AIR QUALITY
IN HONG KONG 2015

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) (2015)

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Summary

This report summarises the 2015 air quality monitoring data collected by the Environmental Protection Department's monitoring network comprising 12 general stations and 3 roadside stations.

As a result of the wide range of vehicle emission control measures implemented by the Government since 2000, concentrations of respirable suspended particulates (RSP), fine suspended particulates (FSP) and sulphur dioxide (SO_2) at roadside have been reduced substantially over the past decade. Although roadside nitrogen dioxide (NO_2) concentrations remained high in the period, it has dropped from its peak in 2011. Additional control measures are being introduced to reduce its concentration.

With the joint efforts of the Hong Kong Special Administrative Region Government and the Guangdong Provincial Government in cutting emissions in the Pearl River Delta (PRD) Region, the ambient levels of NO_2, SO_2, RSP and FSP have also been reduced in recent years. However, concentrations of ozone, a major constituent of photochemical smog, were on a slow rising trend over the past years. The two governments will continue to implement measures to alleviate photochemical smog and ozone problem in the PRD Region.

As in previous years, concentrations of carbon monoxide and lead in 2015 remained at levels well below their respective Air Quality Objectives limits.

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1. Introduction

The Environmental Protection Department (EPD) operates a network of 15 air quality monitoring stations for measuring concentrations of major air pollutants. It consists of twelve general stations for monitoring ambient air quality and three roadside stations for measuring street level air quality in 2015. 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.

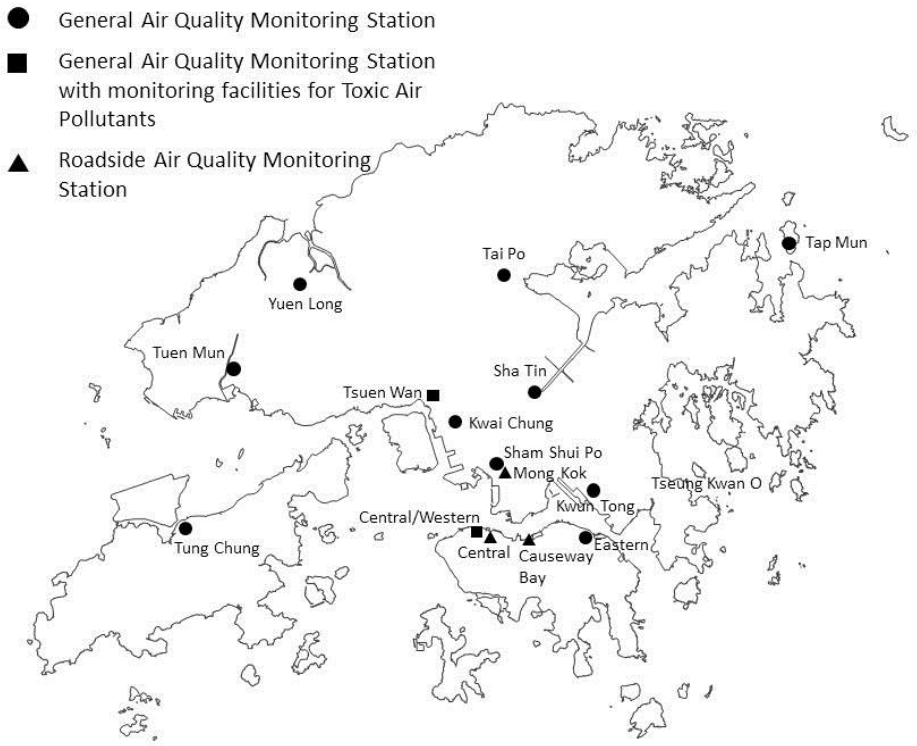


Figure 1: Location of EPD's Air Quality Monitoring Stations (2015)

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 at 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

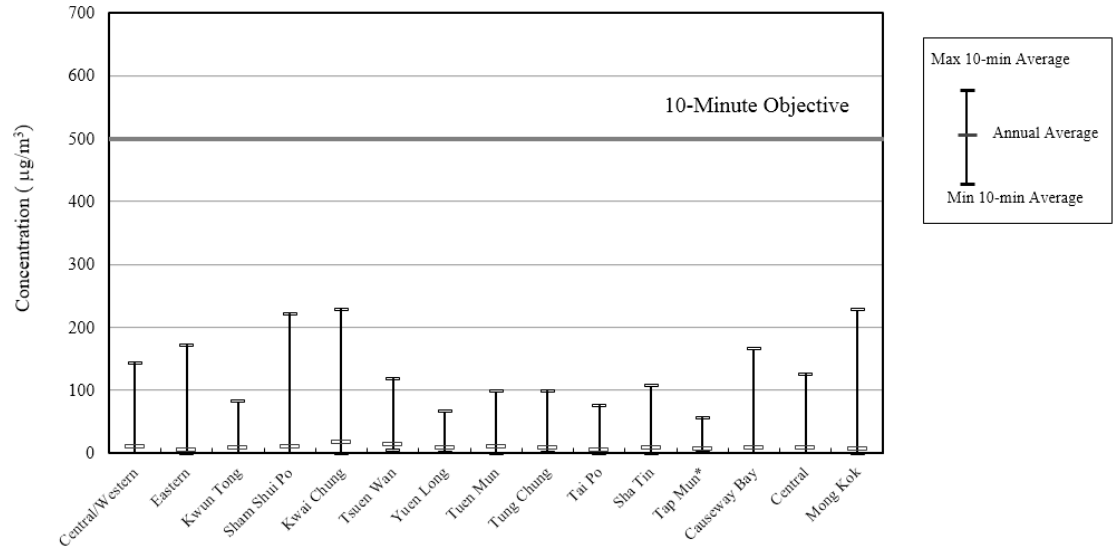
2. Gaseous Pollutants

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 source of SO_2, followed by fuel combustion equipment and motor vehicles.

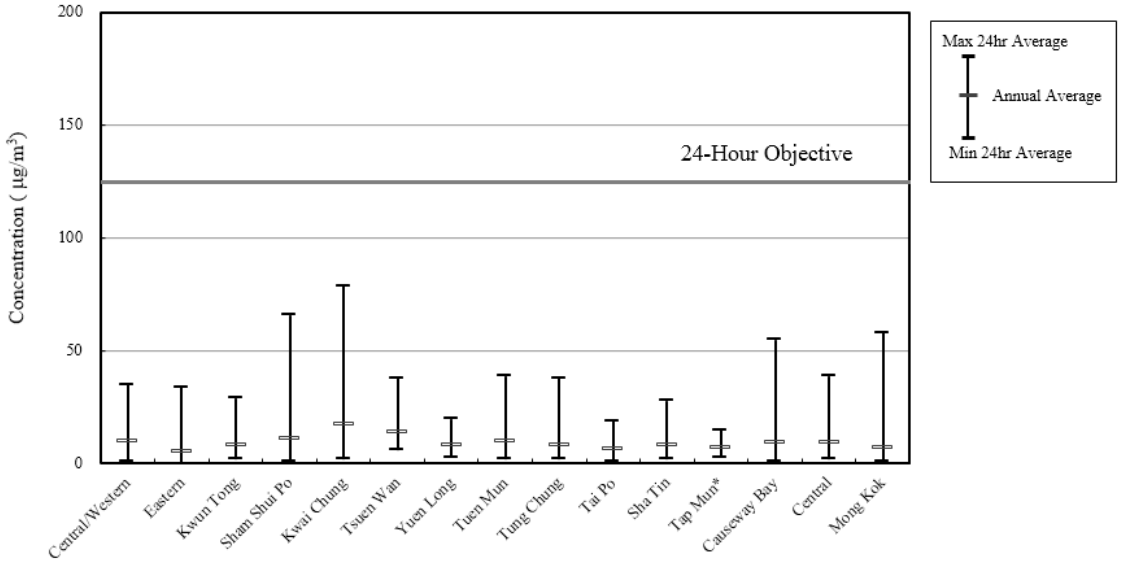
Exposure to high levels of SO_2 may cause impairment of respiratory function and aggravate existing respiratory and cardiac illnesses. Prolonged exposure at lower levels may also increase the risk of developing chronic respiratory diseases.

Figure 2a: Sulphur Dioxide Monitoring 2015
(10-Minute Average Statistics)



Note: *Tap Mun general station had insufficient data in 2015.

Figure 2b: Sulphur Dioxide Monitoring 2015
(24-Hour Average Statistics)



Note: *Tap Mun general station had insufficient data in 2015.

Sulphur dioxide was continuously measured at all the 15 monitoring stations during 2015. As in previous years, SO_2 concentrations remained low throughout the territory. All

monitoring stations[1] complied with the relevant Hong Kong Air Quality Objectives[2] (AQOs) for SO_2. The highest 10-minute average (229 μg/m^3) and 24-hour average (79 μg/m^3) were both measured at Kwai Chung general station and well below the respective AQO limits.

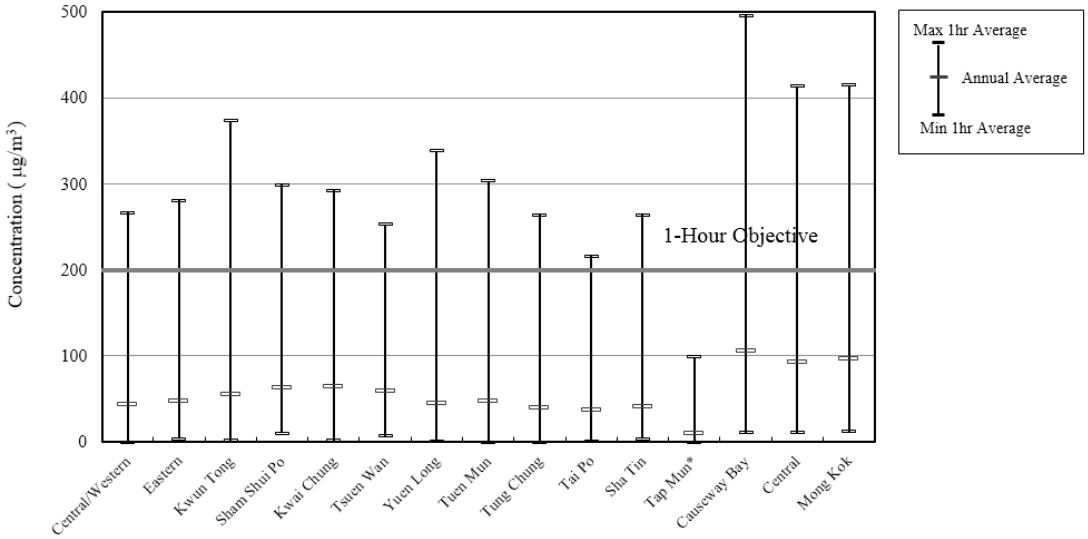
2.2 Nitrogen Oxides (NOx) and Nitrogen Dioxide (NO_2)

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 continuously measured at all the 15 monitoring stations during 2015. In 2015, the highest 1-hour average (496 μg/m^3) and the highest annual average (106 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 for eighteen occasions, all general stations[1], except Kwun Tong, Sham Sui Po and Kwai Chung, were in compliance with the respective AQO in the year. For the annual AQO, only Tung Chung and Tai Po were in compliance[1]. Non-compliance with the 1-hour and annual AQOs for NO_2 were recorded at all the three roadside stations.

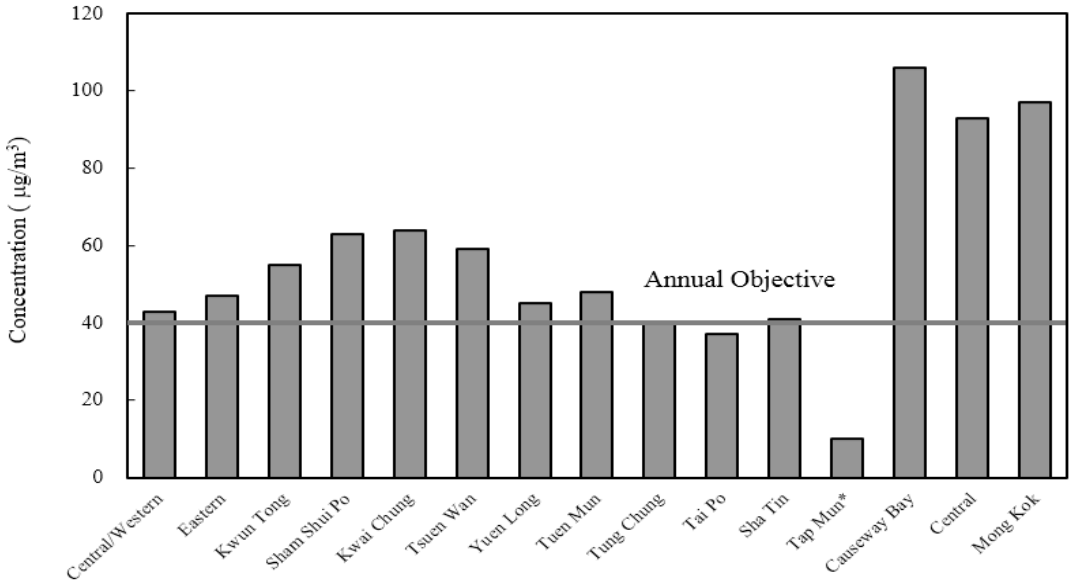
Figure 3a: Nitrogen Dioxide Monitoring 2015
(1-Hour Average Statistics)



Note: *Tap Mun general station had insufficient data in 2015.

[1] Excluding Tap Mun general station which had insufficient data in 2015.
[2] Details of the Hong Kong Air Quality Objectives can be found in Appendix A.

Figure 3b: Nitrogen Dioxide Monitoring 2015
(Annual Average)



Note: *Tap Mun general station had insufficient data in 2015.

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.

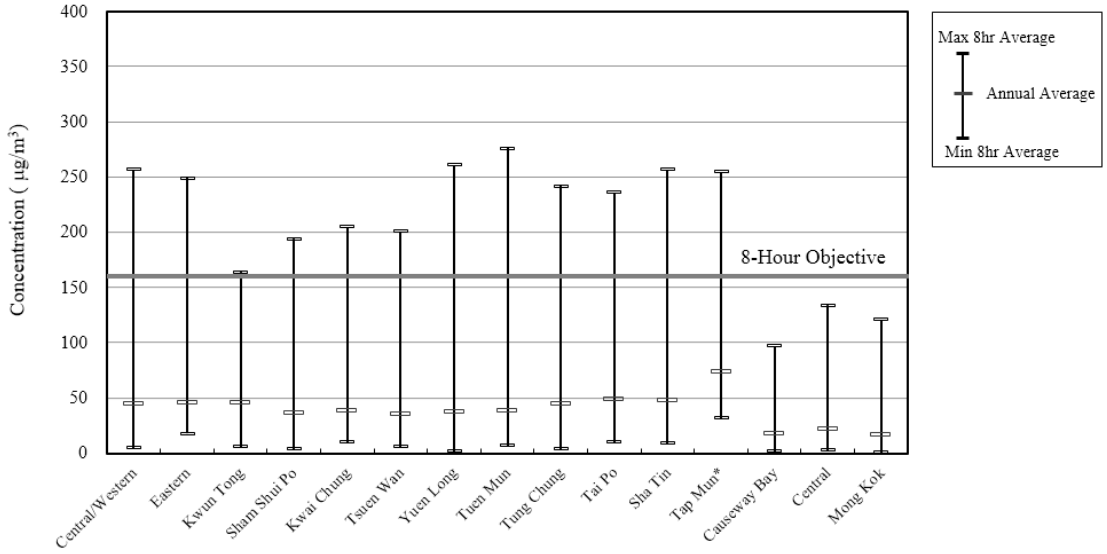
Ozone was monitored at all of the general and roadside stations in 2015. Among the 12 general stations, six of them (namely Central/Western, Yuen Long, Tuen Mun, Tung Chung, Sha Tin and Tap Mun[1]) recorded non-compliance with the 8-hour AQO in 2015 (i.e., the 8-hour AQO limit was exceeded more than nine times in the year). The highest 8-hour average (276 μg/m^3) was recorded at the 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, elevated O_3 incidents are mostly associated with very hot, fine and calm weather conditions in the region, which favour the formation via photochemical reactions and accumulation of ozone. Such weather conditions mostly occur in summer and autumn, especially when Hong Kong and the Pearl River Delta Region is under the influence of subsiding air induced by a tropical cyclone located in the Western Pacific Ocean near Taiwan.

[1]Tap Mun general station exceeded 8-hour AQO limit for 24 times with only 11 month data in 2015.

Figure 4a: Ozone Monitoring 2015
(Daily Maximum 8-Hour Average Statistics)



Note: *Tap Mun general station had insufficient data in 2015.

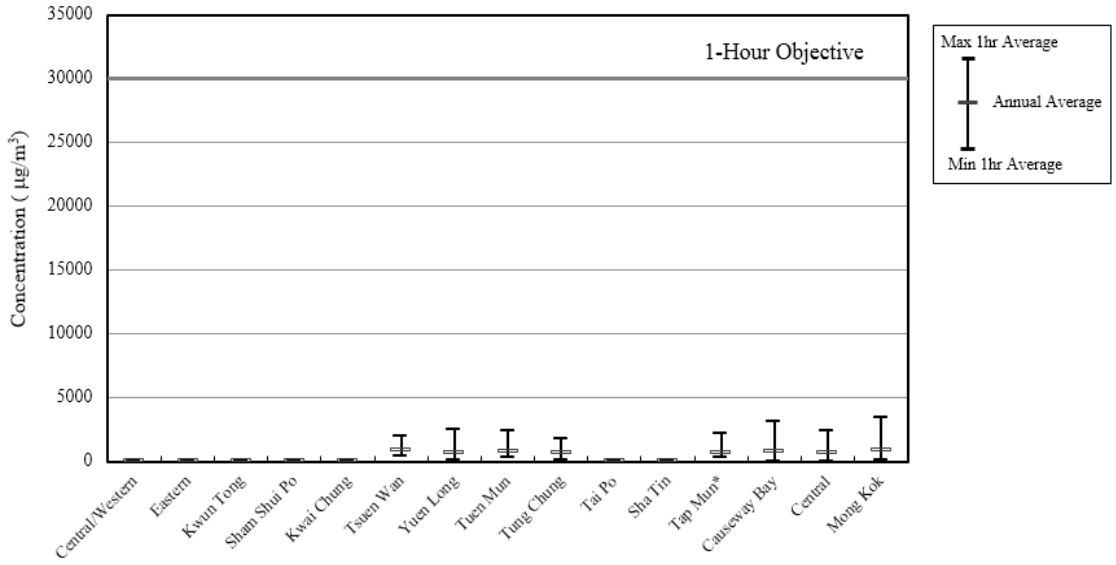
2.4 Carbon Monoxide (CO)

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

Carbon monoxide was continuously monitored at eight stations including five general stations and three roadside stations during 2015. Similar to previous years, both the ambient and roadside CO concentrations remained very low throughout the year. All the monitoring stations[1] complied with the 1-hour and 8-hour AQOs for CO. In 2015, the highest 1-hour average (3,410 μg/m^3) and the highest 8-hour average (2,303 μg/m^3) were both recorded at Mong Kok roadside station and well below the respective AQO limits.

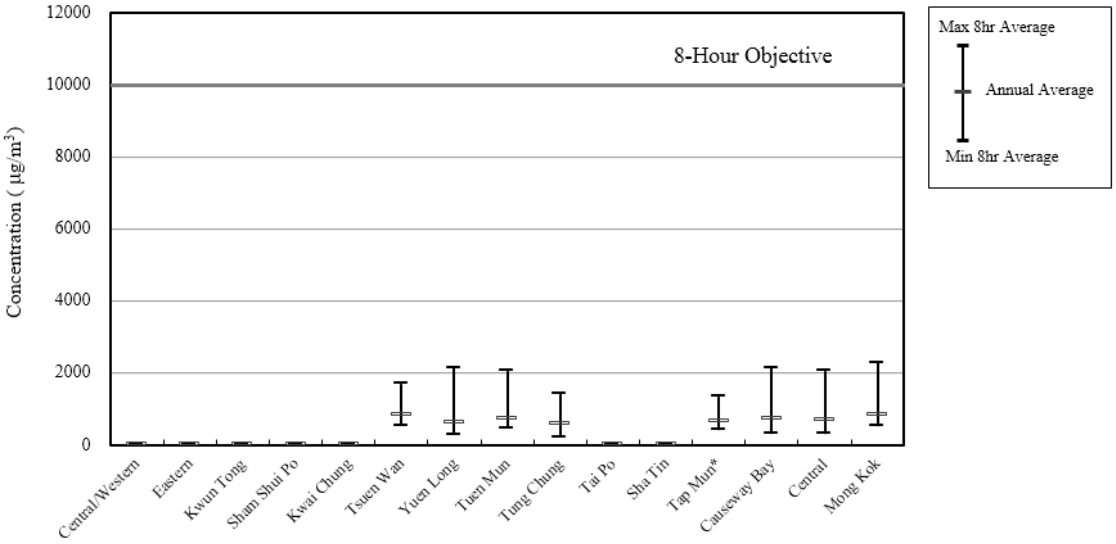
[1] Excluding Tap Mun general station which had insufficient data in 2015.

Figure 5a: Carbon Monoxide Monitoring 2015
(1-Hour Average Statistics)



Notes:
CO was only monitored at Tsuen Wan, Yuen Long, Tuen Mun, Tung Chung and Tap Mun general stations and Causeway Bay, Central and Mong Kok roadside stations.
* Tap Mun general station had insufficient data in 2015.

Figure 5b: Carbon Monoxide Monitoring 2015
(8-Hour Average Statistics)



Notes:
CO was only monitored at Tsuen Wan, Yuen Long, Tuen Mun, Tung Chung and Tap Mun general stations and Causeway Bay, Central and Mong Kok roadside stations.
*Tap Mun general station had insufficient data in 2015.

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. In Hong Kong, the ambient particulate matters including RSP and FSP are contributed mainly by the regional sources. Combustion sources, in particular marine vessels, diesel vehicles and power plants, are the major regional and local sources of RSP and FSP. Besides, RSP and FSP can also be formed by photochemical reactions of nitrogen oxides and volatile organic

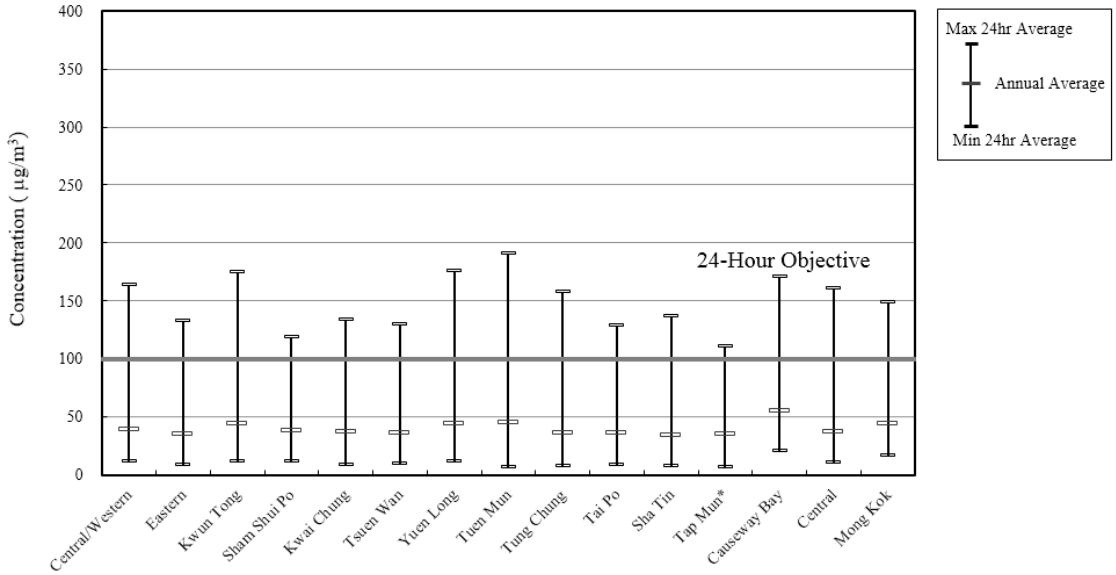
compounds and atmospheric oxidation of gaseous pollutants such as sulphur dioxide and nitrogen oxides. Although to a lesser extent, crustal derived dust and marine aerosols are also sources of RSP.

RSP at high levels may cause chronic and acute effects on human health, particularly the pulmonary function, as they can penetrate deep into the lungs and cause respiratory problems. These effects are enhanced if high RSP levels are associated with higher levels of other pollutants, such as SO_2.

RSP was continuously measured at all 15 monitoring stations during 2015. Eight of these stations were also equipped with high-volume sampler to collect particulate samples for chemical analysis.

In 2015, 9 general stations complied with the 24-hour AQO for RSP (100 μg/m^3 with allowance of nine exceedances per year) out of the 11 general stations[1]. Two general stations (namely Yuen Long and Tuen Mun) exceeded the 24-hour AQO for RSP with the highest 24-hour average (191 μg/m^3) recorded at the Tuen Mun station. Only one roadside station (namely Causeway Bay) out of the 3 roadside stations, exceeded the 24-hour AQO for RSP with the highest 24-average recorded at 171 μg/m^3. As regards the annual AQO for RSP (50 μg/m^3), non-compliance was only observed at Causeway Bay roadside station[1] with the highest annual average (55 μg/m^3) in the year.

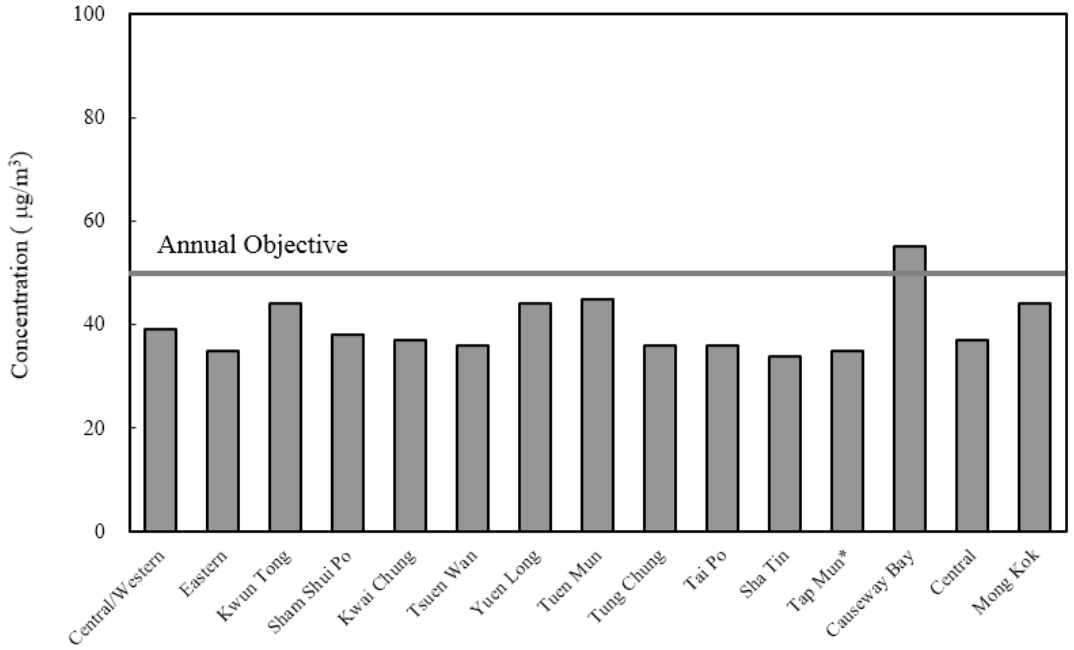
Figure 6a: RSP Monitoring 2015
(24-Hour Average Statistics)



Note: *Tap Mun general station had insufficient data in 2015.

[1] Excluding Tap Mun general station which had insufficient data in 2015.

Figure 6b: RSP Monitoring 2015
(Annual Average)



Note: *Tap Mun general station had insufficient data in 2015.

3.2 Fine Suspended Particulates (FSP)

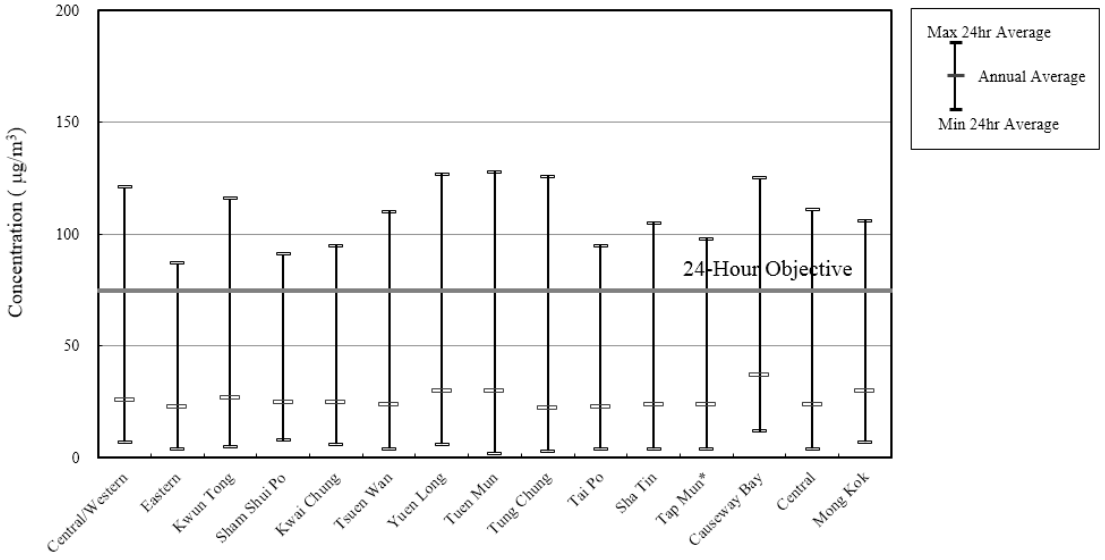
Fine suspended particulates (FSP or $PM_{2.5}$) refer to those suspended particulates with nominal aerodynamic diameters of 2.5 micrometres or less, which is the finer component of RSP. FSP is able to penetrate to the deepest parts of the lung because of its small size, hence poses a higher risk to health.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

In 2015, 9 general stations complied with the 24-hour AQO for FSP (75 μg/m^3 with allowance of nine exceedances per year) out of the 11 general stations[1]. Two general stations (namely Yuen Long and Tuen Mun) exceeded the 24-hour AQO limit for FSP by 11 times at each station. The highest 24-hour average FSP of 128 μg/m^3 was recorded at Tuen Mun general station. Two roadside stations complied with the 24-hour AQO for FSP. Non-compliance was only observed at the Causeway Bay roadside station with the highest 24-hour average (125 μg/m^3) recorded and exceeded the 24-hour AQO limit for FSP by 10 times.

For the annual AQO for FSP (35 μg/m^3), non-compliance was only observed at Causeway Bay roadside station[1] with the highest annual average (37 μg/m^3) in the year.

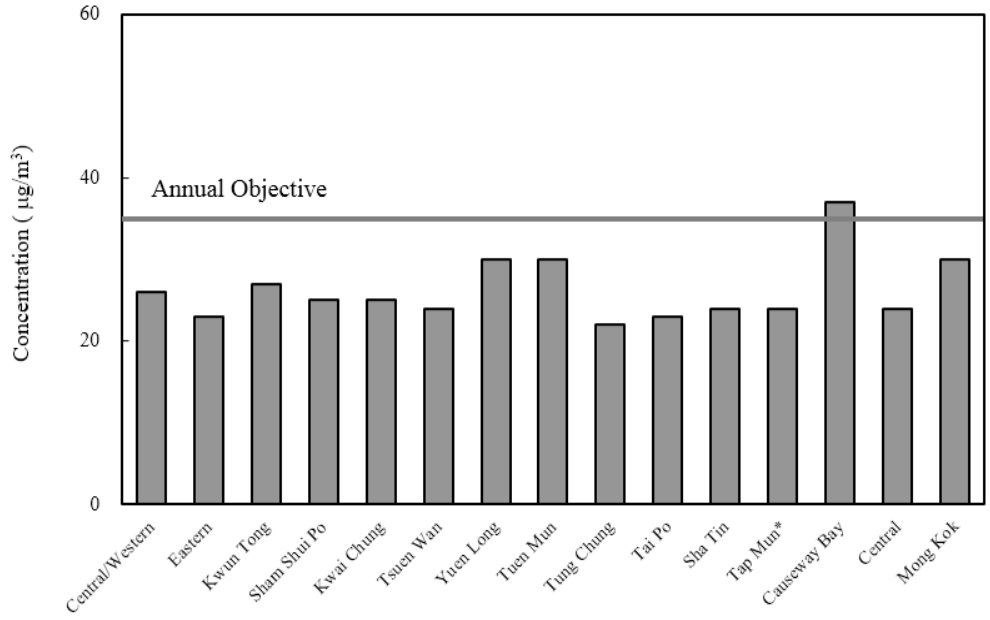
[1] Excluding Tap Mun general station which had insufficient data in 2015.

Figure 7a: FSP Monitoring 2015
(24-Hour Average Statistics)



Note: *Tap Mun general station had insufficient data in 2015.

Figure 7b: FSP Monitoring 2015
(Annual Average)



Note: *Tap Mun general station had insufficient data in 2015.

3.3 Lead (Pb)

Lead is the only one criteria pollutant included in the AQO that is also a toxic air pollutant. In Hong Kong, the sale and supply of leaded petrol, which is a known major source of lead, was banned from 1 April 1999. As in previous years, the ambient lead concentrations continued to linger at very low levels during 2015. The overall annual averages, ranging from 22 ng/m^3 (at Central/Western, Kwun Tong, Shum Shui Po, Kwai Chung and Mong Kok) to 29 ng/m^3 (at Yuen Long), 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 1997. Among the various TAPs monitored in 2015, 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. The monitoring data collected so far indicate that the levels of toxic air pollutants in Hong Kong are comparable to those observed in other major cities.

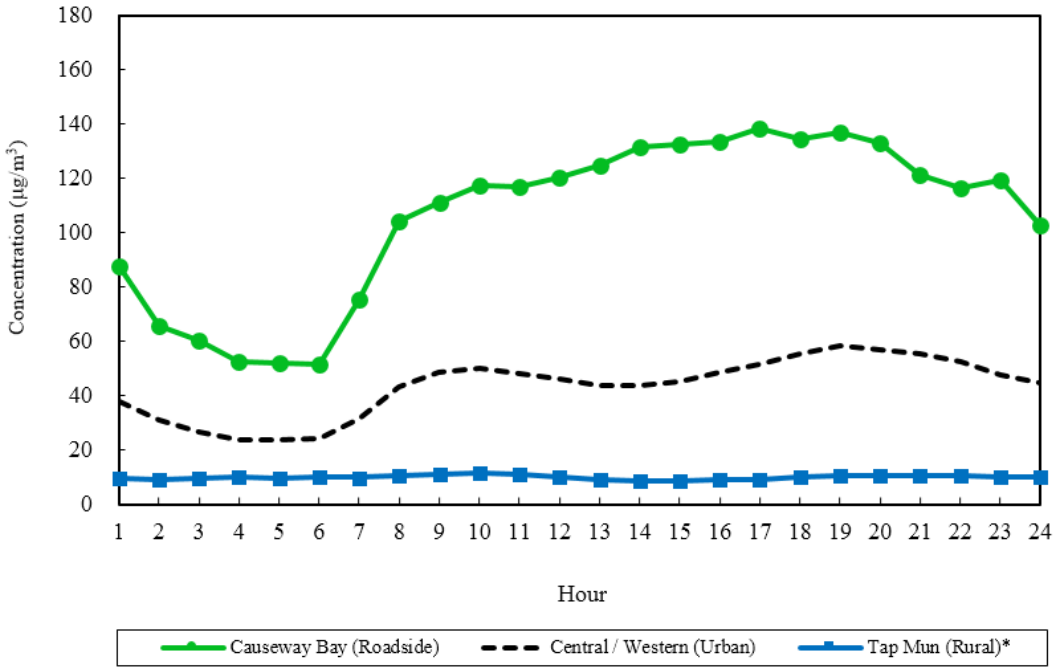
5. Variation of Air Pollution Levels over Time

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

5.1 Over a Day

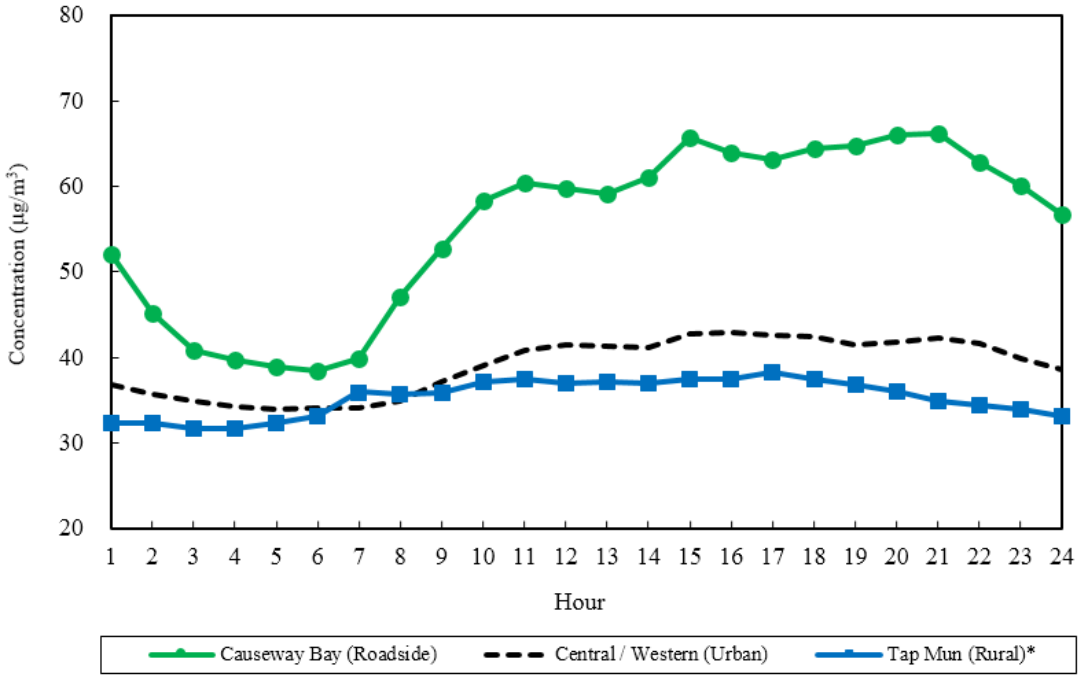
The concentrations of most air pollutants generally follow the diurnal pattern of human activities and traffic. For instance, higher levels of NO_2, RSP and FSP are usually observed in the morning and the evening rush hours when there are more traffic and human activities. Likewise, the lowest concentrations 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: 2015 Diurnal variations of NO_2



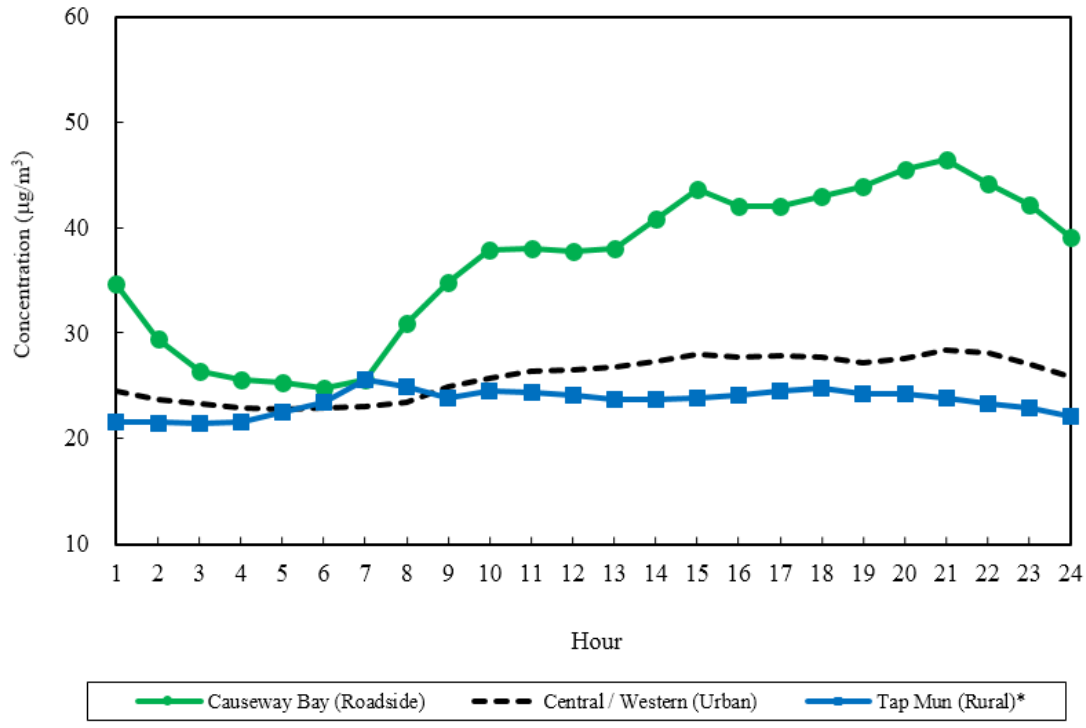
Note: *Tap Mun general station had insufficient data in 2015.

Figure 9: 2015 Diurnal variations of RSP



Note: *Tap Mun general station had insufficient data in 2015.

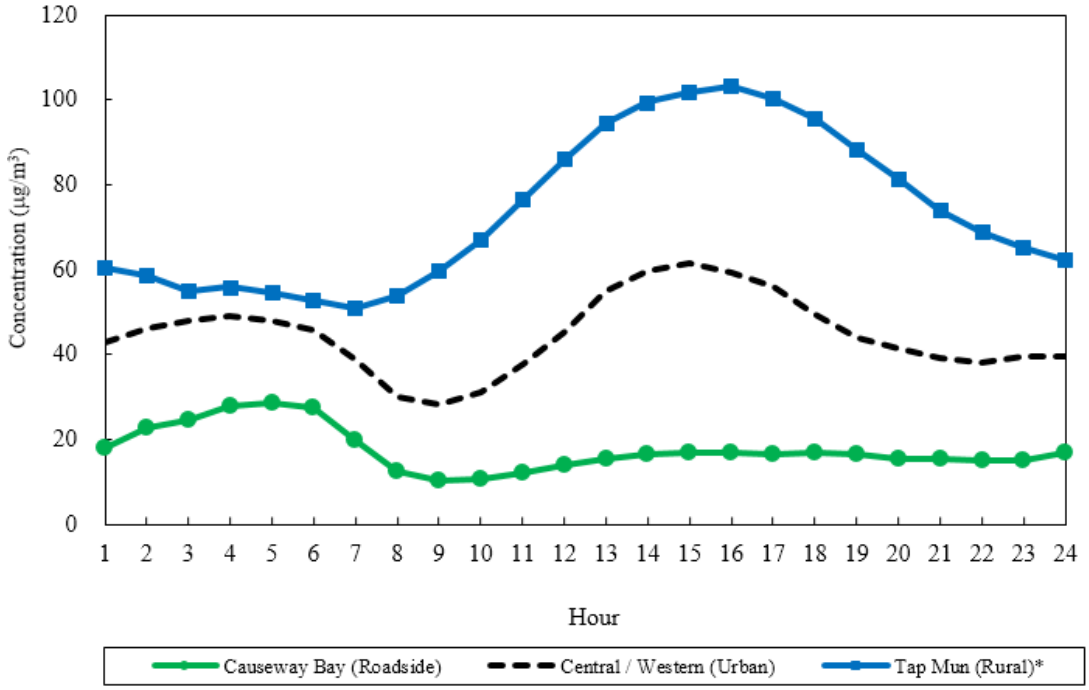
Figure 10: 2015 Diurnal variations of FSP



Note: *Tap Mun general station had insufficient data in 2015.

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: 2015 Diurnal variations of O_3

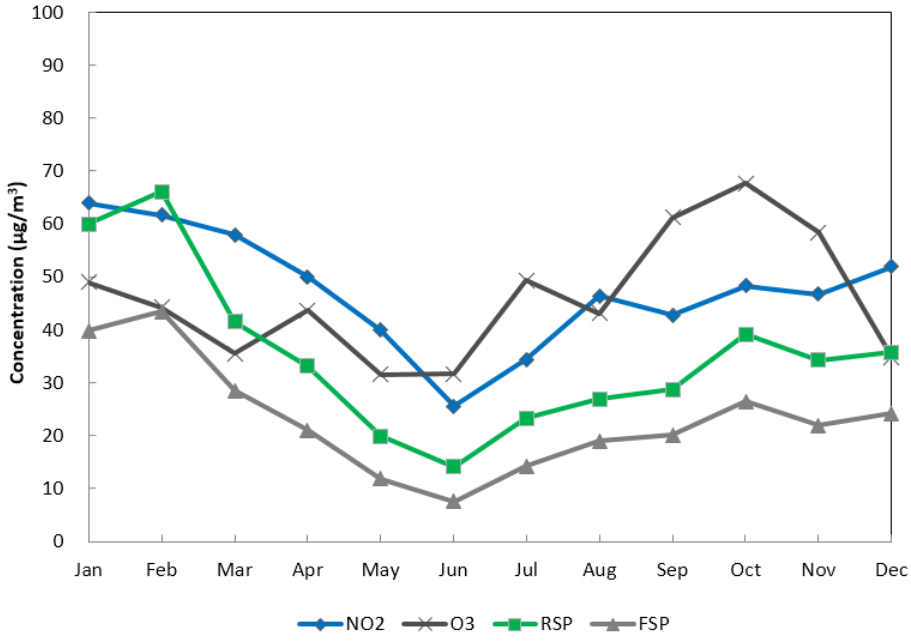


Note: *Tap Mun general station had insufficient data in 2015.

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.

Figure 12: Monthly variations of NO_2, O_3, RSP and FSP at Eastern in 2015



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, Kwai Chung, Kwun Tong, Sham Shui Po and Tsuen Wan
New Town	Mainly residential areas	Sha Tin, Tai Po, Tung Chung, Yuen Long and Tuen Mun
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 2014, the annual average SO_2, O_3, RSP and FSP concentrations recorded at general stations decreased by 9% to 14% while NO_2 remained the same and CO increased by 7% in 2015. Nevertheless, CO concentrations remained at levels well below AQO limits.

As for roadside stations, the annual average concentrations of all major air pollutants including NO_2, SO_2, O_3, RSP, FSP and CO decreased by 3% to 12% in the same period.

5.3.1 Sulphur Dioxide (SO_2)

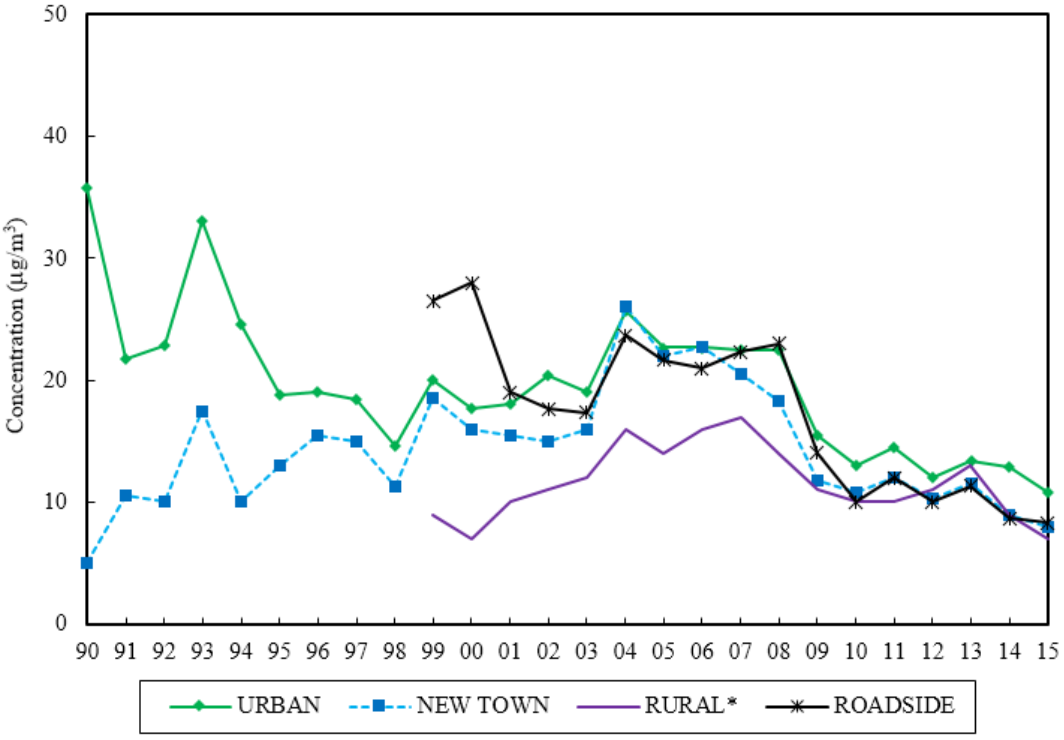
Since the implementation of the Air Pollution Control (Fuel Restriction) Regulations in 1990 for restricting sulphur content of industrial fuels, the Air Pollution Control (Motor Vehicle Fuel) Regulations in 1995 for controlling motor vehicle fuel quality, introduction of ultra-low sulphur diesel for 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 AQO limit.

Significant improvement was noted in the past few years due to measures taken by Governments in Guangdong Province and Hong Kong, such as retrofitting power plants with flue gas desulphurization devices, phasing out highly polluting industrial plants in the Pearl River Delta, introducing fuels with lower sulphur content, etc.

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

As a result of the introduction of various fuel control measures, both the ambient and roadside SO_2 concentrations in 2015 remained low at 10 μg/m^3 and 8 μg/m^3 respectively.

Figure 13: SO_2 long term trend



Note: *Tap Mun general station, for Rural areas, had insufficient data in 2015.

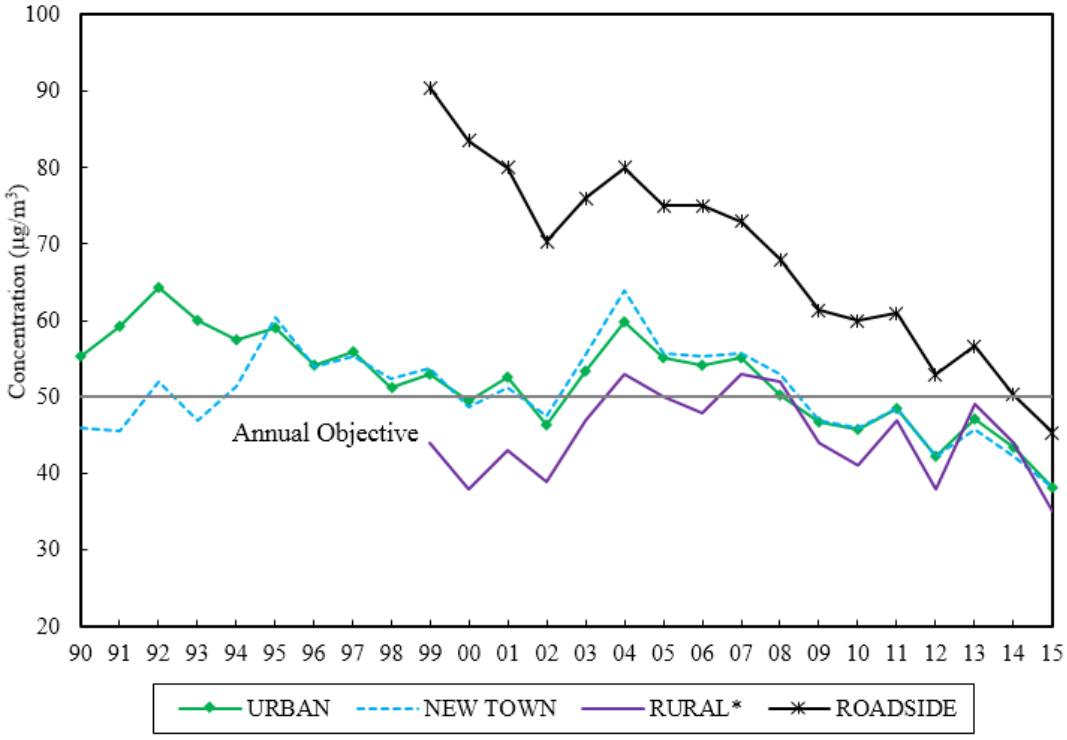
5.3.2 Respirable Suspended Particulates (RSP)

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 RSP concentrations then 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.

In Hong Kong, high level of roadside RSP, caused mainly by the exhaust emissions of diesel vehicles, has long been a major air pollution concern. As a result of the implementation of various vehicle emission control measures in recent years, the annual average of RSP concentration at roadside in 2015 had been reduced by 51% when compared with the 1999[1] value and for the first time dropped to below the annual AQO limit.

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

Figure 14: RSP long term trend



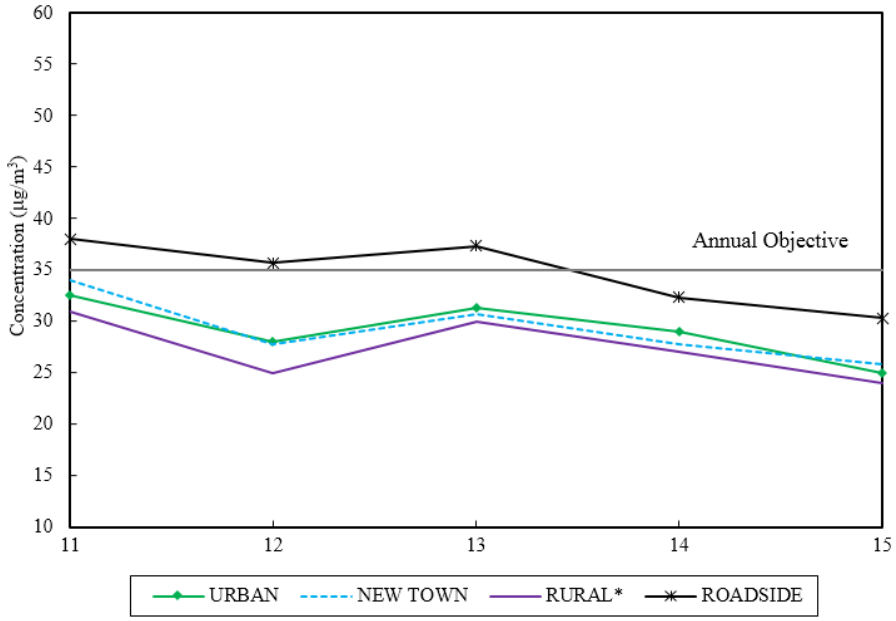
Note: *Tap Mun general station, for Rural areas, had insufficient data in 2015.

5.3.3 Fine Suspended Particulates (FSP)

We started to monitor FSP at our monitoring stations in 2011. The ambient concentrations of FSP in the territory showed an overall downward trend between 2011 and 2015, reflecting a reduction in regional background FSP levels in the past few years.

In Hong Kong, same as RSP, roadside FSP is also a major air pollution concern. As a result of the implementation of various vehicle emission control measures in recent years, the annual average of FSP concentration at roadside in 2015 had dropped to a level below the annual AQO limit and reduced by about 21% when compared with the 2011 value.

Figure 15: FSP long term trend



Note: *Tap Mun general station, for Rural areas, had insufficient data in 2015.

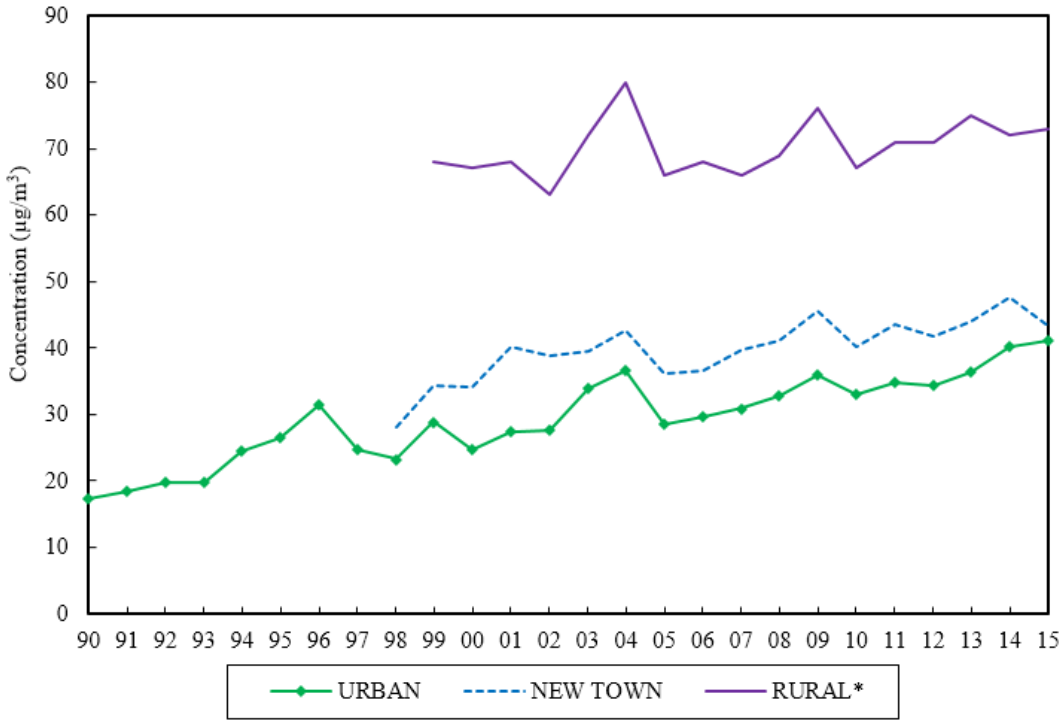
5.3.4 Ozone (O_3)

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

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

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

Figure 16: O_3 long term trend

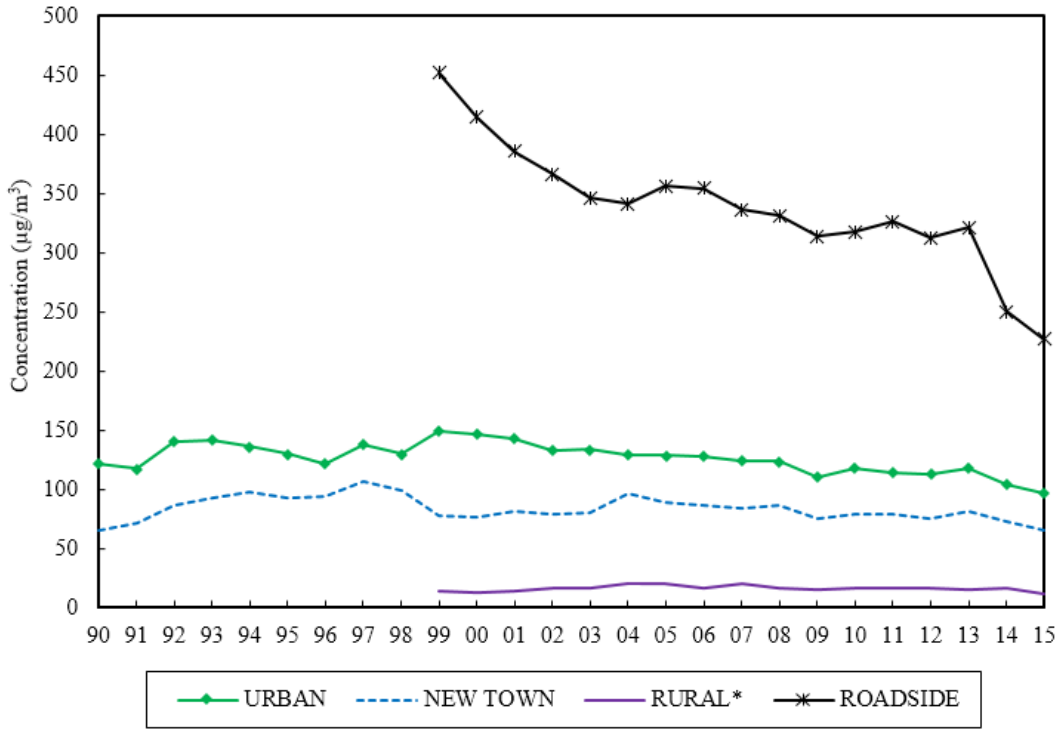


Note: *Tap Mun general station, for Rural areas, had insufficient data in 2015.

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 2015. During the same period, the roadside NOx concentration showed a more distinct decreasing trend, reflecting a reduction in vehicular NOx emission as a result of vehicle emission control measures implemented over the past decade. The roadside NOx concentration in 2015 was 50% lower than that in 1999[1].

Figure 17: NOx long term trend

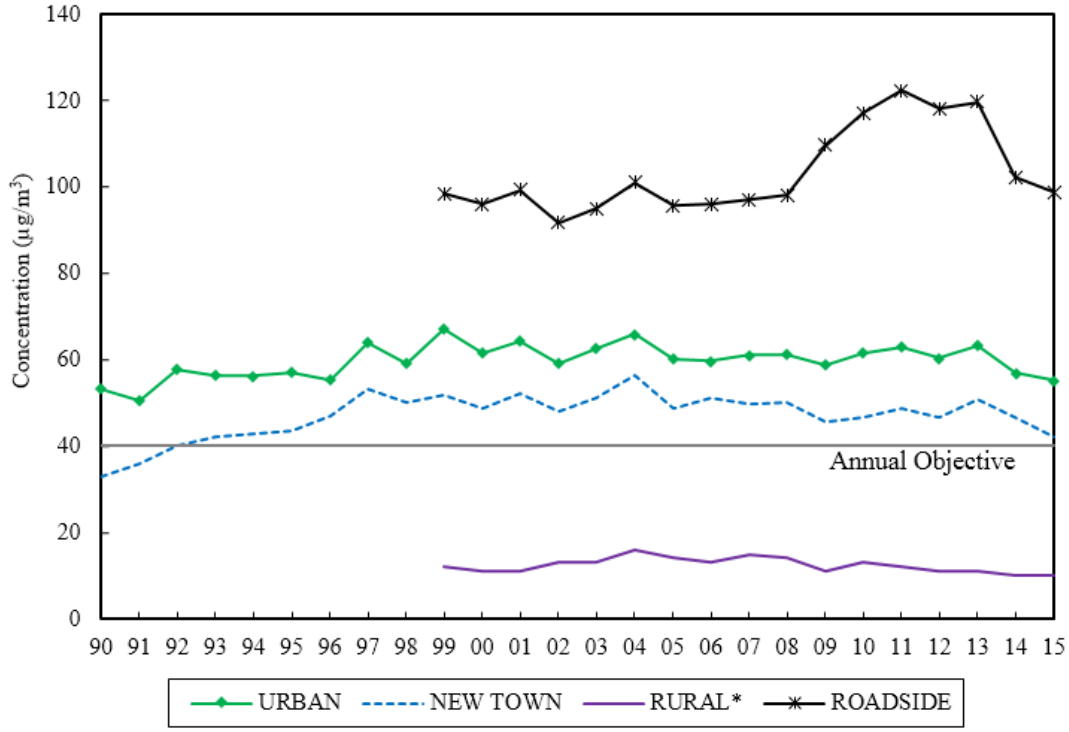


Note: *Tap Mun general station, for Rural areas, had insufficient data in 2015.

NO_2 is mainly formed from the oxidation of nitric oxide, a major component of NOx. The oxidation can be promoted by the presence of more ozone and VOCs in the ambient air. The ambient NO_2 levels have exhibited slow rising trends since 1990 but the trends have levelled off in recent years. The increasing trend of roadside NO_2 concentrations over the past years, which could be caused by a combination of the ageing of motor vehicles, increase in direct NO_2 emissions from motor vehicles and rise in regional background ozone concentration promoting the conversion of nitric oxide emitted from motor vehicles to NO_2, was, by and large, stabilised and started to drop from its peak in 2011. The annual NO_2 concentration at roadside recorded in 2015 remained at 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, testing the feasibility of installing after-treatment devices to franchised buses to reduce their NOx emissions, stepping up the control on emissions from petrol and liquefied petroleum gas vehicles and providing incentives to accelerate the phasing out of old and polluting diesel commercial vehicles.

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

Figure 18: NO_2 long term trend

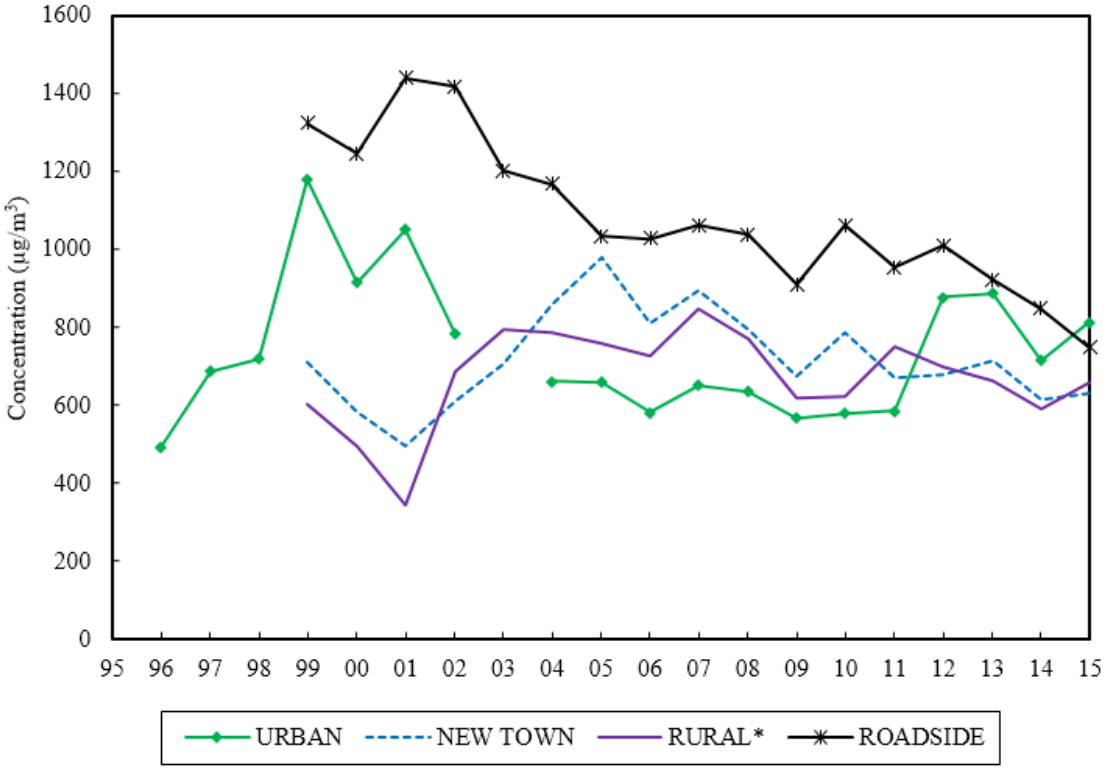


Note: *Tap Mun general station, for Rural areas, had insufficient data in 2015.

5.3.6 Carbon Monoxide (CO)

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

Figure 19: CO long term trend

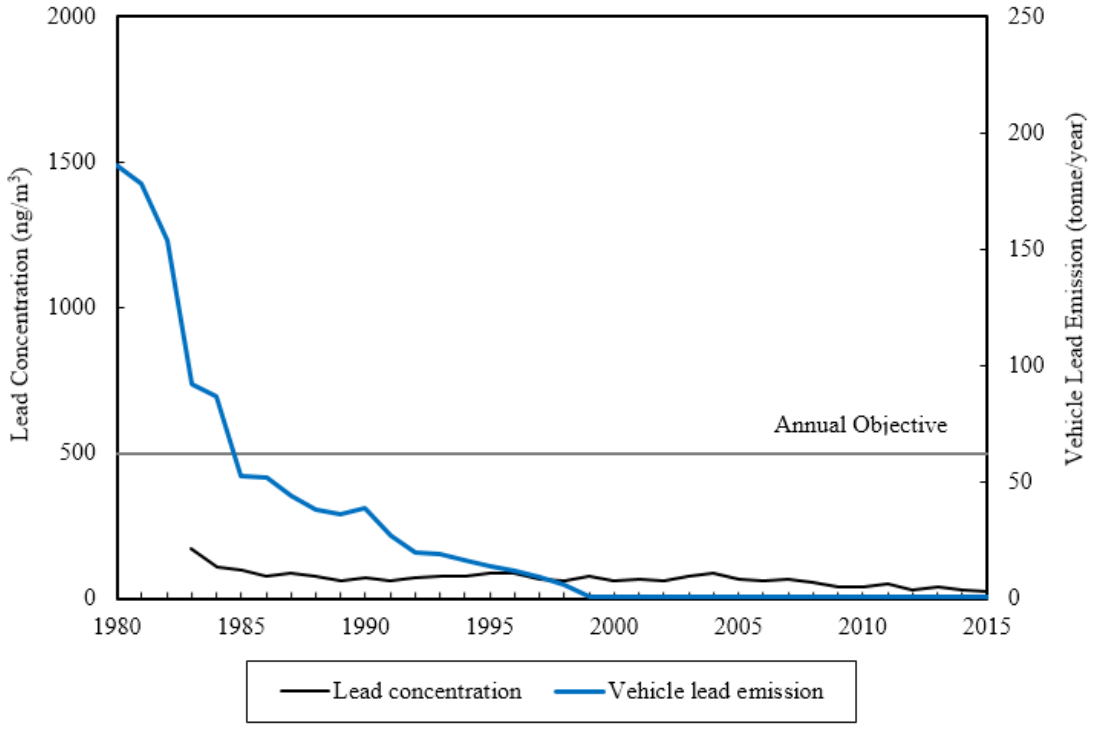


Note: *Tap Mun general station, for Rural areas, had insufficient data in 2015.

5.3.7 Lead (Pb)

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

Figure 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 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 2015. Tap Mun general station was not in operation from 30 November to 31 December 2015 owing to renovation work and hence the data monitored were insufficient and unevenly distributed in the year. Nevertheless, Tap Mun Station was still found not to comply with the 8-hour AQO with 11 month data only whereas six general stations and all 3 roadside stations complied with the 8-hour AQO for O_3. For compliance status of other criteria pollutants[1], eight general stations complied with the 1-hour AQO for NO_2, nine general and two roadside stations complied with the 24-hour AQO for RSP and FSP and all general and roadside stations complied with the short-term AQO for SO_2 and CO.

[1] Excluding Tap Mun general station, which had insufficient data in 2015.

Table A2: Compliance Status of Short-Term Air Quality Objectives in 2015

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	✓	✓	✓	✓	✓	✓	✓	✓
	Yuen Long	×	✓	×	×	✓	✓	✓	✓
	Tuen Mun	×	✓	×	×	✓	✓	✓	✓
	Tung Chung	×	✓	✓	✓	✓	✓	✓	✓
	Tai Po	✓	✓	✓	✓	✓	✓	--	--
	Sha Tin	×	✓	✓	✓	✓	✓	--	--
	Tap Mun#	×	NA	NA	NA	NA	NA	NA	NA
Roadside Station	Causeway Bay	✓	×	×	×	✓	✓	✓	✓
	Central	✓	×	✓	✓	✓	✓	✓	✓
	Mong Kok	✓	×	✓	✓	✓	✓	✓	✓

Notes: "✓" Complied with the AQO "×" Violated the AQO "--" Not measured
"#" Owing to renovation works, all pollutant data were not available at Tap Mun Station in December 2015.
"NA" Measured data either insufficient or unevenly distributed for compliance assessment

Compliance with the long-term AQO

Table A3 shows the compliance status of the long-term (annual) AQO for all 15 monitoring stations in 2015. All monitoring stations with lead measurement achieved full compliance with the long term AQO for lead in 2015. 13 stations complied with the annual AQO for RSP and FSP whereas 12 stations could not comply with the annual AQO for NO_2 in 2015[1].

[1] Excluding Tap Mun general station, which had insufficient data in 2015.

Table A3: Compliance Status of Long-Term (Annual) Air Quality Objectives in 2015

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

Notes: "✓" *Complied with the AQO* "×" *Violated the AQO* "--" *Not measured*
"#" Owing to renovation works, all pollutant data were not available at Tap Mun Station in December 2015.
"NA" - Measured data either insufficient or unevenly distributed for compliance assessment

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 15 monitoring stations in 2015. Table B1 shows the station site information. The measurement of ambient concentrations of respirable suspended particulates (RSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3) and carbon monoxide (CO) have been accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS) since August 1995.

In order to provide good representation of the air quality in areas of high population density, the locations of the 15 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. In addition, meteorological parameters, including temperature and solar radiation, wind speed and direction, are also recorded continuously at each station as appropriate.

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

B.2 Data Processing and Dissemination

At each monitoring station, signals from the continuous analysers and the meteorological instruments are first stored in a data logger and then sent back to the Data Processing Unit of the Air Science Group via dedicated 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 2015, 313 audit checks were carried out on the stations' analysers and samplers. Based on the 95% probability limits, the accuracy of the network was within the specified 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 2015, 2550 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 -4.5% and 5.4%, 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 (Above P.D.H.K.)	Above Ground	Date Start Operation
Central/Western (Sai Ying Pun Community Complex)	2 High Street, Sai Ying Pun	Urban : Mixed residential/ commercial	82m	16m (5 floors)	Oct 09
Eastern (Sai Wan Ho Fire Station)	20 Wai Hang Street, Sai Wan Ho	Urban : Residential	28m	15m (4 floors)	Jan 99
Kwun Tong (Yue Wah Mansion)	407-431 Kwun Tong Road, Kwun Tong	Urban : Mixed residential/ commercial/industrial	34m	25m	Apr 12
Sham Shui Po (Police Station)	37A Yen Chow Street, Sham Shui Po	Urban : Mixed residential/ commercial	21m	17m (4 floors)	Jul 84
Kwai Chung (Kwai Chung Police Station)	999 Kwai Chung Road, Kwai Chung	Urban : Mixed residential/ commercial/industrial	19m	13m (2 floors)	Jan 99
Tsuen Wan (Princess Alexandra Community Centre)	60 Tai Ho Road, Tsuen Wan	Urban : Mixed residential/ commercial/industrial	21m	17m (4 floors)	Aug 88
Yuen Long (Yuen Long District Branch Offices Bldg.)	269 Castle Peak Road Yuen Long	New Town : Residential	31m	25m (6 floors)	July 95
Tuen Mun (Tuen Mun Public Library)	1 Tuen Hi Road, Tuen Mun	New Town : Residential	31m	26m (4 floors)	Dec 13
Tung Chung (Tung Chung Health Centre)	6 Fu Tung Street, Tung Chung	New Town : Residential	34.5m	27.5m (4 floors)	Apr 99
Tai Po (Tai Po Govt. Office Bldg.)	1 Ting Kok Road, Tai Po	New Town : Residential	31m	25m (6 floors)	Feb 90
Sha Tin (Sha Tin Govt. Secondary School)	11-17 Man Lai Road, Tai Wai, Sha Tin	New Town : Residential	31m	25m (6 floors)	Jul 91
Tap Mun (Tap Mun Police Station)	Tap Mun	Background : Rural	26m	11m (3 floors)	Apr 98
Causeway Bay	1 Yee Woo Street, Causeway Bay	Urban Roadside : Mixed commercial/ residential area surrounded by many tall buildings	6.5m	3m	Jan 98
Central	Junction of Des Voeux Road Central and Chater Road, Central	Urban Roadside : Busy commercial/ financial area surrounded by many tall buildings	8.5m	4.5m	Oct 98
Mong Kok	Junction of Nathan Road and Lai Chi Kok Road	Urban Roadside : Mixed commercial/ residential area surrounded by many tall buildings	8.5m	3m	Jan 01

Note: P.D. = Principal Datum

Table B2: Summary of the Parameters Monitored in the Network (2015)

STATIONS	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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Yuen Long	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tuen Mun	✓	✓	✓	✓	✓	✓	✓	✓		✓
Tung Chung	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tai Po	✓	✓	✓	✓		✓	✓	✓		✓
Sha Tin	✓	✓	✓	✓		✓	✓	✓		✓
Tap Mun	✓	✓	✓	✓	✓	✓	✓	✓		
Causeway Bay	✓	✓	✓	✓	✓	✓	✓	✓		
Central	✓	✓	✓	✓	✓	✓	✓	✓		
Mong Kok	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note:

[1] "Cont" denotes continuous monitoring.

[2] "Hi-Vol" denotes high-volume sampling.

[3] "MET" denotes meteorological parameters such as temperature, wind speed, wind direction, etc.

Table B3 List of Equipment Used in Measuring Air Pollutant Concentration

Pollutants	**Measurement Principle**	**Commercial Instrument**
SO_2	UV fluorescence	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, TECO 49i
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 silica gel cartridge	Once per month	24 hours
Benzo(a)pyrene	USEPA Method TO-13	Graseby GPS1 / Tisch TE-1000	Quartz fibre filter and polyurethane foam with XAD-2 resin	Once per month	24 hours
Dioxin	USEPA Method TO-9A	Graseby GPS1 / Tisch TE-1000	Quartz fibre filter and polyurethane foam	Once per month	24 hours
Hexavalent Chromium	CARB SOP MLD 039	Xontech 924	Bicarbonate Impregnated Filter	Once per month	24 hours

Figure B1: Accuracy of Air Quality Monitoring Network, 2015

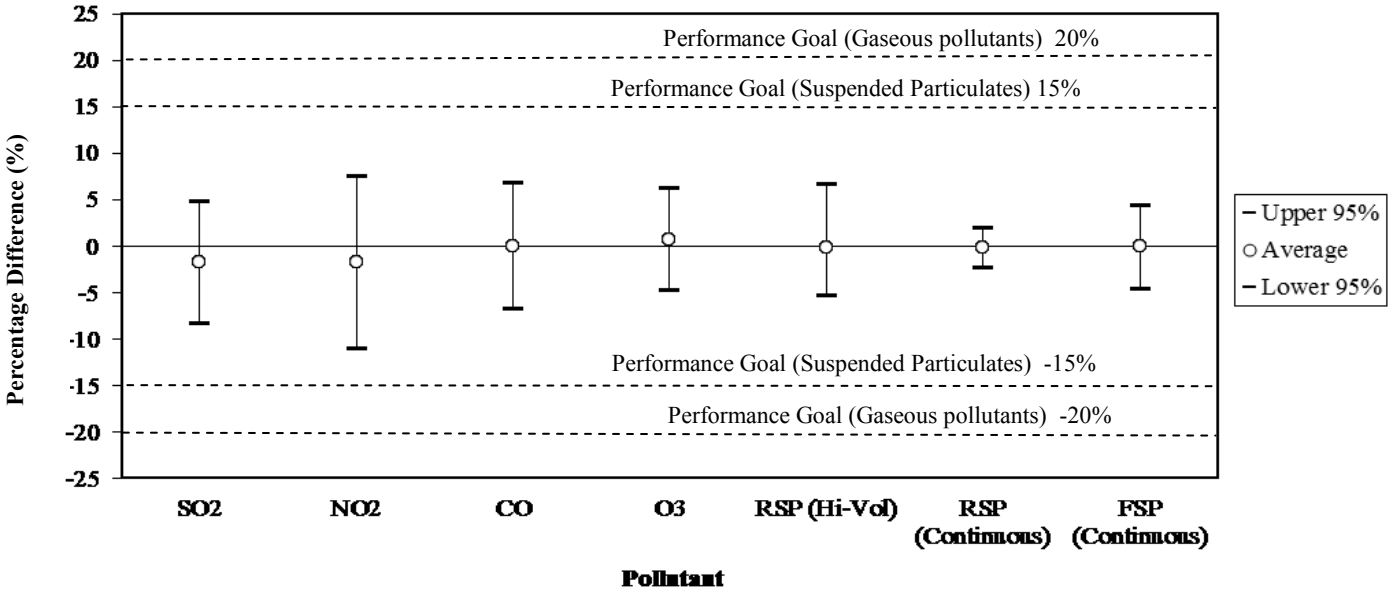
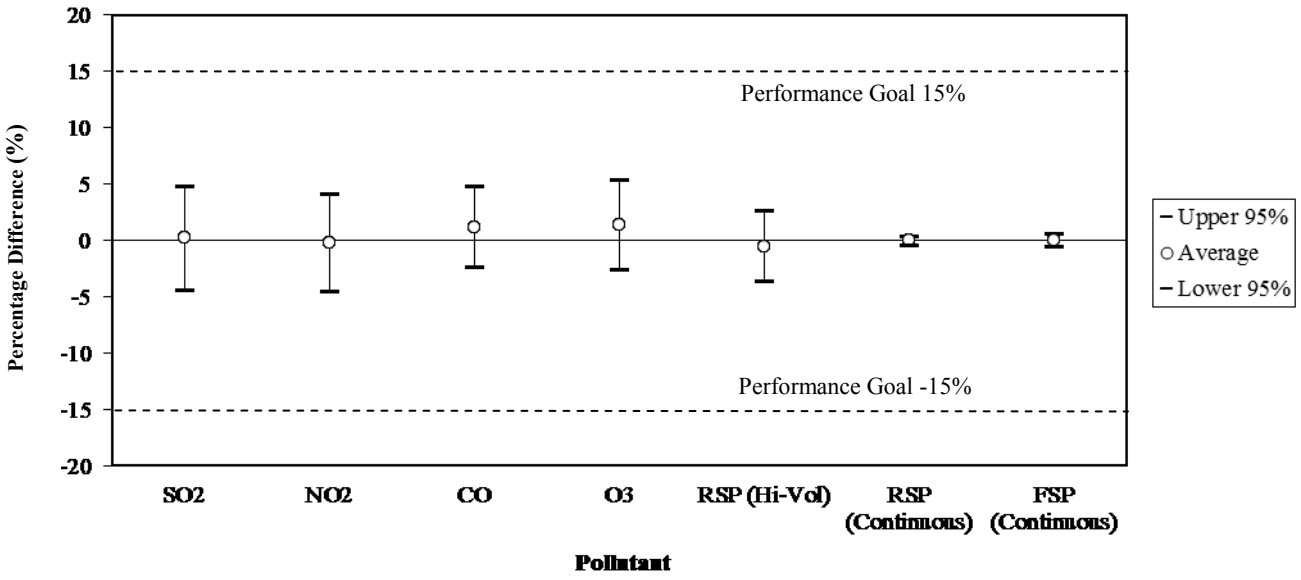


Figure B2: Precision of Air Quality Monitoring Network, 2015



Appendix C

Tables of Air Quality Data

Table No.	Title
C1.	2015 Exceedance of Short Term Limits of Air Quality Objectives
C2.	2015 Monthly and Annual Averages of Air Pollutants
C3.	2015 Hourly Statistics of Air Pollutants
C4.	2015 Diurnal Variations of Air Pollutants
C5.	2015 Total Wet and Dry Deposition
C6.	2015 Ambient Levels of Toxic Air Pollutants

Table C1: 2015 Exceedance of Short Term Limits of Air Quality Objectives

Pollutant: Sulphur Dioxide

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

Station	No. of exceedance	1st High	2nd High	3rd High	4th High
Central/Western	0	144	127	124	123
Eastern	0	172	147	146	145
Kwun Tong	0	82	82	79	79
Sham Shui Po	0	222	212	205	186
Kwai Chung	0	229	217	210	207
Tsuen Wan	0	119	116	116	112
Yuen Long	0	67	59	55	51
Tuen Mun	0	98	92	91	90
Tung Chung	0	99	97	92	88
Tai Po	0	77	67	61	56
Sha Tin	0	107	105	103	102
Tap Mun	0	57	55	51	50
Causeway Bay	0	166	134	125	124
Central	0	126	106	105	97
Mong Kok	0	228	183	165	153

Pollutant: Carbon Monoxide

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

Station	No. of exceedance	1st High
Tsuen Wan	0	2030
Yuen Long	0	2460
Tuen Mun	0	2400
Tung Chung	0	1780
Tap Mun	0	2140
Causeway Bay	0	3160
Central	0	2400
Mong Kok	0	3410

Pollutant: Sulphur Dioxide

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

Station	No. of exceedance	1st High	2nd High	3rd High	4th High
Central/Western	0	35	32	28	27
Eastern	0	34	21	21	19
Kwun Tong	0	29	25	23	22
Sham Shui Po	0	66	48	37	28
Kwai Chung	0	79	63	62	58
Tsuen Wan	0	38	36	34	34
Yuen Long	0	20	19	18	17
Tuen Mun	0	39	31	29	27
Tung Chung	0	38	26	22	22
Tai Po	0	19	15	14	13
Sha Tin	0	28	22	18	18
Tap Mun	0	15	14	14	14
Causeway Bay	0	55	29	24	23
Central	0	39	37	23	23
Mong Kok	0	58	44	27	24

Pollutant: Carbon Monoxide

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

Station	No. of exceedance	1st High
Tsuen Wan	0	1713
Yuen Long	0	2143
Tuen Mun	0	2058
Tung Chung	0	1416
Tap Mun	0	1351
Causeway Bay	0	2156
Central	0	2061
Mong Kok	0	2303

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

Station	No. of exceedance	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	15	267	267	265	260	247	245	242	242	239	237	236	235	232	208	202	200	195	193	191
Eastern	8	281	278	272	268	265	243	236	203	194	192	187	186	183	182	181	180	180	179	176
Kwun Tong	67	374	365	346	345	339	336	335	327	324	307	305	295	292	285	274	274	271	271	271
Sham Shui Po	29	299	279	268	267	266	261	260	258	244	243	238	231	225	224	222	221	218	217	215
Kwai Chung	37	293	290	270	269	263	263	254	252	251	249	241	238	238	237	236	234	234	231	227
Tsuen Wan	11	253	253	241	240	234	233	231	221	206	203	201	199	196	196	193	188	187	186	185
Yuen Long	5	339	293	287	231	201	191	187	182	181	181	179	179	177	175	171	165	164	164	162
Tuen Mun	10	304	291	275	256	250	242	218	215	212	210	190	189	189	186	186	186	186	185	184
Tung Chung	7	264	249	229	226	221	205	203	200	188	186	175	170	167	167	166	164	163	162	162
Tai Po	1	216	198	186	172	165	164	163	160	157	156	156	151	147	144	143	142	140	138	136
Sha Tin	6	264	256	245	231	221	213	199	199	195	192	182	180	180	179	178	176	175	175	175
Tap Mun	0	99	94	86	82	72	69	61	61	59	56	56	56	54	54	53	53	51	51	51
Causeway Bay	460	496	454	438	437	434	433	404	400	399	392	391	391	385	376	374	372	371	369	366
Central	257	414	373	369	366	362	356	356	348	347	343	342	340	337	334	330	326	326	326	322
Mong Kok	200	415	376	374	374	368	355	343	341	338	332	326	323	316	316	315	313	313	313	313

Table C1 (Cont.): 2015 Exceedance of Short Term Limits of Air Quality Objectives

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

Station	No. of exceedance	1st High	2nd High	3rd High	4th High	5th High	6th High	7th High	8th High	9th High	10th High
Central/Western	10	257	224	216	210	209	187	169	166	166	164
Eastern	6	249	232	221	193	181	162	160	153	150	150
Kwun Tong	1	164	155	152	151	140	138	137	137	133	130
Sham Shui Po	3	194	174	169	158	155	155	152	151	143	143
Kwai Chung	1	205	157	144	137	136	131	131	131	129	128
Tsuen Wan	2	201	169	154	151	151	150	150	149	147	145
Yuen Long	10	261	209	198	192	185	181	172	165	164	161
Tuen Mun	16	276	218	203	202	185	182	180	174	169	168
Tung Chung	19	242	215	210	209	206	204	200	196	189	176
Tai Po	8	236	220	182	179	173	166	165	161	158	157
Sha Tin	12	257	208	190	189	173	173	172	172	170	169
Tap Mun	24	255	255	206	198	194	192	190	185	182	182
Causeway Bay	0	97	91	89	80	78	76	74	72	72	70
Central	0	134	119	117	105	104	100	97	96	95	94
Mong Kok	0	121	98	86	82	79	76	75	73	73	71

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

Station	No. of exceedance	1st High	2nd High	3rd High	4th High	5th High	6th High	7th High	8th High	9th High	10th High
Central/Western	6	164	128	121	117	104	101	100	95	95	92
Eastern	4	133	113	107	102	99	92	90	87	87	86
Kwun Tong	9	175	123	116	115	110	105	104	101	101	99
Sham Shui Po	4	119	113	110	110	97	96	92	92	82	80
Kwai Chung	3	134	113	112	99	94	92	89	84	80	78
Tsuen Wan	4	130	118	116	106	100	98	96	87	82	79
Yuen Long	12	176	148	133	113	110	108	105	104	102	102
Tuen Mun	18	191	162	139	128	122	117	115	115	112	110
Tung Chung	7	158	146	122	115	109	101	101	100	97	93
Tai Po	1	129	89	86	86	85	83	83	82	80	77
Sha Tin	3	137	124	115	95	94	93	92	85	80	79
Tap Mun	4	111	111	109	105	97	95	94	92	90	86
Causeway Bay	11	171	149	145	142	129	116	111	108	107	103
Central	4	161	149	118	117	97	95	95	93	93	90
Mong Kok	8	149	132	118	115	106	106	105	103	99	90

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

Station	No. of exceedance	1st High	2nd High	3rd High	4th High	5th High	6th High	7th High	8th High	9th High	10th High
Central/Western	5	121	107	94	87	76	70	68	67	66	65
Eastern	2	87	86	70	67	64	63	60	60	58	56
Kwun Tong	4	116	90	82	81	73	72	72	70	68	65
Sham Shui Po	2	91	85	75	75	63	61	59	59	58	58
Kwai Chung	3	95	93	78	70	67	66	62	61	60	57
Tsuen Wan	5	110	86	84	84	82	74	74	65	63	60
Yuen Long	11	127	123	98	85	84	82	80	80	80	78
Tuen Mun	11	128	127	96	96	85	84	83	82	78	76
Tung Chung	5	126	98	85	78	77	75	73	70	65	65
Tai Po	1	95	66	63	62	61	60	59	59	58	57
Sha Tin	3	105	105	86	70	67	65	62	61	60	60
Tap Mun	4	98	77	77	76	75	74	74	70	68	66
Causeway Bay	10	125	117	105	102	96	82	78	77	77	76
Central	4	111	106	94	81	68	66	65	64	63	63
Mong Kok	5	106	106	94	86	79	72	70	70	70	69

Notes:

1. All concentration units are in microgram per cubic metre (μg/m^3).
2. Shaded no. of exceedance are above their respective allowable limits.
3. Shaded concentrations are above their respective limits of air quality objectives.
4. Owing to renovation works, all pollutant data were not available at Tap Mun monitoring station in December 2015.

Table C2: 2015 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	11	9	7	14	14	12	10	10	8	12	6	10	10
Eastern	8	8	4	6	4	5	5	7	5	5	5	5	5
Kwun Tong	12	10	5	9	6	9	7	9	5	7	7	9	8
Sham Shui Po	12	13	9	14	13	12	10	14	9	7	8	8	11
Kwai Chung	18	16	16	25	27	31	16	20	13	11	5	6	17
Tsuen Wan	17	16	14	17	18	18	12	13	11	11	9	10	14
Yuen Long	10	8	6	9	8	7	7	9	8	9	8	9	8
Tuen Mun	17	15	11	10	10	7	8	12	9	10	6	8	10
Tung Chung	17	14	10	10	7	3	4	5	5	6	5	8	8
Tai Po	7	5	4	6	3	5	6	6	5	6	6	7	6
Sha Tin	11	9	6	9	5	8	6	9	8	9	5	6	8
Tap Mun	9	8	6	7	6	6	6	7	7	8	8	--	7 *
Causeway Bay	8	8	4	7	9	10	10	12	8	9	8	9	9
Central	11	10	8	9	7	8	7	12	7	8	8	9	9
Mong Kok	11	11	6	7	6	7	6	9	5	6	5	5	7

Pollutant: Nitrogen Oxides

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	73	86	86	65	49	30	39	74	45	51	51	75	60
Kwun Tong	85	82	71	111	137	145	126	147	85	76	58	84	101
Sham Shui Po	123	145	127	101	93	68	77	118	82	83	84	89	99
Kwai Chung	135	137	122	129	144	131	131	148	97	99	86	105	122
Tsuen Wan	118	125	119	103	110	90	94	107	82	82	80	95	100
Yuen Long	117	93	74	71	62	51	55	76	62	72	72	83	74
Tuen Mun	134	109	94	77	66	47	54	72	62	75	68	94	79
Tung Chung	99	84	59	59	35	21	36	59	45	60	56	77	57
Tai Po	71	57	48	59	52	46	48	65	51	58	47	59	55
Sha Tin	78	59	48	58	53	46	54	76	54	69	50	62	59
Tap Mun	16	16	13	16	11	10	9	15	11	9	10	--	12 *
Causeway Bay	293	289	265	265	232	213	241	324	256	215	175	261	252
Central	271	240	219	227	196	181	203	271	173	184	151	191	208
Mong Kok	244	264	234	253	251	228	225	258	188	181	164	164	221

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

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	56	56	58	48	33	20	30	47	36	44	40	53	43
Eastern	64	62	58	50	40	26	34	46	43	48	47	52	47
Kwun Tong	53	48	45	61	59	59	66	78	53	52	39	47	55
Sham Shui Po	82	82	74	66	52	38	52	67	57	63	59	60	63
Kwai Chung	76	70	62	69	64	54	67	72	59	66	52	58	64
Tsuen Wan	76	72	66	63	57	46	55	59	53	58	53	56	59
Yuen Long	71	59	47	45	34	25	33	44	39	49	47	50	45
Tuen Mun	81	64	53	48	36	24	34	42	38	56	46	55	48
Tung Chung	71	58	40	42	23	13	26	39	34	48	40	46	40
Tai Po	50	42	34	42	33	27	31	40	36	42	34	37	37
Sha Tin	54	41	34	41	34	29	39	51	39	50	34	42	41
Tap Mun	14	14	11	13	8	7	7	12	9	7	8	--	10 *
Causeway Bay	137	125	108	117	91	77	99	122	111	105	81	95	106
Central	125	107	97	103	78	66	88	106	87	102	77	79	93
Mong Kok	120	117	103	109	89	76	91	103	91	99	85	78	97

Pollutant: Carbon Monoxide

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tsuen Wan	847	1003	939	822	682	568	678	737	812	914	868	907	813
Yuen Long	988	790	669	718	595	450	490	433	493	534	477	669	608
Tuen Mun	900	873	708	667	567	507	642	637	630	714	746	848	703
Tung Chung	667	589	565	595	471	382	583	667	458	527	700	803	583
Tap Mun	771	640	594	747	502	538	612	689	694	653	792	--	657 *
Causeway Bay	685	803	1034	865	674	520	660	707	873	763	568	677	735
Central	894	810	655	611	543	482	610	758	737	686	582	682	670
Mong Kok	1114	1111	1007	908	802	635	639	690	667	740	839	923	839

Table C2 (Cont.): 2015 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	41	36	35	48	35	32	49	39	62	71	57	33	45
Eastern	49	44	36	44	32	32	49	43	61	68	58	35	46
Kwun Tong	69	65	51	41	23	18	37	28	59	68	58	37	46
Sham Shui Po	44	37	28	36	22	20	38	30	51	59	43	26	36
Kwai Chung	51	49	40	35	20	16	34	33	49	52	46	31	38
Tsuen Wan	44	42	33	33	18	15	30	29	48	54	44	28	35
Yuen Long	38	40	33	39	27	23	41	35	53	54	39	22	37
Tuen Mun	37	35	29	39	26	24	43	39	57	60	47	25	38
Tung Chung	45	49	43	43	37	33	47	39	60	62	50	27	45
Tai Po	58	64	54	51	37	26	45	41	60	61	56	33	49
Sha Tin	59	63	52	46	34	24	43	37	62	60	60	37	48
Tap Mun	92	84	72	68	58	42	60	57	88	99	86	--	73 *
Causeway Bay	27	27	20	17	12	8	12	6	18	25	27	14	18
Central	30	30	21	19	14	11	17	12	30	32	32	17	22
Mong Kok	22	20	15	16	9	5	15	10	24	30	22	16	17

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

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	66	73	49	37	23	17	28	33	33	42	37	39	39
Eastern	60	66	42	33	20	14	23	27	29	39	34	36	35
Kwun Tong	72	75	51	42	26	21	32	38	38	50	41	46	44
Sham Shui Po	57	65	42	32	22	17	28	34	34	45	39	40	38
Kwai Chung	57	60	37	32	25	22	29	33	32	44	36	35	37
Tsuen Wan	54	66	41	33	22	16	24	31	32	42	37	38	36
Yuen Long	76	74	47	44	22	17	29	34	35	55	45	48	44
Tuen Mun	80	80	48	40	20	14	29	39	38	56	49	54	45
Tung Chung	62	69	38	35	19	14	25	27	27	39	36	45	36
Tai Po	55	58	40	35	22	17	26	31	33	40	35	39	36
Sha Tin	60	60	38	38	19	14	22	27	27	36	34	35	34
Tap Mun	66	59	33	30	24	17	24	28	33	43	35	--	35 *
Causeway Bay	79	89	64	54	40	31	43	52	51	59	50	53	55
Central	63	69	46	35	24	19	28	33	27	33	30	40	37
Mong Kok	71	77	54	41	30	23	32	36	38	44	41	41	44

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

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Central/Western	45	51	34	23	14	10	17	22	22	27	23	26	26
Eastern	40	43	28	21	12	8	14	19	20	26	22	24	23
Kwun Tong	47	50	32	26	15	10	20	24	23	30	21	27	27
Sham Shui Po	38	44	28	20	14	10	17	25	25	30	24	27	25
Kwai Chung	40	43	26	22	15	13	18	24	23	29	23	23	25
Tsuen Wan	38	47	28	21	11	8	14	20	21	28	23	25	24
Yuen Long	55	54	34	31	13	9	18	23	26	37	31	27	30
Tuen Mun	53	56	33	23	11	8	15	25	29	38	29	36	30
Tung Chung	39	44	23	20	10	6	14	17	17	26	22	29	22
Tai Po	38	39	26	22	12	9	15	20	21	28	23	27	23
Sha Tin	42	42	25	23	11	9	14	19	20	26	23	26	24
Tap Mun	48	44	23	19	12	10	15	20	22	28	19	--	24 *
Causeway Bay	53	62	44	34	25	18	27	36	33	40	32	37	37
Central	41	45	29	19	12	9	16	23	20	27	19	26	24
Mong Kok	50	54	37	27	19	13	20	25	25	29	29	31	30

Notes:

1. All concentration units are in microgram per cubic metre ($\mu g/m^3$).
2. Shaded annual averages are above their respective limits of air quality objectives.
3. Annual average marked with asterisk denotes the data for calculation was not evenly distributed in the year.
4. Owing to renovation works, monthly average was not available for all pollutants at Tap Mun monitoring station in December 2015.

Table C3: 2015 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	8566	97.8	2	5	9	13	19	24	30	41	63	10	120
Eastern	8657	98.8	1	2	4	7	11	14	19	25	43	5	137
Kwun Tong	8633	98.6	3	5	7	10	14	17	20	27	41	8	74
Sham Shui Po	8638	98.6	4	6	8	12	18	26	36	53	94	11	167
Kwai Chung	8627	98.5	4	7	11	20	38	51	65	83	121	17	213
Tsuen Wan	8529	97.4	7	8	11	16	24	31	38	48	68	14	109
Yuen Long	8577	97.9	4	5	7	10	14	17	20	25	33	8	62
Tuen Mun	8608	98.3	4	5	8	13	20	25	30	37	50	10	87
Tung Chung	8548	97.6	3	4	7	10	15	19	23	28	39	8	90
Tai Po	8597	98.1	2	4	5	7	9	11	13	17	25	6	59
Sha Tin	8642	98.7	3	4	6	9	13	17	21	29	42	8	102
Tap Mun	7812	89.2	4	5	6	8	11	13	16	18	24	7	48
Causeway Bay	8632	98.5	3	5	7	10	15	19	25	34	54	9	125
Central	8545	97.5	3	5	7	10	16	21	28	37	58	9	80
Mong Kok	8590	98.1	2	3	5	8	14	19	26	39	83	7	138

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	8617	98.4	15	25	45	75	118	159	211	302	498	60	660
Kwun Tong	8617	98.4	24	41	73	141	217	264	305	359	526	101	953
Sham Shui Po	8641	98.6	33	57	87	122	162	206	263	374	742	99	1077
Kwai Chung	8634	98.6	39	71	109	154	211	258	324	418	628	122	964
Tsuen Wan	8557	97.7	36	64	89	121	166	207	261	346	515	100	695
Yuen Long	8582	98.0	27	43	63	91	131	161	200	256	362	74	639
Tuen Mun	8664	98.9	24	40	65	102	150	185	230	298	442	79	766
Tung Chung	8524	97.3	11	22	42	81	123	153	182	220	281	57	353
Tai Po	8591	98.1	21	32	47	70	97	119	142	180	252	55	461
Sha Tin	8642	98.7	18	26	42	72	127	168	206	254	322	59	490
Tap Mun	7815	89.2	5	7	10	15	22	29	36	46	69	12	146
Causeway Bay	8629	98.5	82	135	217	331	470	561	654	775	1002	252	1117
Central	8566	97.8	65	108	179	274	383	466	553	698	1051	208	1804
Mong Kok	8618	98.4	75	137	216	288	356	410	464	568	861	221	1293

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

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles---------->									Arithmetic mean	Highest 1-hour	No. of exceed-ance
			10	25	50	75	90	95	97.5	99	99.8			
Central/Western	8617	98.4	14	21	38	58	79	93	109	137	193	43	267	15
Eastern	8657	98.8	20	29	45	62	76	88	100	121	178	47	281	8
Kwun Tong	8617	98.4	20	32	48	71	95	112	134	178	271	55	374	67
Sham Shui Po	8641	98.6	29	41	59	79	100	116	132	159	216	63	299	29
Kwai Chung	8634	98.6	28	45	60	77	101	123	145	177	230	64	293	37
Tsuen Wan	8557	97.7	27	43	55	71	93	112	131	152	186	59	253	11
Yuen Long	8582	98.0	19	28	40	56	76	94	111	133	164	45	339	5
Tuen Mun	8664	98.9	16	27	41	62	88	108	125	146	185	48	304	10
Tung Chung	8524	97.3	8	17	33	55	82	100	114	134	162	40	264	7
Tai Po	8591	98.1	17	24	34	47	62	74	86	104	138	37	216	1
Sha Tin	8642	98.7	15	22	34	51	75	98	118	137	175	41	264	6
Tap Mun	7815	89.2	3	5	9	13	18	24	30	38	52	10	99	0
Causeway Bay	8629	98.5	46	68	98	133	170	203	239	282	368	106	496	460
Central	8565	97.8	41	59	85	117	153	179	208	248	325	93	414	257
Mong Kok	8618	98.4	44	67	93	119	149	173	198	237	313	97	415	200

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

Station	No. of hourly data	Data capture rate (%)	<----------Percentiles---------->									Arithmetic mean	Highest 1-hour	No. of exceed-ance
			10	25	50	75	90	95	97.5	99	99.8			
Tsuen Wan	8549	97.6	570	660	800	940	1080	1180	1270	1360	1500	813	2030	0
Yuen Long	8581	98.0	330	430	570	740	930	1090	1230	1460	1750	608	2460	0
Tuen Mun	8714	99.5	480	540	660	820	980	1080	1230	1380	1673	703	2400	0
Tung Chung	8486	96.9	350	410	550	700	880	1040	1130	1270	1400	583	1780	0
Tap Mun	7832	89.4	470	530	630	770	890	960	1030	1120	1240	657	2140	0
Causeway Bay	8499	97.0	380	490	670	910	1170	1380	1575	1790	2180	735	3160	0
Central	8595	98.1	380	490	630	800	990	1140	1310	1520	1818	670	2400	0
Mong Kok	8616	98.4	540	650	800	990	1190	1320	1440	1620	1998	839	3410	0

Table C3 (Cont.): 2015 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	8620	98.4	6	20	37	62	88	109	134	168	241	45	339
Eastern	8638	98.6	15	25	39	61	82	98	121	154	214	46	339
Kwun Tong	8600	98.2	8	16	37	72	97	111	121	134	164	46	233
Sham Shui Po	8597	98.1	6	13	28	52	76	97	115	144	190	36	296
Kwai Chung	8637	98.6	8	15	29	55	79	94	108	131	163	38	298
Tsuen Wan	8546	97.6	4	10	25	52	78	94	112	141	197	35	296
Yuen Long	8578	97.9	3	12	28	51	80	103	132	170	223	37	363
Tuen Mun	8723	99.6	7	13	28	52	81	104	133	183	237	38	342
Tung Chung	8547	97.6	5	17	37	61	92	112	144	184	256	45	313
Tai Po	8527	97.3	6	18	40	72	101	119	136	165	211	49	313
Sha Tin	8599	98.2	3	15	38	74	105	124	139	172	217	48	368
Tap Mun	7731	88.3	23	42	67	100	131	149	164	188	221	73	310
Causeway Bay	8418	96.1	2	5	11	26	43	53	62	73	94	18	112
Central	8511	97.2	2	5	13	33	55	69	81	99	122	22	179
Mong Kok	8544	97.5	2	4	10	24	41.7	54	68	82	105	17	144

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	8395	95.8	15	21	33	50	71	84	98	117	190	39	279
Eastern	8551	97.6	12	18	29	46	66	79	93	108	162	35	242
Kwun Tong	8384	95.7	16	25	39	57	80	94	107	124	189	44	294
Sham Shui Po	8473	96.7	15	21	33	49	69	81	90	107	145	38	208
Kwai Chung	8414	96.1	16	22	31	46	67	77	88	106	167	37	216
Tsuen Wan	8678	99.1	13	20	30	47	67	78	91	111	173	36	219
Yuen Long	8438	96.3	15	23	36	58	82	97	111	126	204	44	296
Tuen Mun	8553	97.6	14	22	37	61	89	105	120	143	225	45	321
Tung Chung	8687	99.2	12	18	28	48	72	87	100	124	202	36	259
Tai Po	8625	98.5	15	21	30	46	65	75	85	98	138	36	239
Sha Tin	8029	91.7	11	17	28	45	67	78	90	105	166	34	224
Tap Mun	7805	89.1	13	19	29	45	67	83	95	111	142	35	189
Causeway Bay	8547	97.6	26	36	50	68	91	104	119	146	223	55	327
Central	8466	96.6	14	20	30	48	69	84	99	124	183	37	264
Mong Kok	8388	95.8	19	26	38	56	79	91	102	120	168	44	241

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	8395	95.8	9	13	21	34	49	59	68	86	154	26	220
Eastern	8434	96.3	7	11	19	32	45	53	61	70	120	23	159
Kwun Tong	8383	95.7	9	13	23	36	52	62	70	82	132	27	205
Sham Shui Po	8473	96.7	10	14	21	33	47	54	61	74	112	25	144
Kwai Chung	8414	96.1	10	14	20	31	46	55	63	74	126	25	156
Tsuen Wan	8688	99.2	6	11	19	31	47	56	64	81	140	24	192
Yuen Long	8453	96.5	9	14	25	40	58	70	80	96	166	30	214
Tuen Mun	8496	97.0	7	13	25	41	59	72	84	99	165	30	216
Tung Chung	8686	99.2	5	9	16	29	46	58	70	86	157	22	193
Tai Po	8624	98.4	8	12	19	31	45	52	59	72	105	23	175
Sha Tin	8029	91.7	7	11	19	32	47	56	65	77	135	24	172
Tap Mun	7881	90.0	8	11	18	31	46	57	69	82	122	24	160
Causeway Bay	8547	97.6	15	23	32	46	62	74	85	106	175	37	296
Central	8445	96.4	7	11	19	32	47	57	68	89	143	24	167
Mong Kok	8386	95.7	11	16	25	39	55	65	74	86	139	30	178

Notes:

1. All concentration units are in microgram per cubic metre ($\mu g/m^3$).
2. Shaded no. of exceedance are above their respective allowable limits.
3. Owing to renovation works, all pollutant data were not available at Tap Mun monitoring station in December 2015.

Table C4: 2015 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	10	10	9	10	9	10	10	10	11	10	10	10	10	10	10	10	10	11	11	11	11	11	10	10
Eastern	5	5	5	5	5	4	5	6	6	5	5	5	5	5	5	5	5	6	6	6	7	7	6	5
Kwun Tong	7	7	7	10	8	7	8	8	9	9	9	8	8	8	8	9	9	9	8	8	8	8	8	7
Sham Shui Po	11	11	11	12	10	10	10	10	11	10	10	10	10	10	10	10	10	10	11	12	12	11	11	11
Kwai Chung	16	15	16	16	15	14	14	15	16	17	18	17	17	17	18	19	19	19	20	19	17	17	17	16
Tsuen Wan	13	12	12	14	12	12	12	12	13	14	15	16	15	15	15	16	16	16	15	14	14	13	13	13
Yuen Long	8	8	7	9	7	7	7	8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	8
Tuen Mun	10	10	10	9	9	9	9	10	10	11	11	11	11	11	11	11	11	11	11	12	11	11	10	10
Tung Chung	7	6	6	9	7	7	6	7	8	9	9	9	9	9	9	9	9	9	8	7	7	7	7	7
Tai Po	5	5	5	6	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	5
Sha Tin	7	7	7	10	7	7	7	7	8	8	8	8	8	7	8	8	8	9	8	8	8	8	7	7
Tap Mun	6	6	6	9	7	7	7	7	8	9	9	8	8	8	7	8	7	7	7	6	6	6	6	6
Causeway Bay	8	7	7	7	7	7	8	9	10	11	10	9	9	9	9	9	9	9	9	9	8	8	8	8
Central	8	7	7	8	7	7	8	9	11	10	9	9	8	8	8	9	9	9	10	9	9	9	8	8
Mong Kok	7	7	7	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	9	8	8	7	7

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	54	43	37	32	31	32	42	66	82	83	76	69	62	60	61	65	66	68	72	73	73	71	66	63
Kwun Tong	84	54	42	38	35	47	89	127	145	138	120	109	102	105	113	123	130	138	143	129	111	101	103	101
Sham Shui Po	90	68	58	50	48	55	86	110	125	118	108	102	98	102	104	108	116	124	131	130	122	112	107	104
Kwai Chung	103	79	68	58	57	67	103	147	173	161	142	131	126	125	129	138	145	150	162	156	135	130	125	119
Tsuen Wan	88	60	51	43	41	49	83	112	124	126	123	116	106	107	111	118	122	129	134	127	117	110	108	104
Yuen Long	70	57	49	39	40	46	74	105	99	82	74	69	62	66	67	71	80	86	92	95	91	88	87	82
Tuen Mun	73	62	51	41	40	49	73	103	103	96	89	82	73	69	72	74	80	93	104	107	101	94	91	83
Tung Chung	59	45	38	32	33	40	53	67	70	63	64	62	59	57	57	58	59	63	69	68	66	64	63	63
Tai Po	56	47	37	32	33	37	59	86	79	61	52	49	46	45	47	49	56	63	69	69	66	63	62	60
Sha Tin	72	57	47	40	38	42	62	84	73	57	50	43	40	40	43	46	52	60	70	79	81	80	82	78
Tap Mun	11	11	11	12	12	12	12	14	16	16	15	13	12	11	11	11	11	12	12	12	12	12	12	12
Causeway Bay	202	141	128	107	104	103	171	270	314	328	313	304	302	309	305	303	315	309	318	316	286	279	289	247
Central	165	122	106	98	96	98	142	223	314	293	264	247	226	218	227	240	245	274	297	269	231	214	201	191
Mong Kok	178	107	96	83	82	89	150	213	261	259	252	255	246	258	260	279	302	320	331	291	258	253	256	231

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	38	31	27	24	24	24	31	43	49	50	48	46	44	44	45	49	51	56	58	57	55	53	48	45
Eastern	43	34	28	25	24	26	41	53	56	54	51	48	48	49	51	55	59	62	61	59	57	56	51	48
Kwun Tong	49	36	30	26	25	31	48	60	64	62	57	56	56	59	63	68	73	77	78	73	64	59	58	56
Sham Shui Po	56	44	38	34	33	38	53	63	67	64	62	62	63	66	69	73	78	83	87	85	78	73	68	65
Kwai Chung	56	44	38	33	33	37	51	65	72	70	67	67	69	71	74	79	83	85	87	83	73	69	67	63
Tsuen Wan	53	39	33	29	28	32	48	59	62	63	62	62	62	65	69	73	77	82	84	79	72	67	65	62
Yuen Long	43	38	33	27	28	31	38	45	46	43	41	40	38	41	44	48	54	60	63	62	58	55	52	49
Tuen Mun	45	40	35	29	28	31	39	47	48	47	46	45	43	43	47	50	55	65	70	69	64	58	55	51
Tung Chung	40	33	28	25	25	28	33	36	39	38	40	40	40	41	42	44	46	49	53	51	49	46	45	43
Tai Po	38	33	27	24	24	26	35	44	42	36	33	32	31	32	33	36	41	47	52	52	48	45	43	42
Sha Tin	47	38	33	29	28	30	39	46	43	37	34	31	30	31	32	36	41	48	54	57	56	55	53	51
Tap Mun	10	9	9	10	10	10	10	10	11	11	11	10	9	9	8	9	9	10	11	11	11	10	10	10
Causeway Bay	88	65	61	53	52	52	75	104	111	117	117	120	125	132	132	133	139	134	137	133	121	116	119	103
Central	74	59	54	50	50	50	66	89	111	110	105	106	106	105	112	117	117	125	130	118	104	96	90	84
Mong Kok	82	57	52	47	47	50	71	86	97	98	100	105	109	116	119	125	133	136	137	125	113	110	108	99

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	799	762	732	707	710	725	786	841	847	838	830	807	801	801	804	812	824	842	878	888	884	877	869	837
Yuen Long	633	604	584	553	537	530	584	644	633	601	593	576	571	573	569	576	595	619	651	682	679	666	666	654
Tuen Mun	711	693	677	641	668	677	694	742	732	709	702	683	670	662	662	663	672	697	737	760	761	763	753	730
Tung Chung	579	564	548	551	542	552	566	595	600	589	590	593	587	587	584	585	591	590	603	604	603	600	600	595
Tap Mun	666	665	659	663	652	652	663	662	659	655	652	648	647	642	640	637	646	661	665	663	664	667	668	667
Causeway Bay	775	819	771	688	686	618	582	608	640	688	755	759	751	758	734	733	720	731	768	826	877	847	764	736
Central	644	599	573	550	513	537	546	606	685	742	741	707	683	727	708	685	678	721	772	804	785	744	689	661
Mong Kok	840	854	822	748	725	687	674	737	782	821	802	784	807	869	881	896	912	948	1002	992	960	899	850	838

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	43	46	48	49	48	46	39	30	28	31	38	46	55	60	62	59	56	50	44	41	39	38	39	39
Eastern	43	45	48	49	49	46	36	30	30	35	41	49	55	59	60	60	55	51	48	46	43	41	42	41
Kwun Tong	43	50	52	53	53	47	36	30	31	36	43	49	56	59	59	56	51	47	44	43	43	43	42	41
Sham Shui Po	34	41	43	46	45	39	28	22	23	28	35	41	48	50	51	48	42	35	28	26	28	28	29	29
Kwai Chung	34	42	44	45	45	41	32	25	25	30	36	43	47	51	51	48	43	39	34	32	33	32	31	32
Tsuen Wan	28	39	40	43	43	38	26	21	24	28	34	41	47	51	51	49	44	37	29	26	27	26	24	25
Yuen Long	26	28	29	32	31	28	22	19	23	32	41	52	62	67	68	65	57	45	35	30	27	26	24	24
Tuen Mun	30	32	35	37	37	33	26	22	25	30	38	47	57	64	67	66	58	44	33	28	28	28	28	29
Tung Chung	34	38	39	41	40	36	31	29	31	38	43	50	60	68	71	72	68	59	46	40	37	36	34	34
Tai Po	36	38	41	41	40	36	29	26	33	45	55	64	73	77	79	78	71	60	50	45	42	39	37	36
Sha Tin	33	38	41	42	41	37	30	28	35	45	54	64	73	78	79	76	70	61	50	42	38	35	33	33
Tap Mun	60	58	55	56	55	53	51	54	60	67	77	86	94	99	102	103	100	96	88	81	74	69	65	62
Causeway Bay	18	23	25	28	28	28	20	12	10	11	12	14	16	16	17	17	17	17	16	15	16	15	15	17
Central	24	30	32	33	32	31	23	15	11	13	15	19	24	27	26	24	23	19	16	16	17	18	20	21
Mong Kok	16	24	26	29	30	27	17	10	9	11	14	16	19	21	21	18	15	13	11	11	12	12	11	12

Table C4 (Cont.): 2015 Diurnal Variations of Air Pollutants

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	37	36	35	34	34	34	34	35	37	39	41	41	41	41	43	43	43	42	41	42	42	42	40	38
Eastern	35	34	34	32	32	32	31	31	32	33	34	35	35	35	35	36	38	38	38	38	39	38	38	37
Kwun Tong	43	40	40	39	39	38	38	39	41	43	45	46	48	48	50	50	49	49	49	48	48	47	45	43
Sham Shui Po	37	35	34	33	33	32	33	34	36	36	36	36	36	36	39	42	42	43	43	44	45	44	42	39
Kwai Chung	35	34	33	32	32	31	31	32	35	36	37	38	38	38	40	41	41	41	41	41	41	39	37	36
Tsuen Wan	33	32	31	30	30	30	30	32	33	35	37	39	39	39	41	42	42	41	41	41	40	39	36	34
Yuen Long	41	40	39	38	37	37	37	38	42	46	48	49	50	47	48	49	49	48	47	46	46	45	43	42
Tuen Mun	44	42	41	40	39	39	40	41	43	44	45	46	47	46	47	50	50	51	51	51	51	50	48	45
Tung Chung	33	33	32	32	31	31	31	32	34	35	37	39	40	41	41	42	43	42	40	38	37	36	35	35
Tai Po	36	35	34	33	33	32	33	34	36	37	37	37	37	36	36	35	36	37	38	39	39	38	37	36
Sha Tin	35	34	32	31	31	30	31	33	33	33	34	34	35	35	35	36	36	36	37	37	37	37	36	36
Tap Mun	32	32	32	32	32	33	36	36	36	37	37	37	37	37	37	37	38	37	37	36	35	34	34	33
Causeway Bay	52	45	41	40	39	38	40	47	53	58	60	60	59	61	66	64	63	64	65	66	66	63	60	57
Central	35	33	32	31	30	30	31	33	37	40	39	38	39	39	41	41	41	41	41	42	42	41	39	37
Mong Kok	42	39	37	36	35	35	36	38	41	44	45	46	48	47	49	49	49	49	50	52	53	50	46	44

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	25	24	23	23	23	23	23	23	25	26	26	27	27	27	28	28	28	28	27	28	28	28	27	26
Eastern	23	23	22	22	21	21	21	21	22	22	23	23	23	23	23	23	23	24	24	25	25	25	25	24
Kwun Tong	27	24	24	25	24	24	24	25	26	27	27	27	27	28	29	29	29	29	30	30	31	30	29	28
Sham Shui Po	25	24	23	23	22	22	23	24	25	25	24	24	23	24	25	26	27	27	28	29	30	30	28	27
Kwai Chung	24	23	23	22	22	22	22	23	24	25	25	25	25	26	27	27	27	27	27	28	27	27	26	25
Tsuen Wan	22	21	20	19	19	19	19	20	22	23	24	25	26	26	27	27	27	27	27	27	27	26	24	22
Yuen Long	28	29	28	27	27	26	26	28	30	32	33	34	34	34	32	32	31	31	30	30	30	30	28	28
Tuen Mun	29	28	28	27	26	27	27	28	29	30	29	29	29	29	30	31	32	32	33	33	34	33	32	31
Tung Chung	20	20	19	19	19	19	19	20	20	21	22	23	24	24	25	25	26	26	25	24	23	22	22	21
Tai Po	23	23	22	22	21	21	22	23	24	24	24	24	24	23	23	23	23	24	24	25	25	25	24	24
Sha Tin	24	23	23	22	21	21	22	23	23	23	23	23	23	24	24	24	24	24	25	26	26	25	25	25
Tap Mun	22	22	21	22	22	24	26	25	24	25	24	24	24	24	24	24	24	25	24	24	24	23	23	22
Causeway Bay	35	30	26	26	25	25	26	31	35	38	38	38	38	41	44	42	42	43	44	46	46	44	42	39
Central	22	21	20	20	19	19	20	21	24	25	24	24	25	26	26	26	26	26	26	27	28	27	25	24
Mong Kok	29	26	25	24	24	24	24	26	29	30	29	30	32	32	33	32	33	33	34	36	37	35	32	30

Note:

1. All concentration units are in microgram per cubic metre ($\mu g/m^3$).
2. Owing to renovation works, all pollutant data were not available at Tap Mun monitoring station in December 2015.

Table C5: 2015 Total Wet and Dry Deposition

(a) Wet Deposition

	Monitoring Station	Central/Western	Kwun Tong	Yuen Long
	Wet Deposition (tonne/ha)	21131	20961	15408
	Weighted Mean pH (based on volume-weighted mean hydrogen ion concentrations ($[H^+]$)	4.80	4.72	4.90
	Weighted Mean pH (based on volume-weighted mean pH)	5.00	5.00	5.07
	Number of Samples	93	89	76
Filtrate (Kg/Ha)	**NH_4^+**	6.34	7.29	5.55
	NO_3^-	17.73	23.23	13.13
	SO_4^{2-}	23.77	25.19	14.83
	Cl^-	24.80	25.69	9.01
	F^-	0.53	0.52	0.38
	Na^+	14.01	14.59	5.72
	K^+	5.28	5.27	3.84
	Formate	5.22	4.78	3.89
	Acetate	3.98	3.68	3.39
	Ca^{2+}	3.05	3.02	2.65
	Mg^{2+}	1.81	2.43	0.77

** 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	0.76	0.09
	NO_3^-	7.85	11.91	8.17
	SO_4^{2-}	6.27	8.52	5.28
	Cl^-	9.43	12.92	3.98
	F^-	0.058	0.072	0.079
	Na^+	5.96	8.18	2.43
	K^+	0.43	1.15	0.56
	Formate	0.17	0.17	0.21
	Acetate	0.17	0.17	0.17
	Ca^{2+}	5.10	6.27	6.54
	Mg^{2+}	0.82	1.12	0.45

TABLE C6: 2015 AMBIENT LEVELS OF TOXIC AIR POLLUTANTS

Toxic Air Pollutants	Concentration Unit	Annual Averages [1]	
		Tsuen Wan	Central/Western
Heavy Metals			
Hexavalent chromium	ng/m^3	0.10	0.11
Lead [2]	ng/m^3	24	22
Organic Substances			
Benzene	$\mu g/m^3$	2.21	1.11
Benzo[a]pyrene	ng/m^3	0.12	0.06
1,3-Butadiene	$\mu g/m^3$	0.12	0.07
Formaldehyde [3]	$\mu g/m^3$	3.73	-
Perchloroethylene	$\mu g/m^3$	0.46	0.64
Dioxins [4]	$pgI\text{-}TEQ/m^3$	0.028	0.036

Notes:

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

[2] For lead the reported figures are the respective 2015 annual average concentrations in the elemental analysis of respirable suspended particulates.

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

[4] 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.

[5] The measurement of carbonyl compounds (formaldehyde) at Central/Western Station was affected by influence from the construction works at Sai Ying Pun MTR Station. Hence, the measurement result is not reported in 2015.