Po, Sha Tin and Tap Mun were in compliance with the standard. 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 2018
(1-Hour Average Statistics)



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

Figure 3b: Nitrogen Dioxide Monitoring 2018
(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 air 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.

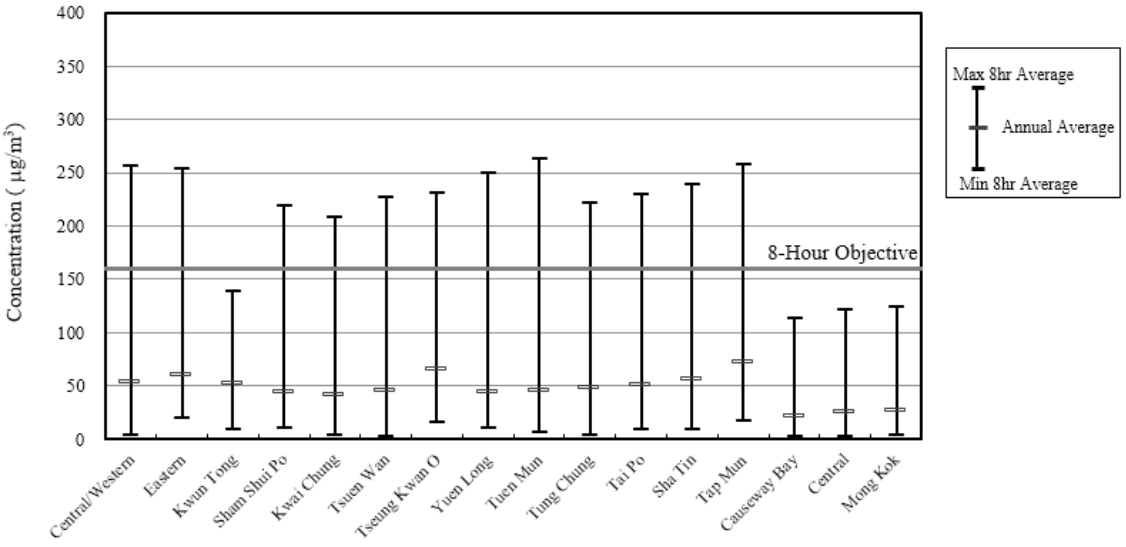
Being a strong oxidant, ozone can cause irritation to the eyes, nose and throat even at low concentrations. At elevated levels, it can increase a person's susceptibility to respiratory infections and aggravate pre-existing respiratory illnesses such as asthma.

Ozone was monitored at all the general and roadside stations in 2018. Among the 13 general stations, Central/Western, Eastern, 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 2018 (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 (263 $\mu g/m^3$) was recorded at Tuen Mun 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 2018
(Maximum 8-Hour Average Statistics)

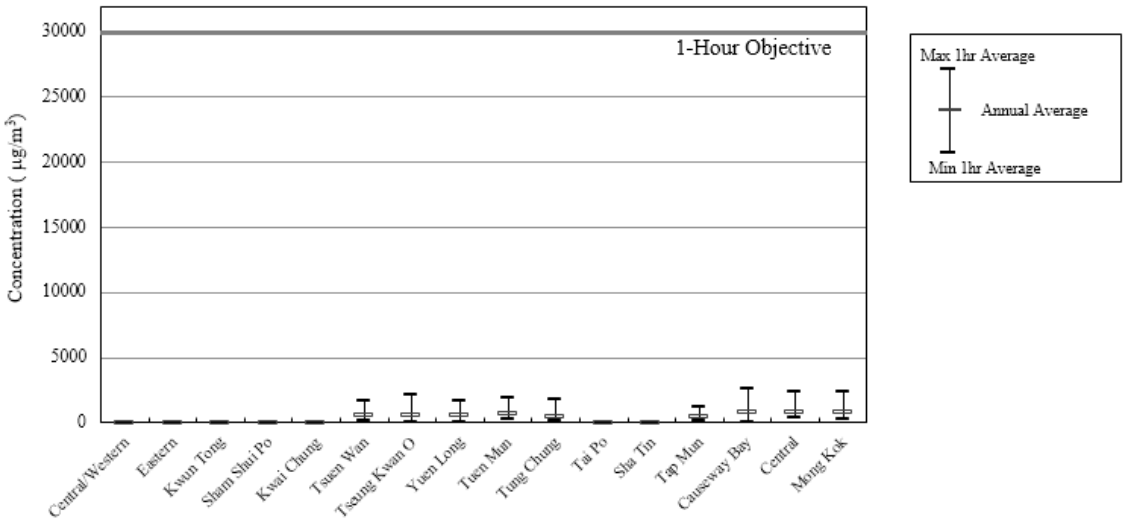


2.4 Carbon Monoxide (CO)

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.

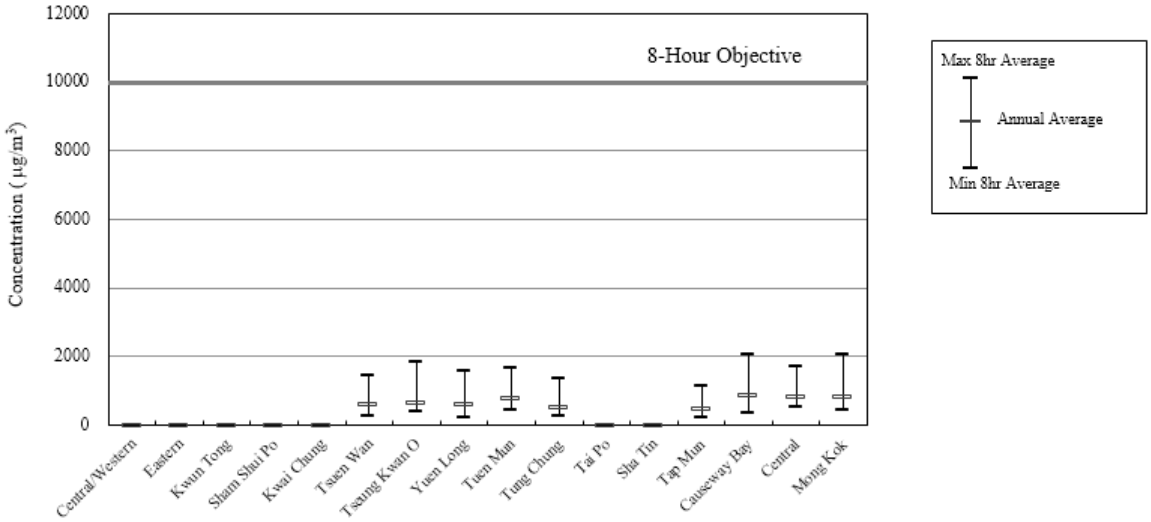
Carbon monoxide was monitored at nine stations including six general stations and three roadside stations in 2018. Similar to previous years, both the ambient and roadside CO concentrations remained very low throughout the year. All the monitoring stations complied with the 1-hour (30,000 µg/m^3) and 8-hour (10,000 µg/m^3) AQOs for CO. In 2018, the highest 1-hour average (2,610 µg/m^3) and 8-hour average (2,047 µg/m^3) were recorded at Causeway Bay roadside station, both were well below the respective AQO limits.

Figure 5a: Carbon Monoxide Monitoring 2018
(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 2018
(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 2018. Ten of these stations were also equipped with high-volume sampler to collect particulate samples for chemical analysis.

In 2018, all general and roadside stations complied with the 24-hour AQO (100 $\mu g/m^3$ with allowance of nine exceedances of AQO limit value per year) and the annual AQO (50 $\mu g/m^3$) for RSP. The highest 24-hour average (157 $\mu g/m^3$) was recorded at Tung Chung general station, while the highest annual average (46 $\mu g/m^3$) was recorded at Causeway Bay roadside station.

Figure 6a: RSP Monitoring 2018
(24-Hour Average Statistics)

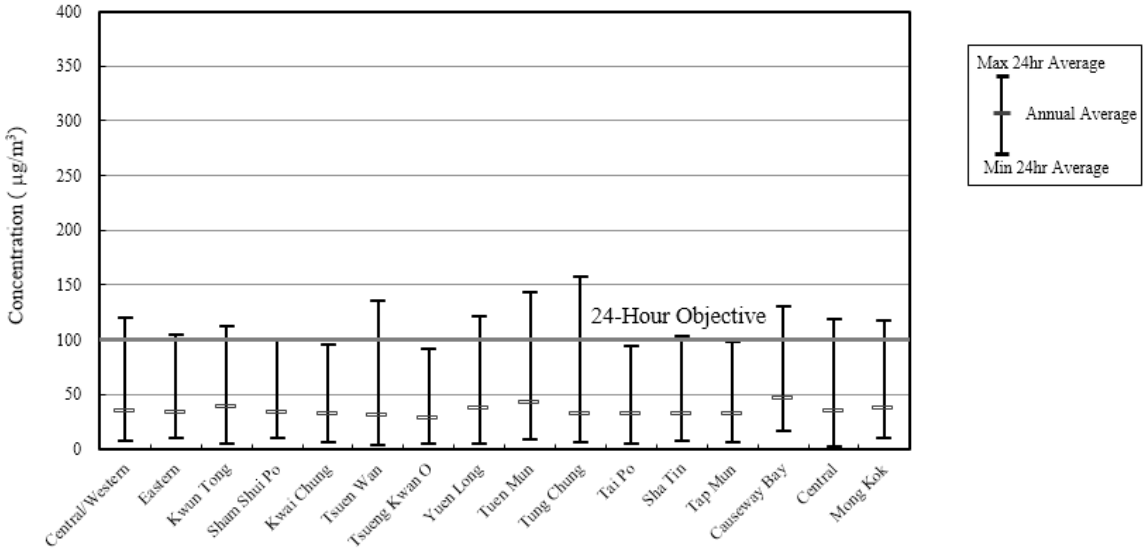
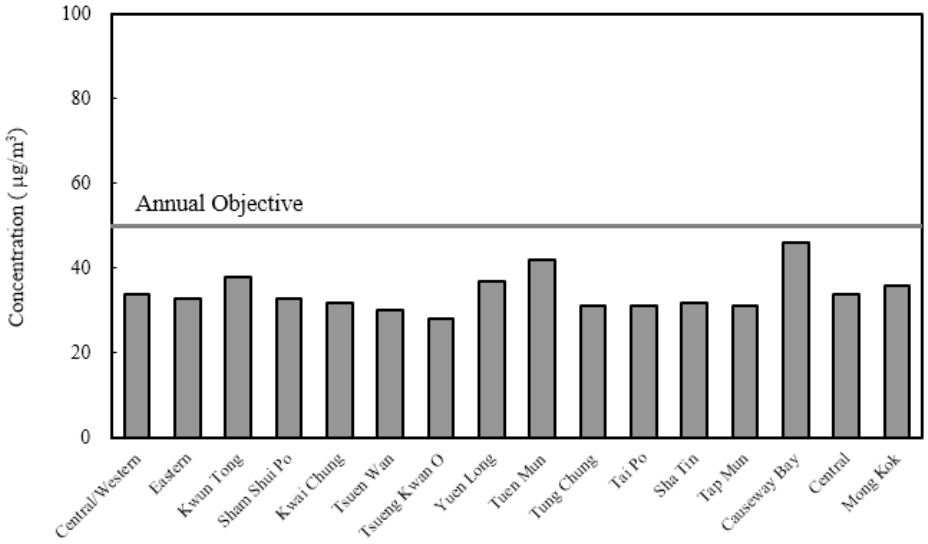


Figure 6b: RSP Monitoring 2018
(Annual Average)



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 2018, full compliance was observed for both the 24-hour AQO (75 $\mu g/m^3$ with allowance of nine exceedances of AQO limit value per year) and the annual AQO (35 $\mu g/m^3$) for FSP at all general and roadside stations, with the highest 24-hour average (119 $\mu g/m^3$) and annual average (30$\mu g/m^3$) recorded at Tung Chung general station and Causeway Bay roadside station respectively.

Figure 7a: FSP Monitoring 2018
(24-Hour Average Statistics)

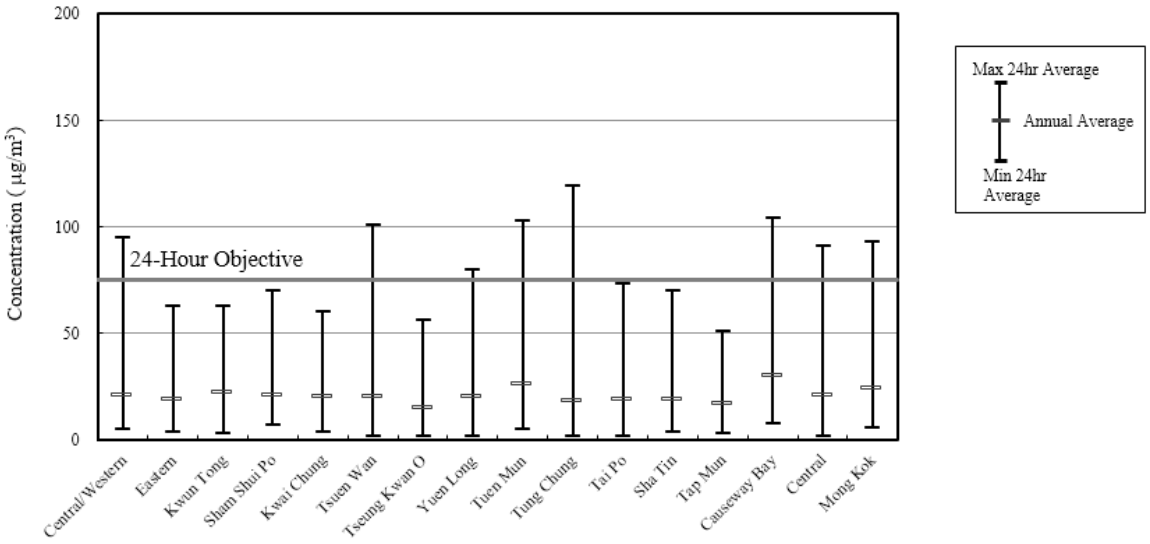
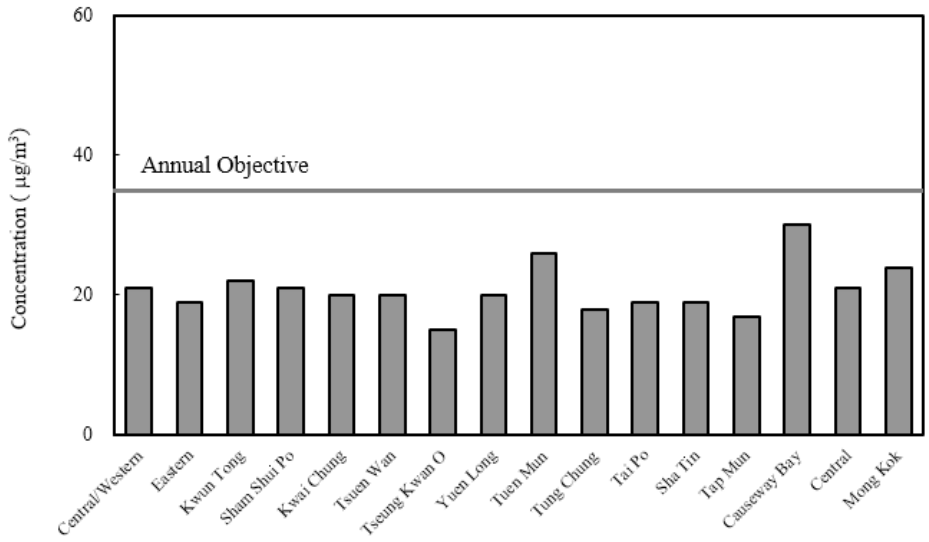


Figure 7b: FSP Monitoring 2018
(Annual Average)



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. Lead was measured at nine general and one roadside stations in 2018[1]. As in previous years, the lead concentrations at the roadside and in ambient air continued to linger at very low levels during 2018. The annual averages, ranging from 12 ng/m^3 (at Central/Western, Shum Shui Po, Mong Kok and Tseung Kwan O) to 15 ng/m^3 (at Yuen Long and Tuen Mun), were well below the respective annual AQO of 500 ng/m^3.

[1] Lead was measured at Central/Western, Kwun Tong, Sham Shui Po, Kwai Chung, Tsuen Wan, Tung Chung, Yuen Long, Tuen Mun and Tseung Kwan O general stations and Mong Kok roadside station.

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, eight of them are considered more important in terms of their health impacts and their annual averages in 2018 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: 2018 Diurnal variations of NO_2

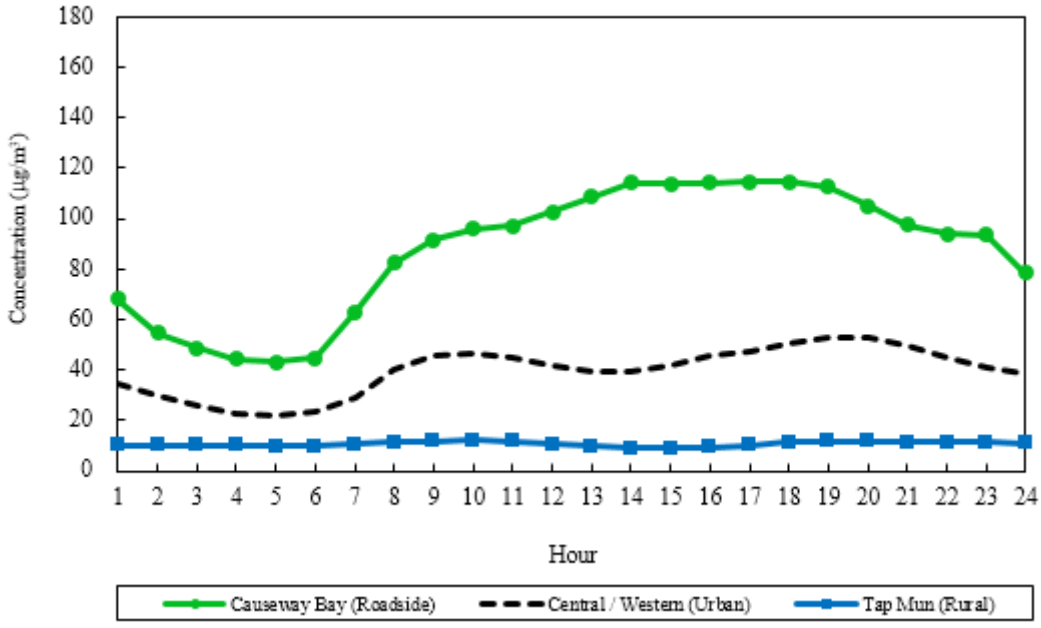


Figure 9: 2018 Diurnal variations of RSP

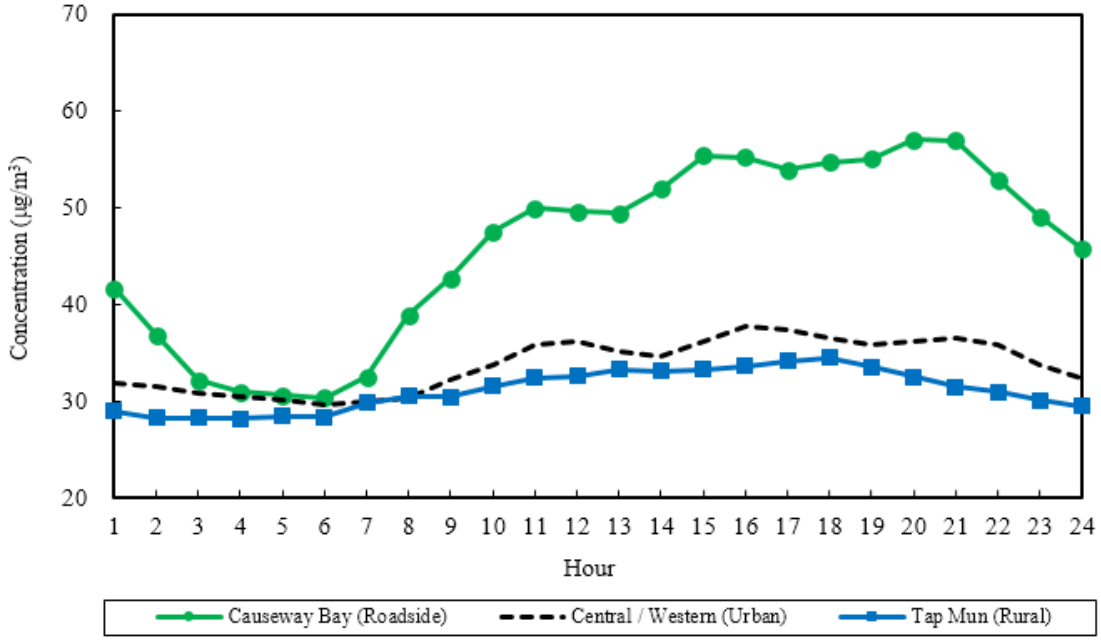
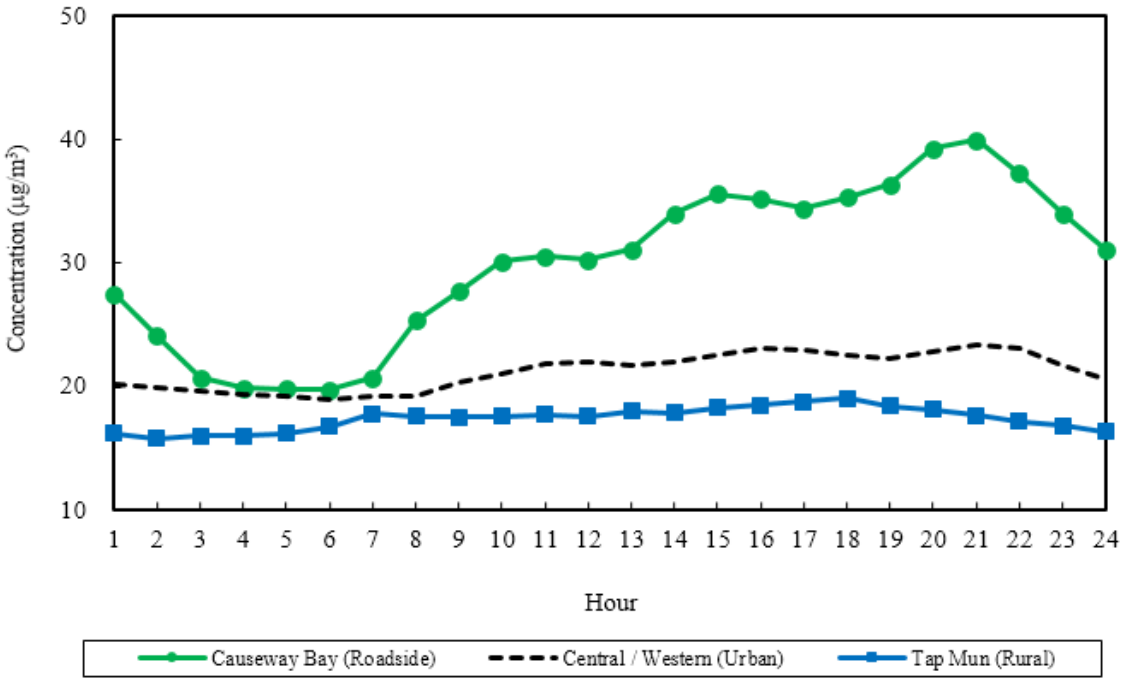
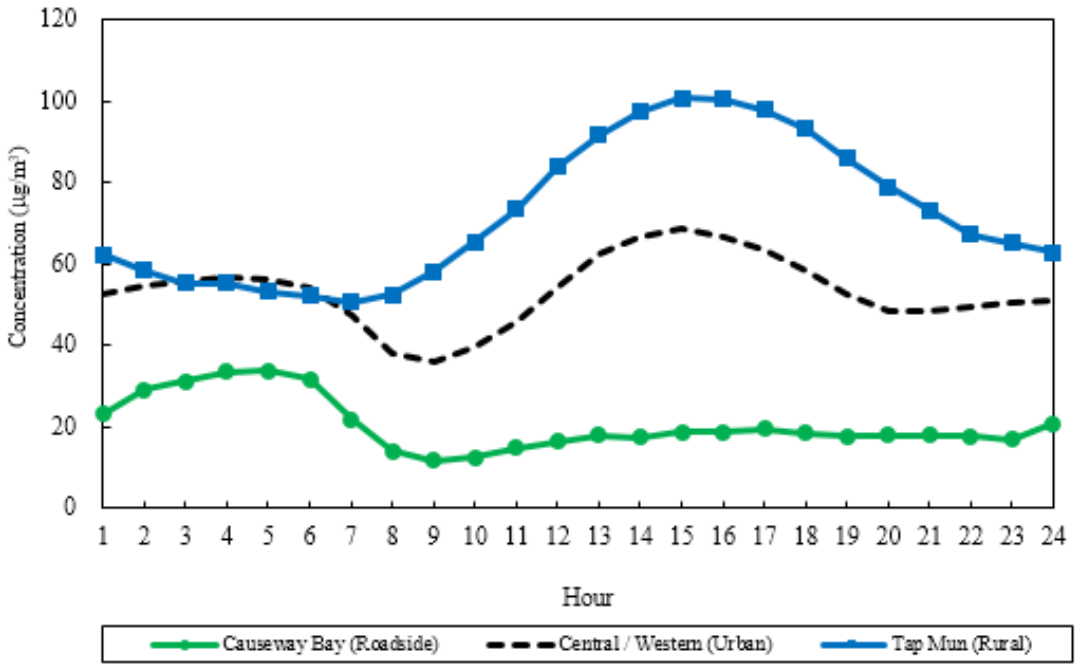


Figure 10: 2018 Diurnal variations of FSP



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: 2018 Diurnal variations of O_3

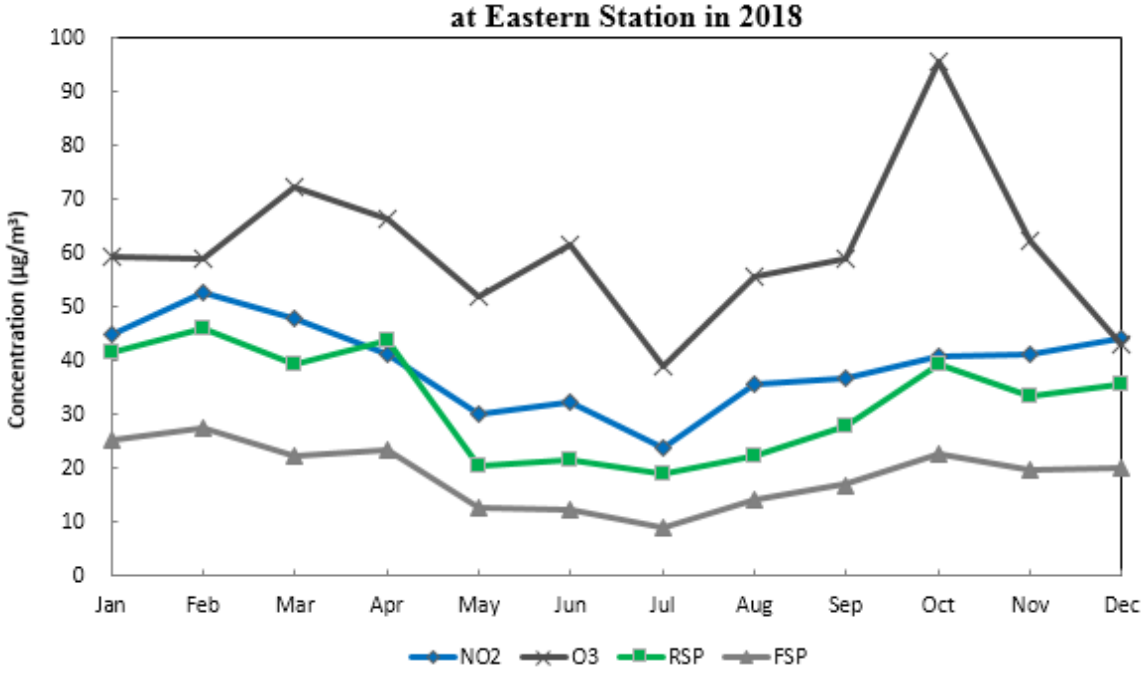


5.2 Over a Year

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 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 Eastern Station in 2018



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 2017, the annual average concentrations of SO_2, NO_2, CO, RSP and FSP at general stations decreased by 25%, 3%, 9%, 6% and 9% respectively. Only the annual average concentration of O_3 recorded at general stations increased by 2%.

As for roadside stations, the annual average concentrations of FSP and NO_2 decreased by 4% and 5% respectively between 2017 and 2018. Whereas, RSP and SO_2 remained at the same level as in 2017, but CO and O_3 increased by 13% and 4%, respectively, in the same period.

Meteorological conditions of 2018 were generally comparable to that of 2017 but with less rainfall to clear the air pollutants. 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)

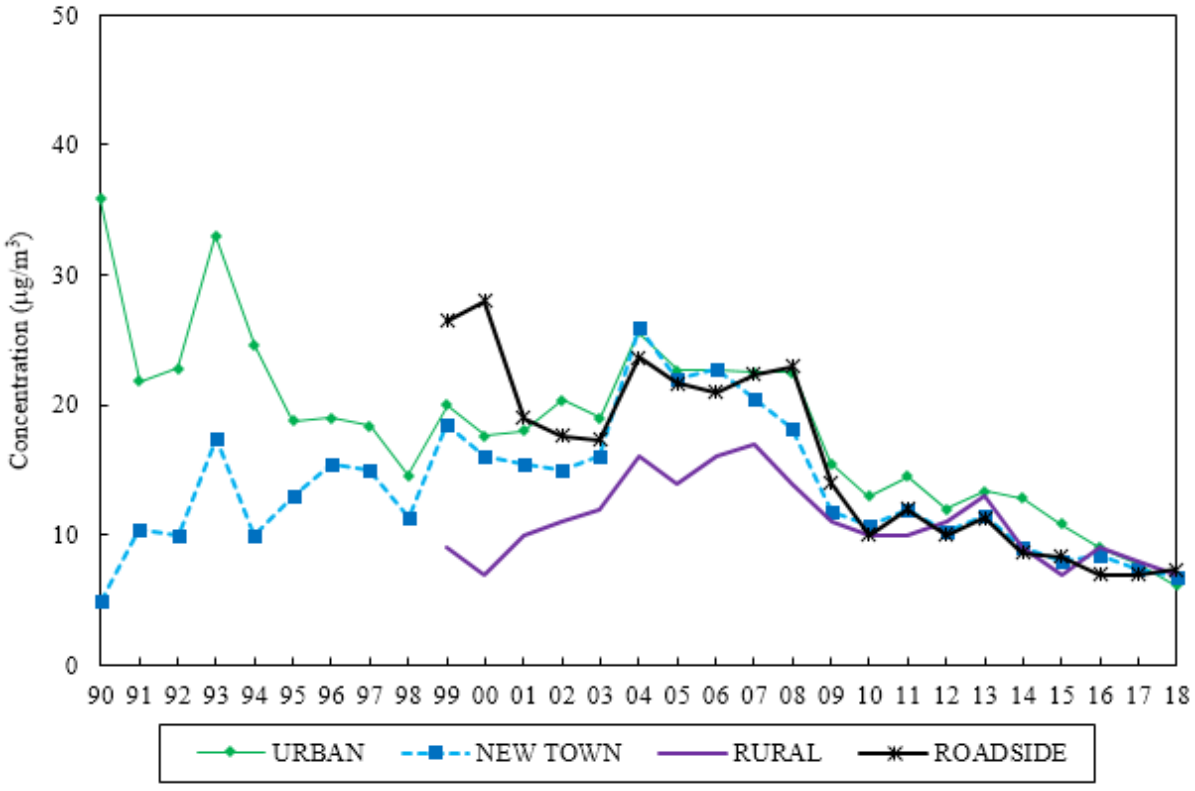
Since the implementation of the Air Pollution Control (Fuel Restriction) Regulations in 1990 for restricting sulphur content of industrial fuels, the Air Pollution Control (Motor Vehicle Fuel) Regulations in 1995 for controlling motor vehicle fuel quality, introduction of ultra-low sulphur diesel for 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 2018 remained low at 6 $\mu g/m^3$ and 7 $\mu g/m^3$, respectively.

Figure 13: SO_2 long term trend

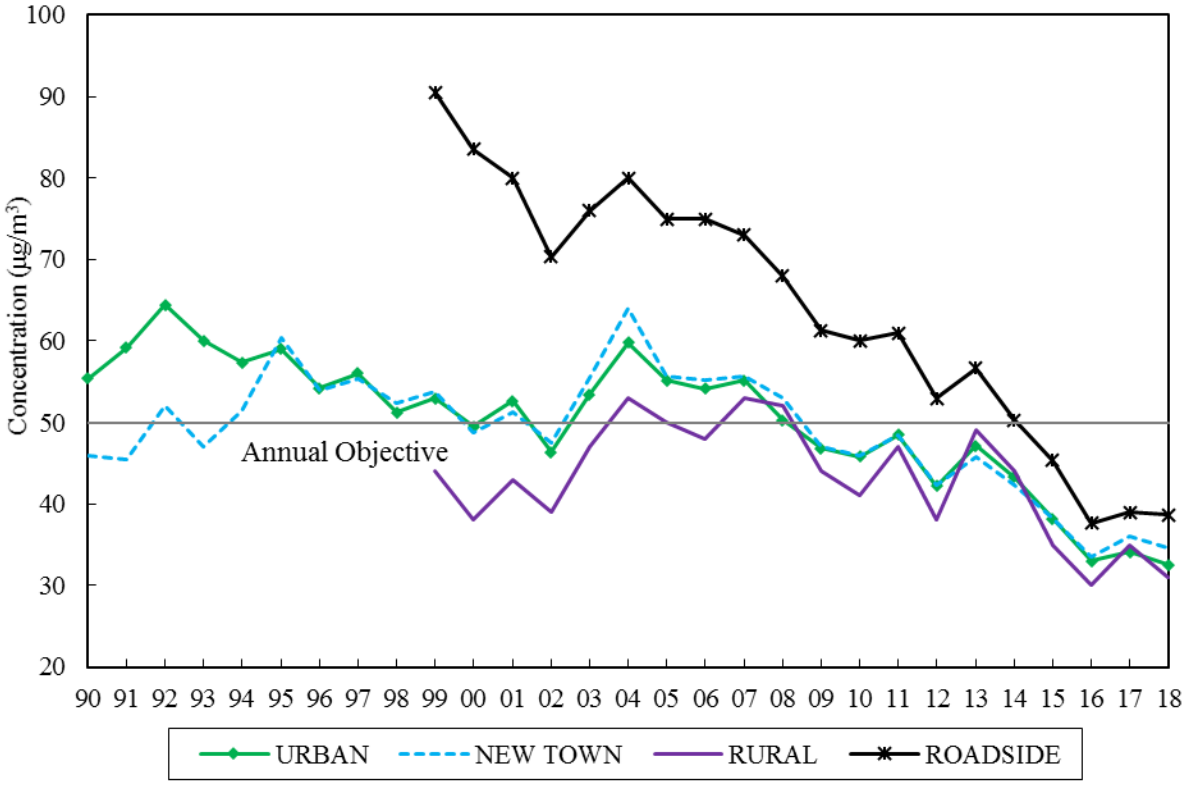


5.3.2 Respirable Suspended Particulates (RSP)

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 over the last ten years.

As a result of the implementation of various vehicle emission control measures in the last two decades, the annual average of RSP concentration at roadside in 2018 had been significantly reduced by 57% when compared with the 1999[1] value and remained below the annual AQO since 2015.

Figure 14: RSP long term trend



5.3.3 Fine Suspended Particulates (FSP)

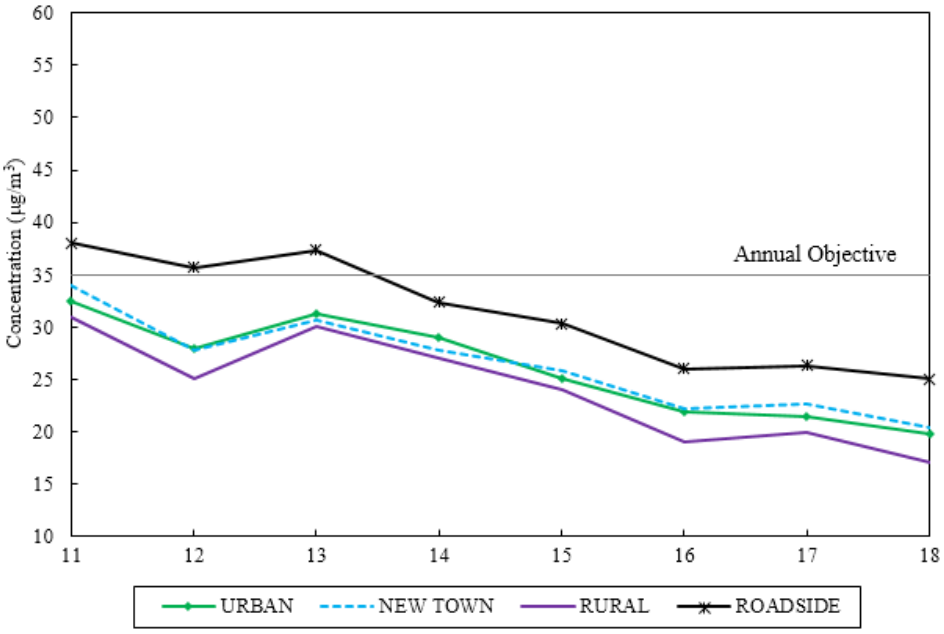
We started to monitor FSP at all our monitoring stations in 2011[2]. Same as RSP, the ambient concentrations of FSP in the territory showed an overall downward trend between 2011 and 2018, reflecting a continuous reduction in regional background FSP levels.

The roadside FSP levels also showed a discernible improvement in recent years. In 2018, the annual average of FSP concentration at roadside reduced by about 34% 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



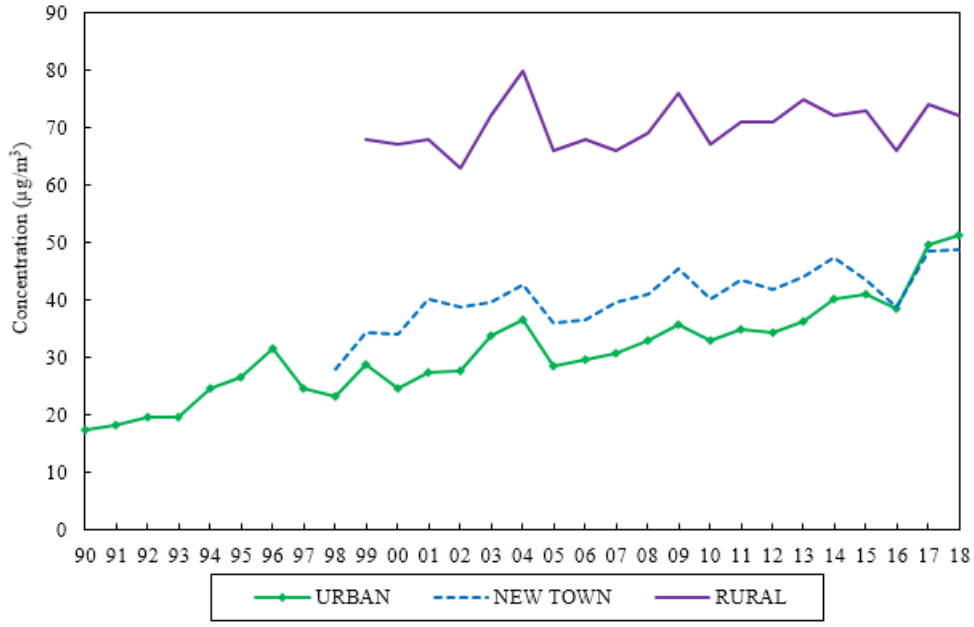
5.3.4 Ozone (O_3)

The ambient 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.

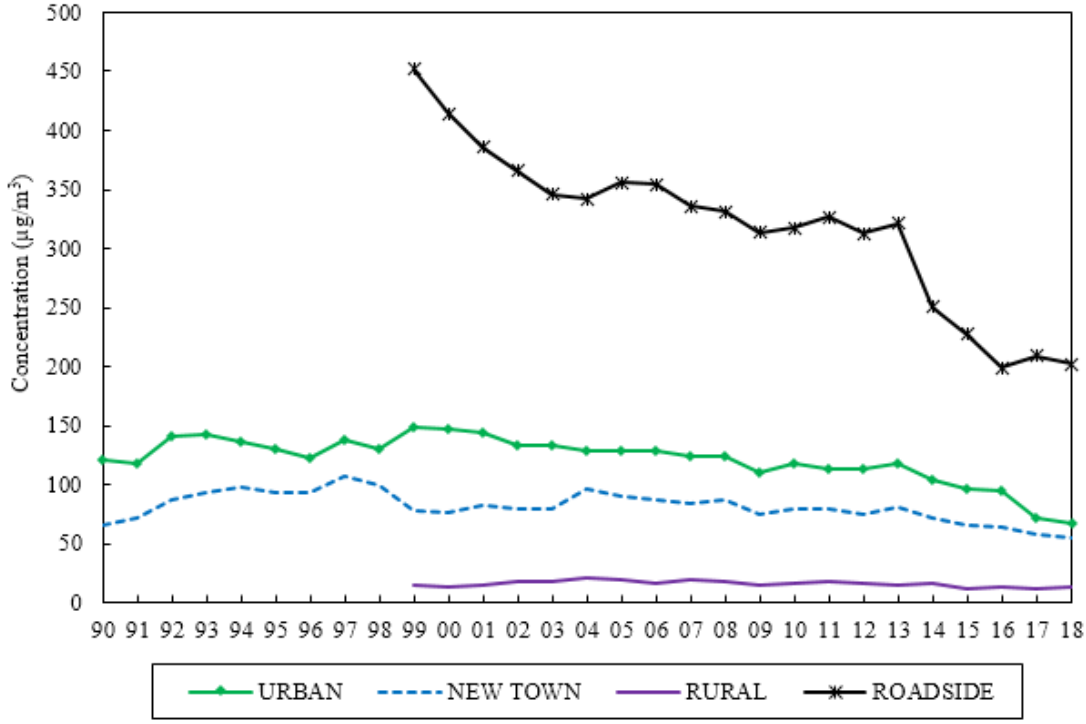
Figure 16: O_3 long term trend



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

While the background NOx concentrations (i.e. rural area in Tap Mun) remained flat, the annual averages of ambient NOx in urban areas and new towns exhibited a gradual declining trend between 1999 and 2018. 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 2018 was 55% lower than that in 1999[1].

Figure 17: NOx long term trend



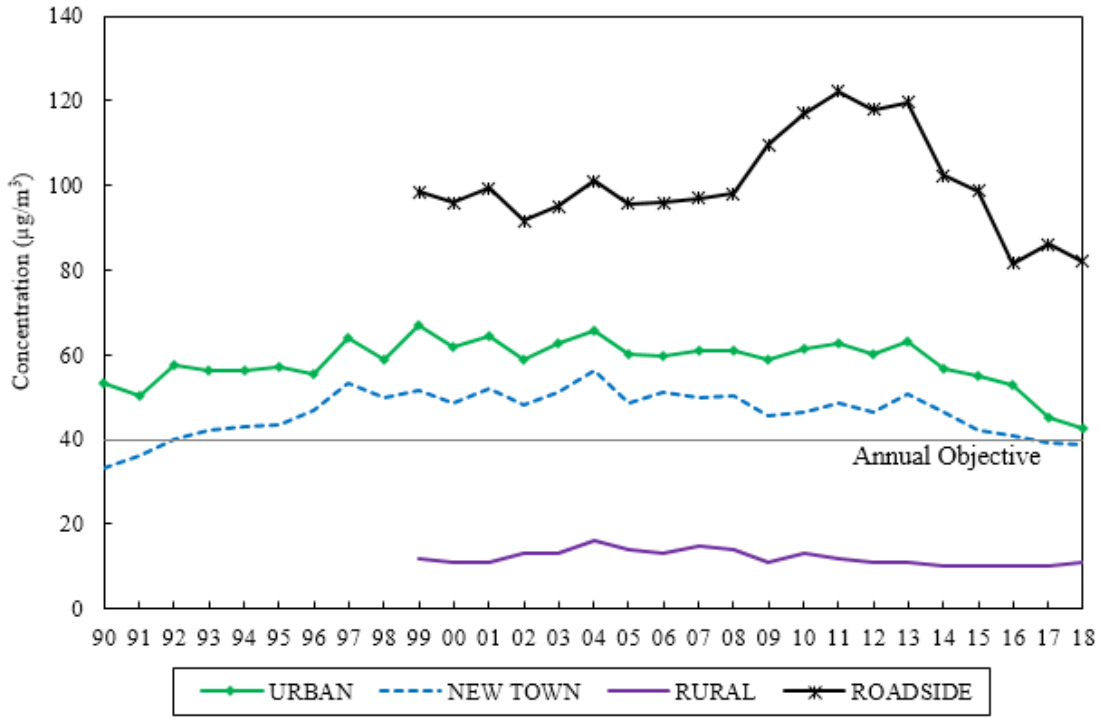
NO_2, a major component of NO_x, is mainly formed from the oxidation of nitric oxide. The oxidation can be promoted by the presence of more ozone and VOCs in the ambient air. The ambient NO_2 levels have exhibited slow ascending trends between 1990 and 2004, but the trends have levelled off from 2005 to 2012 and 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 reversed and started to drop from its peak in 2011. The annual NO_2 concentration at roadside recorded in 2018 had reduced by 17% 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.

[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.

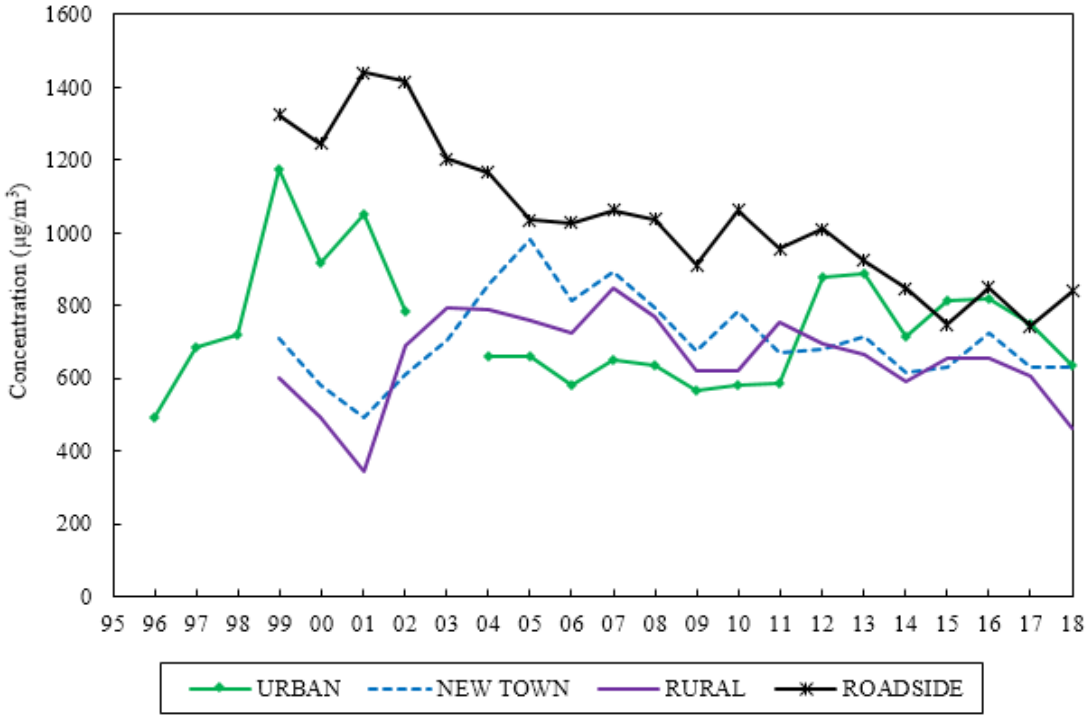
Figure 18: NO_2 long term trend



5.3.6 Carbon Monoxide (CO)

The ambient concentrations of CO in the territory remained at a very low level while the CO concentration at the roadside had dropped to a low level which was close to the ambient concentrations in 2018.

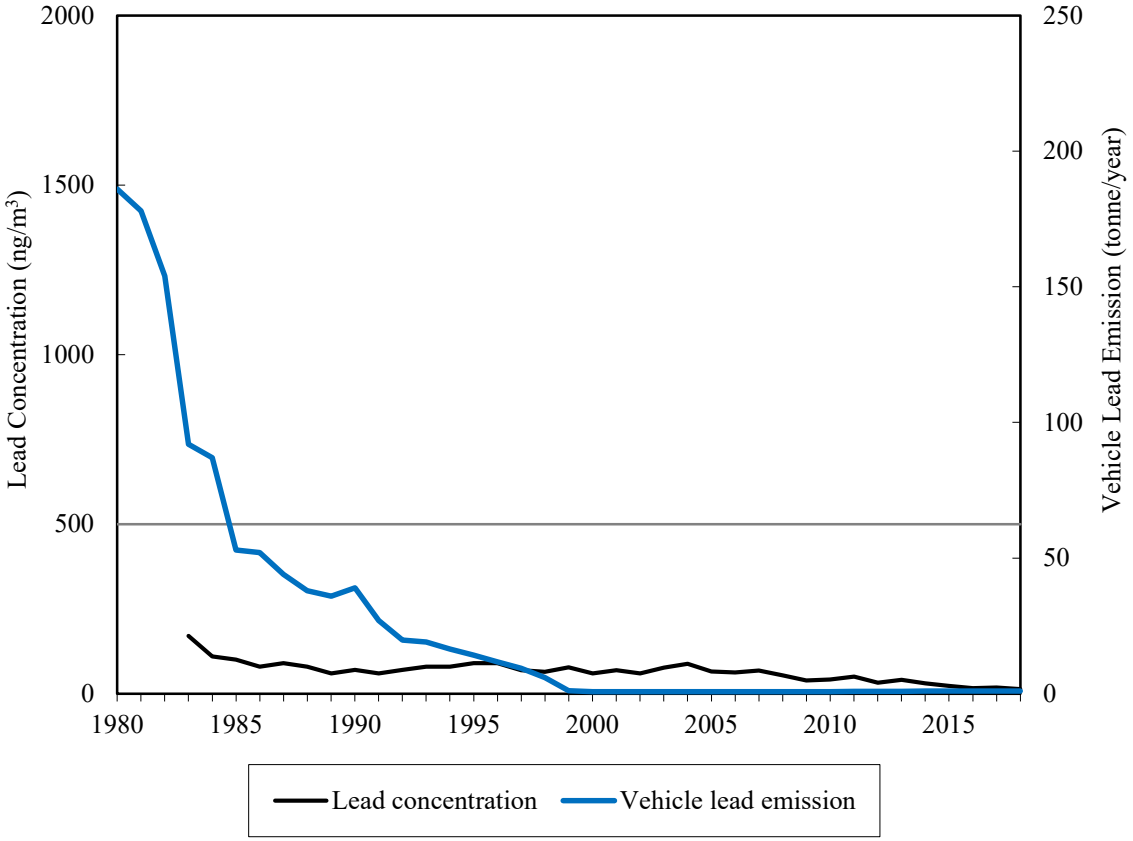
Figure 19: CO long term trend



5.3.7 Lead (Pb)

The lead concentrations at the roadside and in ambient air 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 2018. Four general stations and all three roadside stations complied with the 8 hour AQO for O_3 and all general stations complied with the 1-hour AQO for NO_2. For other criteria pollutants including RSP, FSP, SO_2 and CO, all general and roadside stations complied with their respective short-term AQO.

Table A2: Compliance Status of Short-Term Air Quality Objectives in 2018

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 2018. All stations complied with the annual AQO for RSP and FSP whereas six general and three roadside stations could not comply with the annual AQO for NO_2 in 2018. For lead, all ten monitoring stations achieved full compliance with the long term AQO in 2018.

Table A3: Compliance Status of Long-Term (Annual) Air Quality Objectives in 2018

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 2018. 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 measured 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 measured 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 2018, 371 audit checks were carried out on the stations' analysers and samplers. Based on the 95% probability limits, the accuracy varied from -8.0 % to 5.3 % for gases, and from -8.1 % 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 2018, 3094 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 6.2%, 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 in October 2009.
[2] Kwun Tong station was relocated to the current address in April 2012.
[3] Kwai Chung station was relocated to the current address in January 1999.
[4] Sampling height for gaseous pollutants.
[5] Sampling height for suspended particulates.
[6] Mong Kok station was relocated to the current address in January 2001.

Table B2: Summary of the Parameters Monitored in the Network (2018)

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	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) Oscillating microbalance b) Beta Attenuation	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

Toxic Air Pollutants	Sampling and Analysis method	Sampling Instrument	Sampling Media	Sampling Schedule	Sampling Period
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, 2018

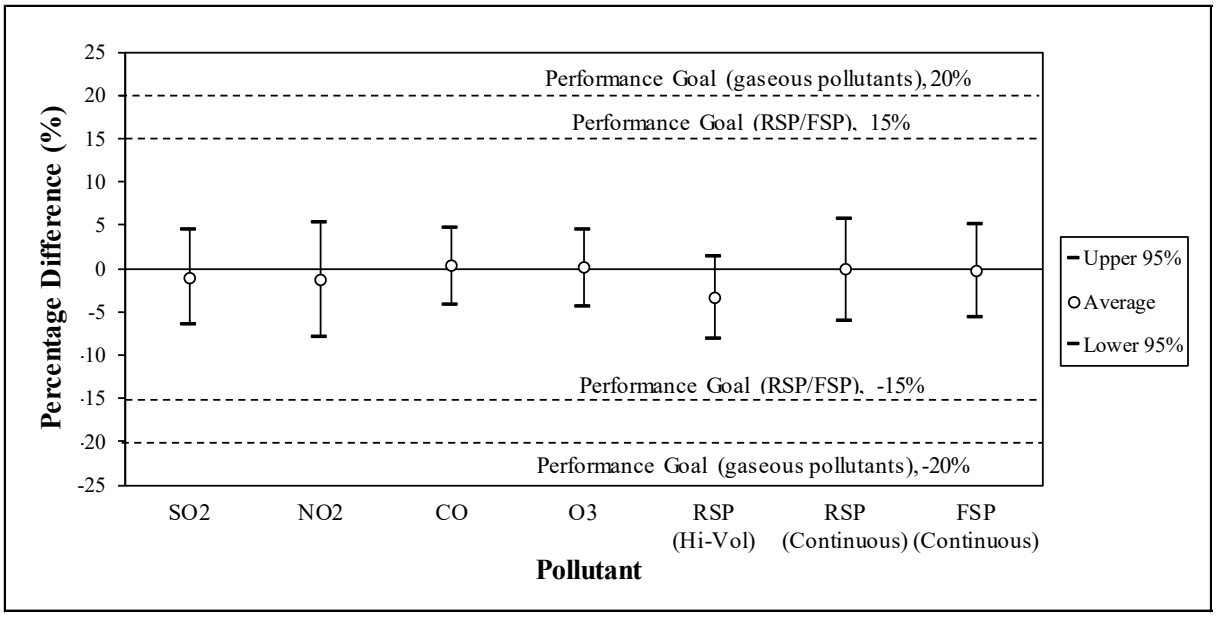
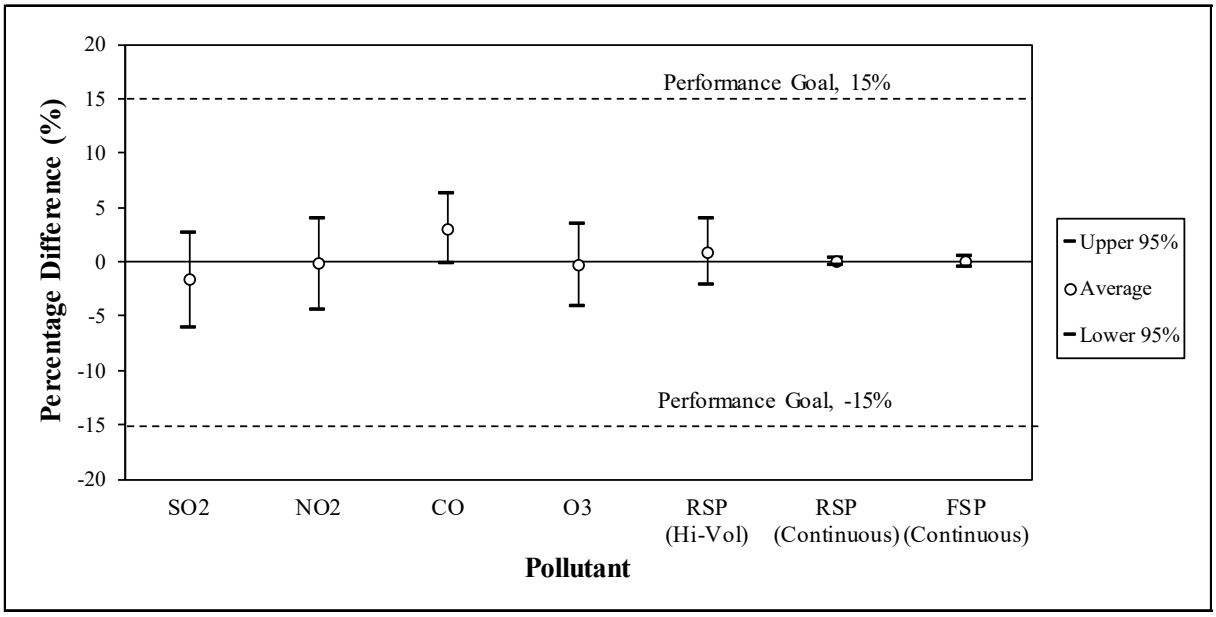


Figure B2: Precision of Air Quality Monitoring Network, 2018



Appendix C

Tables of Air Quality Data

Table C1: 2018 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	203	191	149	135
Eastern	0	164	139	130	123
Kwun Tong	0	68	60	51	51
Sham Shui Po	0	102	99	99	98
Kwai Chung	0	165	155	141	134
Tsuen Wan	0	154	152	133	113
Tseung Kwan O	0	47	42	38	38
Yuen Long	0	70	55	53	52
Tuen Mun	0	130	103	96	94
Tung Chung	0	103	100	96	88
Tai Po	0	38	37	26	24
Sha Tin	0	80	79	78	76
Tap Mun	0	38	33	31	29
Causeway Bay	0	105	97	96	82
Central	0	124	102	101	101
Mong Kok	0	93	92	89	88

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	1680
Tseung Kwan O	0	2130
Yuen Long	0	1720
Tuen Mun	0	1900
Tung Chung	0	1780
Tap Mun	0	1170
Causeway Bay	0	2610
Central	0	2330
Mong Kok	0	2340

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	34	30	24	22
Eastern	0	30	13	12	12
Kwun Tong	0	18	17	13	12
Sham Shui Po	0	26	25	24	21
Kwai Chung	0	30	30	28	27
Tsuen Wan	0	33	29	21	21
Tseung Kwan O	0	13	12	11	11
Yuen Long	0	20	17	17	16
Tuen Mun	0	31	24	20	20
Tung Chung	0	22	20	20	19
Tai Po	0	9	8	8	8
Sha Tin	0	20	18	17	16
Tap Mun	0	14	13	13	13
Causeway Bay	0	23	21	20	19
Central	0	25	21	20	20
Mong Kok	0	30	25	21	19

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	1421
Tseung Kwan O	0	1838
Yuen Long	0	1574
Tuen Mun	0	1666
Tung Chung	0	1353
Tap Mun	0	1151
Causeway Bay	0	2047
Central	0	1685
Mong Kok	0	2041

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	4	256	231	211	201	199	197	189	188	187	182	180	179	177	173	165	162	161	160	159
Eastern	0	178	170	153	152	151	147	147	144	143	137	134	134	133	131	130	129	128	128	128
Kwun Tong	11	257	233	229	226	224	222	221	219	218	210	209	190	188	188	186	186	186	181	178
Sham Shui Po	1	210	178	177	162	161	159	158	157	156	156	154	154	154	154	154	152	152	152	152
Kwai Chung	14	354	312	309	307	303	244	233	230	226	221	219	206	203	202	200	199	197	196	196
Tsuen Wan	9	353	320	305	303	292	285	251	228	209	200	196	195	192	191	191	187	184	183	181
Tseung Kwan O	0	167	167	163	162	162	153	153	149	145	144	143	143	142	141	141	140	140	137	135
Yuen Long	3	231	205	203	197	185	182	181	179	176	171	170	169	165	163	161	152	152	152	150
Tuen Mun	11	367	342	318	300	263	254	233	216	214	211	204	200	193	187	187	183	183	183	177
Tung Chung	7	296	262	261	249	231	220	205	200	195	188	170	166	164	163	160	159	156	156	156
Tai Po	0	166	150	147	145	145	142	141	139	138	135	133	131	131	130	127	126	125	125	125
Sha Tin	0	198	194	189	183	179	178	175	170	170	166	163	163	162	161	154	154	153	152	149
Tap Mun	0	93	83	79	74	72	70	67	66	65	64	62	60	59	56	56	53	52	51	51
Causeway Bay	148	381	368	332	324	322	319	318	309	304	302	300	297	293	291	286	285	281	278	277
Central	120	319	318	315	314	308	306	294	289	289	287	283	279	278	269	266	263	262	257	257
Mong Kok	44	346	327	326	298	276	272	266	262	261	256	255	252	251	249	243	242	240	240	240

Table C1 (Cont.): 2018 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	11	256	237	198	193	177	177	172	168	166	164
Eastern	10	254	202	191	186	176	168	167	163	163	161
Kwun Tong	0	139	138	137	136	135	135	133	133	131	130
Sham Shui Po	5	219	175	172	163	163	152	151	151	150	147
Kwai Chung	1	208	152	146	142	141	140	137	136	134	133
Tsuen Wan	9	227	184	179	177	173	173	169	165	163	148
Tseung Kwan O	15	231	201	199	194	182	181	177	173	171	169
Yuen Long	10	249	236	220	216	193	171	171	169	166	162
Tuen Mun	18	263	230	220	214	211	204	195	191	181	173
Tung Chung	14	222	220	208	207	204	189	187	179	179	173
Tai Po	13	230	215	210	185	172	172	169	168	167	167
Sha Tin	17	239	209	202	201	190	190	189	188	183	182
Tap Mun	20	258	232	205	194	193	189	189	185	185	184
Causeway Bay	0	113	101	97	95	91	84	83	82	78	78
Central	0	121	121	113	111	109	108	105	102	96	96
Mong Kok	0	124	111	103	102	102	101	99	98	97	97

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	2	119	115	88	83	79	73	72	71	71	70
Eastern	1	104	100	85	82	81	78	76	73	69	68
Kwun Tong	2	111	103	86	84	82	81	81	81	80	78
Sham Shui Po	0	99	95	83	79	71	62	62	60	59	59
Kwai Chung	0	95	91	83	77	70	65	65	64	62	62
Tsuen Wan	2	135	115	83	79	78	74	72	72	71	71
Tseung Kwan O	0	91	87	75	69	66	64	58	58	54	53
Yuen Long	4	121	116	109	102	89	80	77	77	75	75
Tuen Mun	4	143	138	125	108	98	94	94	93	92	87
Tung Chung	2	157	138	97	80	80	80	79	75	74	73
Tai Po	0	93	91	88	83	80	78	76	71	70	69
Sha Tin	1	102	91	84	76	74	73	68	68	65	65
Tap Mun	0	98	96	77	71	70	67	63	62	60	60
Causeway Bay	1	130	99	95	93	92	88	84	84	83	82
Central	1	118	89	87	83	78	78	77	77	75	74
Mong Kok	2	117	114	86	84	79	76	76	74	73	73

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	2	95	85	57	56	52	51	49	49	47	46
Eastern	0	63	53	47	45	45	43	41	41	41	39
Kwun Tong	0	63	57	53	52	52	50	50	46	46	45
Sham Shui Po	0	70	61	48	48	47	44	44	43	42	41
Kwai Chung	0	60	51	45	45	45	43	42	41	40	38
Tsuen Wan	2	101	90	58	58	57	53	50	49	48	48
Tseung Kwan O	0	56	43	39	36	34	34	33	32	32	32
Yuen Long	1	80	68	58	57	55	49	48	48	47	46
Tuen Mun	2	103	91	64	63	63	60	59	56	55	53
Tung Chung	2	119	99	53	53	51	51	51	50	48	48
Tai Po	0	73	66	59	55	51	50	49	49	49	47
Sha Tin	0	70	53	51	50	49	49	46	41	40	40
Tap Mun	0	51	46	45	41	38	36	36	36	33	32
Causeway Bay	1	104	74	70	69	63	56	56	55	55	55
Central	1	91	65	60	58	55	54	52	52	50	50
Mong Kok	2	93	86	59	57	57	55	55	52	51	51

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: 2018 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	12	8	6	6	8	9	10	8	6	5	4	7
Eastern	3	3	4	4	5	3	3	4	5	4	3	2	4
Kwun Tong	5	4	4	4	5	4	4	5	6	6	6	8	5
Sham Shui Po	6	7	8	8	7	6	5	7	7	5	5	5	6
Kwai Chung	5	6	8	8	13	13	9	8	11	5	6	7	8
Tsuen Wan	14	10	7	7	8	6	6	7	8	8	7	8	8
Tseung Kwan O	4	4	5	5	5	4	4	5	6	7	6	6	5
Yuen Long	9	9	9	10	9	7	7	7	8	7	6	7	8
Tuen Mun	10	10	10	11	8	8	9	9	10	9	7	8	9
Tung Chung	10	11	9	7	6	7	6	7	9	11	10	11	9
Tai Po	2	2	2	2	2	2	2	2	3	4	2	3	2
Sha Tin	6	7	6	7	8	6	4	5	8	6	6	6	6
Tap Mun	8	8	7	8	7	7	7	7	7 *	9	8	7	7
Causeway Bay	8	10	9	8	8	5	5	7	10	9	8	9	8
Central	8	9	6	4	9	7	7	8	10	9	7	8	8
Mong Kok	6	6	7	6	7	5	5	6	7	4	3	6	6

Pollutant: Nitrogen Oxides

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	62	86	79	57	38	36	32	48	60	51	56	73	56
Kwun Tong	74	88	62	54	88	71	68	94	71	54	53	76	71
Sham Shui Po	82	100	85	63	63	62	54	76	72	64	65	75	71
Kwai Chung	106	115	103	89	100	93	86	105	101	80	73	87	95
Tsuen Wan	91	103	81	62	53	47	45	62	56	52	56	70	65
Tseung Kwan O	44	48	47	40	49	43	36	58	50	36	27	38	43
Yuen Long	79	75	67	60	48	51	46	59	63	63	62	82	63
Tuen Mun	104	104	73	62	46	50	42	58	57	69	73	86	68
Tung Chung	65	77	52	38	29	29	24	38	48	47	48	73	47
Tai Po	63	65	54	48	50	50	43	53	51	53	47	56	53
Sha Tin	54	62	55	42	43	37	30	50	51	44	36	51	46
Tap Mun	12	11	11	13	14	10	8	11	15 *	14	15	21	13
Causeway Bay	300	327	289	265	242	231	213	274	286	218	203	243	257
Central	191	231	203	180	162	175	140	196	197	182	171	204	186
Mong Kok	163	180	166	151	183	167	157	186	170	142	138	156	163

Pollutant: Nitrogen Dioxide (Annual limit value = 40 $\mu g/m^3$)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	46	53	50	41	27	28	20	34	40	42	44	49	39
Eastern	45	53	48	41	30	32	24	36	37	41	41	44	39
Kwun Tong	41	50	42	37	46	42	35	55	45	41	38	44	43
Sham Shui Po	55	60	55	45	40	44	34	53	47	53	50	50	49
Kwai Chung	60	63	59	54	53	53	42	60	56	59	49	51	55
Tsuen Wan	62	63	54	45	34	32	27	43	39	45	45	51	45
Tseung Kwan O	28	31	30	27	29	26	21	40	32	29	21	27	28
Yuen Long	52	50	47	43	33	36	28	41	44	49	47	51	43
Tuen Mun	65	61	48	48	33	36	28	42	43	55	51	53	47
Tung Chung	43	47	36	28	20	23	18	29	36	40	36	45	33
Tai Po	44	46	38	34	31	30	26	36	35	43	36	38	36
Sha Tin	39	46	40	33	32	27	22	38	37	38	30	36	35
Tap Mun	11	11	10	11	11	9	7	9	11 *	11	11	16	11
Causeway Bay	98	101	100	91	75	80	61	91	91	101	81	76	87
Central	81	91	88	67	61	78	56	86	86	103	83	77	80
Mong Kok	83	87	89	79	73	73	55	85	81	90	78	72	79

Pollutant: Carbon Monoxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tsuen Wan	809	1018	928	571	463	461	452	521	410	612	596	703	628
Tseung Kwan O	961	980	539	507	431	485	446	603	607	626	734	822	643
Yuen Long	518	593	576	536	299	362	568	664	577	692	826	861	591
Tuen Mun	810	872	776	596	488	613	596	789	804	952	995	1035	776
Tung Chung	764	729	436	468	421	442	326	472	464	515	560	791	532
Tap Mun	517	481	530	600	401	473	412	421	431 *	383	373	510	462
Causeway Bay	1054	1158	990	651	742	874	833	1103	727	697	732	924	870
Central	838	1020	1005	781	752	915	573	785	772	791	812	910	828
Mong Kok	929	1049	780	816	626	833	696	867	808	753	848	832	818

Table C2 (Cont.): 2018 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	51	48	61	53	44	54	33	54	53	93	60	36	53
Eastern	59	59	72	66	52	61	39	56	59	96	62	43	60
Kwun Tong	60	56	69	62	37	48	29	34	43	81	60	39	51
Sham Shui Po	39	39	53	48	34	40	24	37	45	82	52	32	44
Kwai Chung	45	42	54	48	29	35	18	30	35	73	54	33	41
Tsuen Wan	43	40	54	48	35	45	24	40	43	80	54	32	45
Tseung Kwan O	71	71	79	73	48	59	36	47	58	104	83	55	65
Yuen Long	41	39	50	42	41	47	27	46	45	68	46	29	43
Tuen Mun	34	35	51	47	44	49	30	49	53	79	50	25	46
Tung Chung	42	31	48	48	50	57	38	53	49	75	51	27	48
Tai Po	56	55	70	48	29	34	31	50	51	80	64	38	51
Sha Tin	58	54	64	61	44	57	35	47	52	93	72	43	57
Tap Mun	80	81	82	79	57	66	41	65	70 *	111	83	53	72
Causeway Bay	20	17	27	24	18	20	11	13	15	39	26	17	21
Central	31	25	33	20	19	26	15	18	21	46	33	19	25
Mong Kok	29	27	33	30	18	23	12	19	26	55	33	19	27

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	44	47	42	42	22	21	18	24	29	41	37	38	34
Eastern	42	46	39	44	21	22	19	22	28	39	33	36	33
Kwun Tong	44	52	42	48	30	25	23	29	36	49	39	41	38
Sham Shui Po	35	39	42	44	25	24	21	25	28	40	34	34	33
Kwai Chung	35	39	37	42	27	25	23	26	31	40	32	31	32
Tsuen Wan	42	43	34	37	19	18	14	24	29	39	34	30	30
Tseung Kwan O	35	30	34	39	22	20	18	21	27	35	29	32	28
Yuen Long	49	50	38	45	22	21	16	26	35	53	46	40	37
Tuen Mun	57	59	44	49	24	26	21	27	37	57	49	52	42
Tung Chung	44	45	32	34	15	19	14	20	27	44	38	43	31
Tai Po	41	43	33	40	19	19	15	23	31	39	34	37	31
Sha Tin	37	42	34	40	21	22	25	24	29	39	34	34	32
Tap Mun	36	39	33	39	23	23	22	23	32 *	41	32	31	31
Causeway Bay	53	61	55	56	33	33	32	38	42	51	46	50	46
Central	41	47	41	43	19	19	14	24	31	40	38	45	34
Mong Kok	46	50	44	44	23	21	20	29	30	42	35	41	36

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	30	31	26	24	13	13	10	17	18	25	24	24	21
Eastern	25	27	22	23	13	12	9	14	17	23	20	20	19
Kwun Tong	27	31	25	26	18	16	13	19	20	25	23	22	22
Sham Shui Po	25	28	27	25	15	15	11	17	20	26	24	23	21
Kwai Chung	23	26	22	23	17	16	13	18	21	24	21	19	20
Tsuen Wan	30	31	21	22	13	11	7	18	20	25	24	21	20
Tseung Kwan O	20	19	18	19	11	10	7	12	15	19	17	18	15
Yuen Long	29	34	23	23	10	12	8	17	20	26	22	22	20
Tuen Mun	37	38	28	28	16	16	11	17	22	33	30	31	26
Tung Chung	28	28	18	15	7	10	6	12	16	24	22	24	18
Tai Po	28	30	21	23	12	12	9	16	20	25	21	20	19
Sha Tin	24	27	21	23	14	13	11	15	18	23	20	18	19
Tap Mun	21	23	20	21	14	12	10	14	18 *	21	18	17	17
Causeway Bay	36	42	36	34	21	22	19	27	29	32	30	31	30
Central	27	31	25	25	12	11	7	17	22	25	23	27	21
Mong Kok	33	35	29	27	15	14	13	22	21	28	23	28	24

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: 2018 Hourly Statistics of Air Pollutants

Pollutant: Sulphur Dioxide

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	8620	98.4	2	3	6	9	15	19	25	34	53	7	108
Eastern	8613	98.3	1	2	3	4	7	9	12	15	25	4	105
Kwun Tong	8617	98.4	2	3	4	7	9	10	13	17	25	5	46
Sham Shui Po	8652	98.8	2	3	4	7	12	18	25	35	51	6	93
Kwai Chung	8628	98.5	2	3	5	10	19	26	33	44	62	8	125
Tsuen Wan	8412	96.0	4	5	6	9	14	18	22	29	49	8	97
Tseung Kwan O	8492	96.9	3	4	5	6	8	10	12	14	19	5	28
Yuen Long	8410	96.0	5	6	7	9	12	15	18	22	31	8	51
Tuen Mun	8698	99.3	5	6	8	10	15	18	22	29	45	9	81
Tung Chung	8425	96.2	5	6	8	10	13	17	21	26	39	9	71
Tai Po	8667	98.9	1	1	2	3	5	6	7	9	14	2	25
Sha Tin	8628	98.5	2	3	5	8	11	14	17	22	37	6	51
Tap Mun	8095	92.4	6	6	7	8	10	12	13	15	18	7	26
Causeway Bay	8531	97.4	3	4	7	10	14	18	22	28	39	8	55
Central	8698	99.3	3	5	6	9	14	17	22	30	42	8	62
Mong Kok	8633	98.6	2	3	4	7	11	16	23	33	49	6	81

Pollutant: Nitrogen Oxides

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	8634	98.6	16	25	43	67	105	141	192	285	501	56	774
Kwun Tong	8614	98.3	19	30	53	94	146	186	217	269	477	71	721
Sham Shui Po	8622	98.4	24	40	62	88	121	151	199	281	500	71	800
Kwai Chung	8630	98.5	28	48	80	121	174	220	269	359	508	95	871
Tsuen Wan	8401	95.9	20	35	53	77	114	159	205	289	387	65	632
Tseung Kwan O	8596	98.1	16	20	29	51	86	119	149	198	364	43	552
Yuen Long	8415	96.1	26	38	53	76	109	138	170	213	302	63	648
Tuen Mun	8572	97.9	22	34	54	86	130	165	205	273	378	68	715
Tung Chung	8285	94.6	10	18	34	65	103	128	155	191	256	47	411
Tai Po	8650	98.7	23	32	46	65	88	109	134	164	256	53	369
Sha Tin	8598	98.2	14	20	34	58	92	123	151	196	276	46	599
Tap Mun	8068	92.1	5	7	11	16	23	28	33	41	70	13	105
Causeway Bay	8559	97.7	77	133	218	344	487	588	680	777	986	257	1440
Central	8681	99.1	59	95	155	247	350	421	492	613	801	186	1170
Mong Kok	8640	98.6	57	97	154	212	274	319	363	439	622	163	912

Pollutant: Nitrogen Dioxide (1-hour limit value = 200 μg/m^3; allowable no. of exceedance of limit value = 18. Annual limit value = 40 μg/m^3)

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	No. of exceedance of limit value
Central/Western	8634	98.6	12	20	35	52	72	89	107	129	160	39	256	4
Eastern	8572	97.9	16	25	37	50	64	74	86	100	128	39	178	0
Kwun Tong	8614	98.3	15	23	37	56	76	93	114	137	180	43	257	11
Sham Shui Po	8622	98.4	21	31	44	62	81	95	109	127	152	49	210	1
Kwai Chung	8630	98.5	22	34	50	68	93	115	134	158	196	55	354	14
Tsuen Wan	8401	95.9	17	27	40	56	79	98	116	139	183	45	353	9
Tseung Kwan O	8596	98.1	10	14	21	35	57	76	95	110	137	28	167	0
Yuen Long	8415	96.1	21	28	38	53	72	86	100	119	152	43	231	3
Tuen Mun	8572	97.9	17	27	40	60	84	101	118	137	182	47	367	11
Tung Chung	8285	94.6	8	15	27	45	66	80	94	110	156	33	296	7
Tai Po	8650	98.7	17	23	33	45	60	73	83	98	125	36	166	0
Sha Tin	8598	98.2	11	18	29	44	67	85	99	119	151	35	198	0
Tap Mun	8068	92.1	4	6	9	13	19	23	28	34	52	11	93	0
Causeway Bay	8559	97.7	39	57	82	109	138	161	185	220	278	87	381	148
Central	8681	99.1	35	50	73	100	132	155	179	211	257	80	319	120
Mong Kok	8640	98.6	36	53	76	98	124	142	160	186	240	79	346	44

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----------> 10	25	50	75	90	95	97.5	99	99.8	Arithmetic mean	Highest 1-hour	No. of exceedance of limit value
Tsuen Wan	8400	95.9	350	440	580	780	990	1090	1200	1280	1410	628	1680	0
Tseung Kwan O	8556	97.7	400	450	580	800	980	1090	1160	1290	1730	643	2130	0
Yuen Long	8395	95.8	310	420	570	730	890	1020	1110	1210	1431	591	1720	0
Tuen Mun	8707	99.4	500	600	750	920	1090	1180	1270	1380	1556	776	1900	0
Tung Chung	8359	95.4	310	370	470	650	850	950	1040	1180	1360	532	1780	0
Tap Mun	8109	92.6	280	350	450	550	670	740	800	870	1058	462	1170	0
Causeway Bay	8389	95.8	560	690	830	1020	1240	1390	1530	1690	1982	870	2610	0
Central	8686	99.2	540	650	800	970	1150	1270	1379	1510	1743	828	2330	0
Mong Kok	8632	98.5	540	660	800	950	1100	1190	1300	1450	1797	818	2340	0

Table C3 (Cont.): 2018 Hourly Statistics of Air Pollutants

Pollutant: Ozone

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	8471	96.7	9	26	47	76	99	115	135	161	233	53	313
Eastern	8611	98.3	22	35	52	82	107	124	139	158	208	60	312
Kwun Tong	8565	97.8	11	22	45	78	99	111	121	130	144	51	201
Sham Shui Po	8600	98.2	8	18	36	64	87	104	123	145	199	44	311
Kwai Chung	8537	97.5	4	13	33	64	88	102	114	134	167	41	283
Tsuen Wan	8352	95.3	7	17	37	67	91	107	122	143	206	45	308
Tseung Kwan O	8568	97.8	13	31	59	97	122	136	152	171	205	65	292
Yuen Long	8387	95.7	6	16	35	62	89	108	131	171	229	43	353
Tuen Mun	8638	98.6	7	17	36	66	94	113	137	179	250	46	353
Tung Chung	8362	95.5	5	18	41	67	96	115	141	179	240	48	314
Tai Po	8668	98.9	6	19	44	76	101	119	137	165	213	51	329
Sha Tin	8598	98.2	6	22	48	85	115	130	148	181	231	57	312
Tap Mun	8098	92.4	22	40	67	101	128	142	158	183	220	72	340
Causeway Bay	8481	96.8	2	5	14	30	49	61	72	86	106	21	147
Central	8707	99.4	2	6	17	38	62	75	87	103	121	25	157
Mong Kok	8622	98.4	4	9	20	40	60	72	85	102	124	27	165

Pollutant: Respirable Suspended Particulates (PM_{10})

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	8638	98.6	12	19	31	45	57	68	79	94	146	34	184
Eastern	8366	95.5	13	19	30	43	57	66	76	92	115	33	140
Kwun Tong	8435	96.3	16	24	36	50	63	73	84	97	127	38	167
Sham Shui Po	8308	94.8	14	21	30	41	53	61	69	85	115	33	135
Kwai Chung	8619	98.4	15	21	30	40	52	61	72	83	113	32	150
Tsuen Wan	8499	97.0	9	16	27	40	53	64	77	99	151	30	285
Tseung Kwan O	8607	98.3	12	17	26	37	47	54	62	78	104	28	132
Yuen Long	8580	97.9	13	20	33	49	66	77	87	104	142	37	219
Tuen Mun	8520	97.3	15	23	38	55	72	84	100	122	178	42	261
Tung Chung	8642	98.7	9	15	27	42	58	70	84	104	186	31	290
Tai Po	8578	97.9	11	17	28	41	54	63	75	91	117	31	186
Sha Tin	8134	92.9	13	20	29	42	52	61	71	87	121	32	145
Tap Mun	8183	93.4	13	19	29	40	52	60	68	81	111	31	141
Causeway Bay	8343	95.2	21	30	43	58	73	83	94	109	147	46	210
Central	8363	95.5	10	17	31	46	59	71	83	99	129	34	183
Mong Kok	8183	93.4	14	21	33	47	60	70	82	94	141	36	193

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

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	8638	98.6	8	12	19	28	36	44	54	66	113	21	146
Eastern	8358	95.4	6	11	17	25	33	39	45	53	70	19	92
Kwun Tong	8489	96.9	10	14	20	28	36	42	48	58	76	22	106
Sham Shui Po	8296	94.7	9	13	20	28	35	41	47	55	81	21	99
Kwai Chung	8397	95.9	10	14	19	25	32	36	42	51	68	20	92
Tsuen Wan	8499	97.0	6	10	18	27	36	44	54	70	113	20	211
Tseung Kwan O	8608	98.3	5	9	14	21	27	31	36	43	63	15	93
Yuen Long	8557	97.7	7	11	18	27	36	44	53	63	88	20	144
Tuen Mun	8591	98.1	9	14	23	34	43	51	60	75	120	26	188
Tung Chung	8640	98.6	4	7	14	24	33	42	52	67	131	18	215
Tai Po	8583	98.0	7	11	17	26	34	42	50	61	88	19	139
Sha Tin	7938	90.6	6	11	17	25	34	40	47	57	85	19	109
Tap Mun	8146	93.0	7	11	16	23	29	33	38	45	63	17	94
Causeway Bay	8343	95.2	13	19	28	38	49	57	66	78	118	30	160
Central	8364	95.5	6	10	19	29	38	46	56	67	94	21	144
Mong Kok	8184	93.4	10	14	22	31	41	49	57	67	108	24	146

Notes:

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

Table C4: 2018 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	7	7	7	7	7	7	7	8	8	8	8	8	7	7	7	7	7	7	7	7	8	7	7	7
Eastern	4	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	4	5	4	4	4
Kwun Tong	5	5	5	8	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Sham Shui Po	6	6	6	9	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	7
Kwai Chung	7	7	6	7	6	5	6	7	8	9	9	9	9	9	10	10	11	11	10	10	8	8	7	7
Tsuen Wan	8	8	7	6	7	6	6	7	8	8	9	9	9	9	9	10	10	10	9	9	8	7	7	7
Tseung Kwan O	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	5	5	5	5	5	5
Yuen Long	8	8	8	8	7	7	7	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	8	8
Tuen Mun	9	8	8	7	8	7	8	8	9	9	9	9	10	10	10	10	10	11	10	10	10	9	9	9
Tung Chung	8	8	7	7	7	7	8	8	9	10	10	10	11	11	10	10	10	9	9	8	8	8	8	8
Tai Po	2	2	2	2	2	2	2	3	3	3	3	3	3	2	3	3	3	3	3	2	2	2	2	2
Sha Tin	6	6	6	8	6	5	5	6	6	6	6	6	6	6	7	7	7	7	7	7	6	6	6	6
Tap Mun	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7
Causeway Bay	7	6	5	5	5	5	6	8	10	10	9	9	9	10	9	9	9	9	9	9	9	8	9	8
Central	7	6	6	6	6	6	6	8	9	9	9	8	8	7	8	8	8	9	9	9	8	8	7	7
Mong Kok	5	5	4	4	4	4	4	5	6	6	6	6	6	6	7	7	7	7	7	7	6	6	6	6

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	51	43	38	32	30	31	39	61	76	80	74	64	57	55	57	61	61	64	67	69	67	62	58	55
Kwun Tong	54	38	32	28	27	37	67	92	99	93	85	82	76	75	82	86	91	94	99	88	77	68	70	65
Sham Shui Po	57	45	39	37	37	41	56	78	93	93	87	83	77	79	81	85	88	91	91	86	77	74	72	68
Kwai Chung	73	57	48	42	42	49	76	113	137	133	117	107	102	101	113	113	120	124	128	115	98	91	89	83
Tsuen Wan	52	34	28	23	25	30	51	70	87	91	83	77	71	72	75	77	82	88	90	81	72	64	63	59
Tseung Kwan O	49	44	36	33	38	47	63	60	47	37	34	32	32	32	34	35	38	42	47	50	49	48	51	52
Yuen Long	59	48	41	37	39	45	73	92	80	66	58	55	53	56	56	62	68	71	75	81	78	75	72	66
Tuen Mun	60	51	45	37	37	46	66	91	91	84	75	68	64	62	65	69	74	83	89	85	81	76	74	67
Tung Chung	45	34	29	25	26	30	43	57	59	57	59	59	60	57	54	54	51	52	52	51	47	44	43	43
Tai Po	47	42	35	33	33	37	59	87	81	62	52	48	44	45	47	49	54	59	64	62	58	56	55	53
Sha Tin	47	40	35	31	30	34	50	66	63	52	43	39	34	35	38	40	44	51	55	58	58	57	56	51
Tap Mun	12	12	12	12	12	12	13	14	16	16	15	13	12	11	11	11	12	13	13	13	13	13	13	13
Causeway Bay	176	124	108	94	92	95	166	265	328	335	316	327	339	357	338	322	340	342	343	319	277	276	282	221
Central	133	107	94	82	77	81	117	186	262	261	250	237	220	203	218	234	230	254	288	241	194	174	161	155
Mong Kok	122	86	77	69	69	72	107	155	193	195	198	197	192	204	208	213	226	228	230	206	174	171	175	156

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	35	29	26	22	22	23	29	40	45	46	45	42	39	39	42	46	47	50	53	53	50	45	41	38
Eastern	33	28	23	22	22	24	35	46	48	45	42	41	40	40	43	46	49	50	49	47	46	42	39	37
Kwun Tong	36	27	23	20	20	25	39	49	50	47	45	44	44	45	49	53	57	60	62	56	49	45	44	42
Sham Shui Po	41	33	28	26	26	30	39	49	54	53	50	51	50	53	56	59	63	66	68	64	58	53	50	47
Kwai Chung	45	36	31	28	28	32	42	55	62	62	59	58	59	61	68	71	75	77	77	70	61	57	54	51
Tsuen Wan	39	27	23	20	21	24	37	45	49	50	47	46	47	49	52	55	59	65	67	61	54	50	48	44
Tseung Kwan O	32	28	24	22	23	28	33	33	28	22	21	20	20	21	23	25	28	32	37	38	37	35	36	35
Yuen Long	42	36	32	29	30	33	41	46	44	40	37	37	37	40	41	45	51	56	59	59	56	53	50	46
Tuen Mun	42	37	33	29	29	33	40	48	48	47	45	44	43	43	47	50	55	63	67	64	59	54	52	47
Tung Chung	32	26	22	19	19	22	27	32	34	34	36	37	39	40	39	40	39	41	41	40	37	34	33	32
Tai Po	35	30	25	24	24	26	36	45	44	37	33	32	30	32	34	36	40	45	49	49	45	42	40	39
Sha Tin	36	31	27	25	24	26	34	40	39	34	30	28	26	27	29	31	36	42	46	48	47	44	43	40
Tap Mun	10	10	10	10	10	10	10	11	12	12	12	10	10	9	9	9	10	11	12	12	11	11	11	11
Causeway Bay	68	54	49	44	43	45	63	82	92	96	97	103	109	114	114	114	115	114	112	105	98	94	94	79
Central	62	52	47	43	42	44	55	74	91	93	93	93	92	93	99	103	103	108	112	101	88	80	75	71
Mong Kok	65	50	45	41	40	42	56	71	80	82	84	88	91	97	101	104	108	109	107	99	88	85	82	77

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	618	552	527	496	525	546	612	665	690	674	654	631	621	623	625	626	636	666	696	700	696	678	660	630
Tseung Kwan O	666	642	630	595	604	612	648	658	645	628	627	615	613	608	611	610	618	639	678	691	691	697	701	695
Yuen Long	602	591	582	554	549	557	601	631	614	578	567	553	545	547	542	551	564	588	617	651	659	657	642	626
Tuen Mun	766	747	739	721	751	767	769	829	799	784	778	761	759	754	754	757	764	783	809	818	820	814	803	782
Tung Chung	556	509	500	476	488	508	529	541	541	539	541	542	540	541	540	536	538	542	553	554	550	541	536	532
Tap Mun	460	454	447	453	453	457	472	479	478	477	474	472	468	465	463	461	458	462	458	457	455	455	453	453
Causeway Bay	849	830	817	783	738	729	756	821	864	910	917	890	899	901	896	899	897	921	944	967	974	952	879	831
Central	765	750	723	707	686	690	713	781	845	888	882	856	865	868	861	857	860	892	948	953	937	906	838	803
Mong Kok	810	816	787	737	743	725	721	763	803	814	813	801	803	831	839	839	854	878	927	923	895	856	828	826

Table C4 (Cont.): 2018 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	56	57	56	54	48	38	36	40	46	54	62	67	69	67	64	58	52	49	48	50	51	51
Eastern	59	61	63	63	62	58	48	40	42	48	55	63	71	74	74	74	72	68	64	62	58	57	58	58
Kwun Tong	51	55	56	56	56	51	41	36	38	43	49	55	61	63	62	60	58	53	49	49	50	50	48	48
Sham Shui Po	44	49	51	51	50	45	37	30	29	34	40	46	52	54	56	54	50	44	38	37	39	40	40	41
Kwai Chung	41	46	48	49	48	44	36	28	27	32	39	45	50	52	50	49	45	41	36	36	38	38	38	38
Tsuen Wan	43	49	51	51	50	45	34	30	32	36	43	50	56	60	60	60	54	47	39	37	37	38	37	38
Tseung Kwan O	55	55	56	55	53	49	45	48	54	63	71	78	85	88	89	89	86	82	72	65	62	59	56	54
Yuen Long	33	35	35	37	35	30	23	22	29	39	50	58	67	71	74	72	65	54	43	36	34	32	31	32
Tuen Mun	39	42	43	43	43	37	30	27	31	37	46	55	65	71	72	71	65	52	42	37	37	37	36	38
Tung Chung	38	43	45	44	43	37	32	30	34	40	46	52	59	66	71	72	68	60	49	44	42	42	41	39
Tai Po	42	42	43	42	40	37	29	26	33	45	56	65	73	77	78	77	72	63	53	49	47	44	43	41
Sha Tin	46	47	49	48	47	43	37	36	42	53	63	72	79	83	84	83	78	70	60	53	48	46	45	46
Tap Mun	62	58	55	55	53	52	51	53	58	65	74	84	92	97	101	101	98	93	86	79	73	67	65	63
Causeway Bay	23	29	31	33	34	32	22	14	12	12	15	16	18	18	19	19	19	19	18	18	18	18	17	21
Central	29	34	36	37	37	34	26	17	14	15	18	22	26	29	28	26	25	22	18	19	22	24	25	26
Mong Kok	28	35	37	40	39	37	27	19	17	19	23	26	29	30	29	29	25	23	21	21	23	23	23	24

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	32	32	31	31	30	30	30	30	32	34	36	36	35	35	36	38	37	37	36	36	36	36	34	32
Eastern	32	31	31	31	30	30	29	29	30	31	31	32	33	33	33	35	37	37	37	37	35	34	33	33
Kwun Tong	36	34	34	33	32	32	33	34	36	39	41	42	42	40	42	44	43	43	42	41	41	39	38	37
Sham Shui Po	31	30	29	28	27	27	27	28	29	31	33	34	34	33	34	37	39	38	37	36	36	35	34	32
Kwai Chung	28	27	27	27	27	27	29	30	31	33	34	34	33	34	37	38	39	38	37	36	35	33	31	29
Tsuen Wan	27	27	26	25	25	25	25	26	27	29	32	33	33	33	36	37	37	36	35	34	34	31	30	28
Tseung Kwan O	28	27	27	26	26	25	25	25	26	26	27	28	28	28	29	31	32	33	33	32	31	30	29	28
Yuen Long	35	33	33	32	31	31	31	32	35	37	39	40	39	39	40	40	41	41	41	40	40	38	37	36
Tuen Mun	39	39	37	37	36	36	36	37	39	41	43	43	44	44	45	47	47	48	47	46	46	45	42	41
Tung Chung	28	28	26	26	26	26	26	27	29	31	33	35	36	36	39	39	38	37	34	32	31	30	29	29
Tai Po	31	30	29	29	28	28	28	30	31	31	31	31	31	31	31	32	32	32	33	34	34	33	32	31
Sha Tin	32	31	30	30	29	29	29	30	31	31	32	33	32	32	32	34	34	35	35	35	35	34	33	33
Tap Mun	29	28	28	28	28	28	30	31	30	32	32	33	33	33	33	34	34	35	34	33	32	31	30	29
Causeway Bay	42	37	32	31	31	30	33	39	43	48	50	50	49	52	55	55	54	55	55	57	57	53	49	46
Central	32	30	29	28	27	26	28	29	33	35	36	36	35	36	37	38	39	38	37	37	37	36	34	32
Mong Kok	34	31	29	29	28	28	29	31	33	35	37	38	38	39	40	41	41	41	41	42	43	41	37	35

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	20	20	20	19	19	19	19	19	20	21	22	22	22	22	23	23	23	23	22	23	23	23	22	21
Eastern	19	18	18	18	17	17	17	18	18	18	18	18	18	19	19	20	21	21	21	21	20	20	20	19
Kwun Tong	21	20	20	20	20	19	19	20	21	22	23	23	22	22	23	23	24	24	24	24	25	24	23	22
Sham Shui Po	21	21	20	19	19	18	18	19	20	21	22	22	22	21	21	22	23	23	23	23	24	24	23	22
Kwai Chung	18	17	17	17	18	18	19	20	21	22	22	21	20	21	22	22	22	23	23	23	22	21	19	18
Tsuen Wan	18	18	17	17	17	17	17	18	19	19	20	21	21	22	23	23	24	23	23	23	24	22	20	19
Tseung Kwan O	15	15	15	15	14	14	14	15	15	15	15	15	15	15	15	16	17	17	17	17	17	16	16	16
Yuen Long	20	19	19	19	18	18	19	19	20	20	20	20	20	20	21	22	22	23	23	23	23	22	21	20
Tuen Mun	24	24	24	23	23	23	23	24	25	25	25	25	25	26	27	27	28	28	28	28	29	28	27	26
Tung Chung	16	16	15	14	14	15	15	16	16	17	18	18	19	20	21	22	21	20	19	19	19	18	17	17
Tai Po	20	19	19	18	18	18	18	19	20	20	20	19	19	19	20	20	20	20	21	21	21	21	20	20
Sha Tin	19	18	18	18	18	18	18	18	19	19	20	20	19	19	19	20	20	20	20	20	21	21	20	19
Tap Mun	16	16	16	16	16	17	18	18	18	18	18	18	18	18	18	19	19	19	18	18	18	17	17	16
Causeway Bay	27	24	21	20	20	20	21	25	28	30	31	30	31	34	36	35	34	35	36	39	40	37	34	31
Central	20	19	18	18	17	17	18	19	20	22	22	22	22	23	23	24	24	23	23	24	24	23	21	20
Mong Kok	23	21	20	19	19	19	20	21	23	24	24	25	25	26	27	27	27	27	27	29	31	29	25	24

Note:

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

Table C5: 2018 Total Wet and Dry Deposition

(a) Wet Deposition

	Monitoring Station	Central/Western	Kwun Tong	Yuen Long
	Wet Deposition (tonne/ha)	24386	24014	21868
	Weighted Mean pH (based on volume-weighted mean hydrogen ion concentrations ($[H^+]$)	4.83	4.82	4.86
	Weighted Mean pH (based on volume-weighted mean pH)	5.02	5.11	5.12
	Number of Samples	98	106	97
Filtrate (Kg/Ha)	**NH_4^+**	4.71	6.45	5.64
	NO_3^-	28.30	29.95	24.99
	SO_4^{2-}	35.80	41.89	18.95
	Cl^-	75.93	94.79	24.76
	F^-	0.62	0.61	0.55
	Na^+	66.72	92.75	20.14
	K^+	6.08	6.07	5.45
	Formate	4.40	4.59	4.56
	Acetate	4.11	4.14	3.97
	Ca^{2+}	5.87	7.25	4.60
	Mg^{2+}	6.66	9.78	1.86

** 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	27	27	27
Filtrate (Kg/Ha)	**NH_4^+**	0.23	0.46	0.15
	NO_3^-	9.55	11.40	7.87
	SO_4^{2-}	5.75	6.12	3.91
	Cl^-	9.97	11.78	4.41
	F^-	0.042	0.043	0.044
	Na^+	6.75	7.66	2.98
	K^+	0.57	0.56	0.43
	Formate	0.18	0.17	0.29
	Acetate	0.17	0.17	0.17
	Ca^{2+}	5.31	5.79	5.68
	Mg^{2+}	0.88	1.00	0.46

Table C6: 2018 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	13	12
Organic Substances			
Benzene [2] [4]	$\mu g/m^3$	-	1.69
Benzo[a]pyrene	ng/m^3	0.02	0.05
1,3-Butadiene [4]	$\mu g/m^3$	0.10	0.17
Formaldehyde [4]	$\mu g/m^3$	3.70	2.25
Perchloroethylene [4]	$\mu g/m^3$	0.75	0.79
Dioxins [5]	$pgI\text{-}TEQ/m^3$	0.030	0.023

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. In 2018, the benzene measurement at Kwai Chung Station was influenced by the construction and renovation works of the adjacent Kwai Tsui Estate. Hence, the benzene measurement results are not reported in 2018.

[3] For lead, the reported figures are the respective 2018 annual average concentrations in the elemental analysis of respirable suspended particulates.

[4] In early January 2018, the formaldehyde and the VOC (including benzene, 1,3-Butadiene and Perchloroethylene) measurements at Central/Western Station were influenced by the construction and re-roofing work at Sai Ying Pun Community Complex. Hence, the affected measurement results during the period 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).