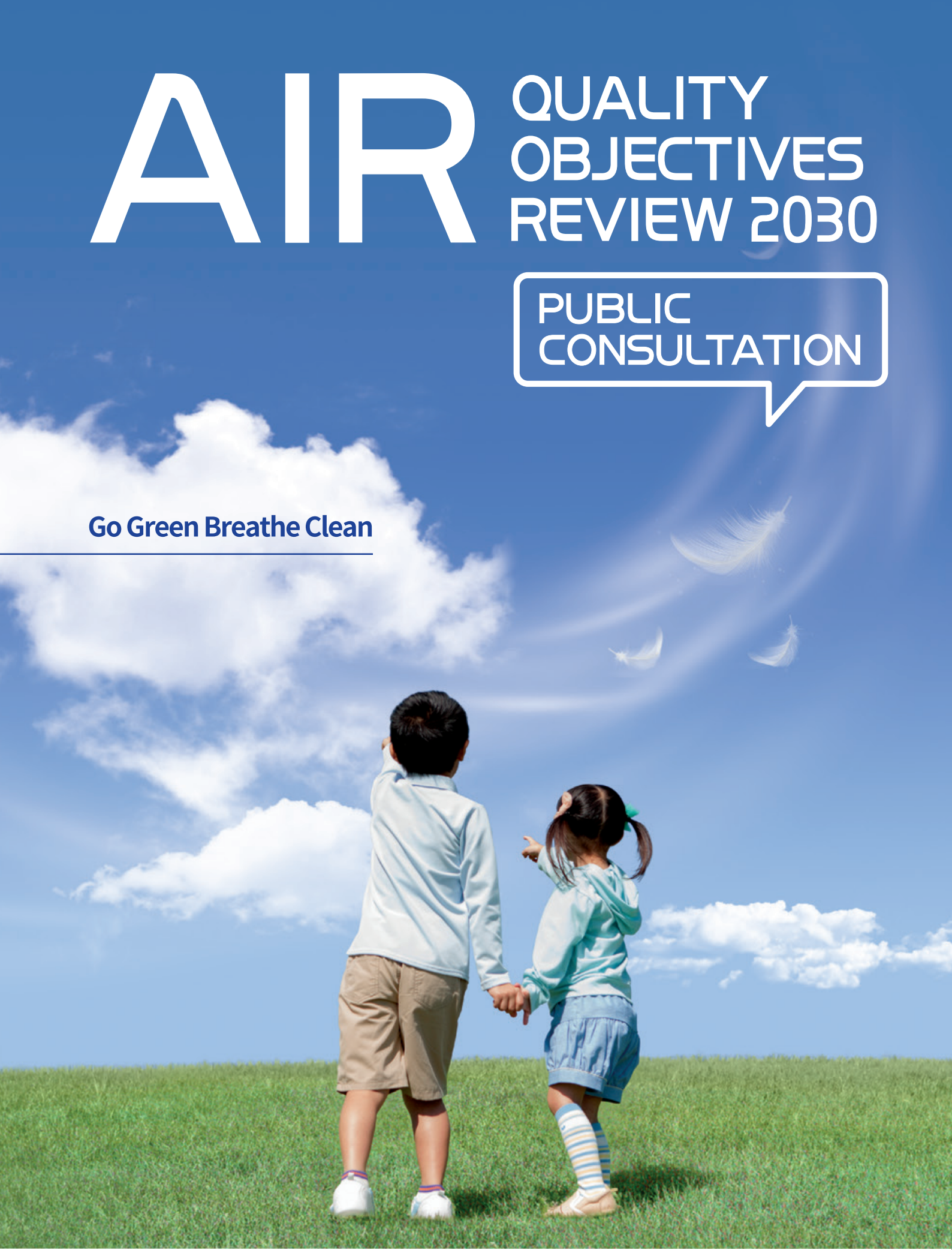
AIR QUALITY OBJECTIVES REVIEW 2030

PUBLIC CONSULTATION

Go Green Breathe Clean



Environment and Ecology Bureau
The Government of the Hong Kong Special Administrative Region
of the People's Republic of China

August 2023

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Foreword

Air quality is closely related to public health and also one of the key factors for enhancing a city's living quality. To continuously improve air quality and better protect public health, the Environment and Ecology Bureau shall review the air quality objectives (AQOs) at least once every five years.

Hong Kong's air quality has been improving continuously, with over 40% to 60% reduction in major air pollutants and great enhancement of visibility over the past decade. Hong Kong's air quality is also the best since the re-unification. To further improve air quality and reduce carbon emissions, the Government announced the *Hong Kong Roadmap on Popularisation of Electric Vehicles*, *Clean Air Plan for Hong Kong 2035* and *Hong Kong's Climate Action Plan 2050* in 2021. These roadmap and blueprints cover strategies for promoting the use of new energy transport technologies, combating climate change and achieving carbon neutrality in various aspects, and set out a number of short-, medium-and long-term targets.

Meanwhile, the World Health Organisation (WHO) released the WHO Global Air Quality Guidelines (AQGs) in September 2021, setting interim targets and AQG levels and recommending governments to consider their local conditions before adopting the suggested levels as legal air quality standards, including considerations on scientific evidence, public health, technological development, economic benefits and sociopolitical aspects.

In the current review, as in the past, the Government has balanced between public health and local circumstances, as per the WHO's recommendations and the practices of advanced countries, when exploring the scope for further tightening the AQOs.

The strategies and targets outlined in the above three roadmap and blueprints have also formed the basis of discussion for the current review. The Environment and Ecology Bureau established in 2022 the Air Quality Objectives Review Working Group (the Working Group), which comprised members from the air science field, environmental groups, professional bodies, business associations and relevant trades, as well as representatives from related government bureaux and departments, to engage stakeholders and gauge their views on air quality improvement measures, with a view to projecting the air quality improvement in Hong Kong by 2030, and evaluating the scope for further tightening of the prevailing AQOs. The Working Group has conducted detailed discussion and deliberation on various air quality improvement measures with substantial emission reduction impacts by 2030, and endorsed the consultant's proposal to tighten five prevailing AQOs and set three new parameters introduced in the WHO AQGs in May 2023, having regard to the findings of the air quality assessment and health and economic impact assessment.

This consultation document presents the findings of the current review and seeks the public's views on the relevant recommendations. Please share your views with us during the two-month public consultation period.

We would like to take this opportunity to thank the Members of the Working Group and the Air Science and Health Task Force established under it for their participation and valuable views, which contributed to the smooth completion of the review.

Environment and Ecology Bureau

August 2023

BACKGROUND

Air Quality Objectives Review

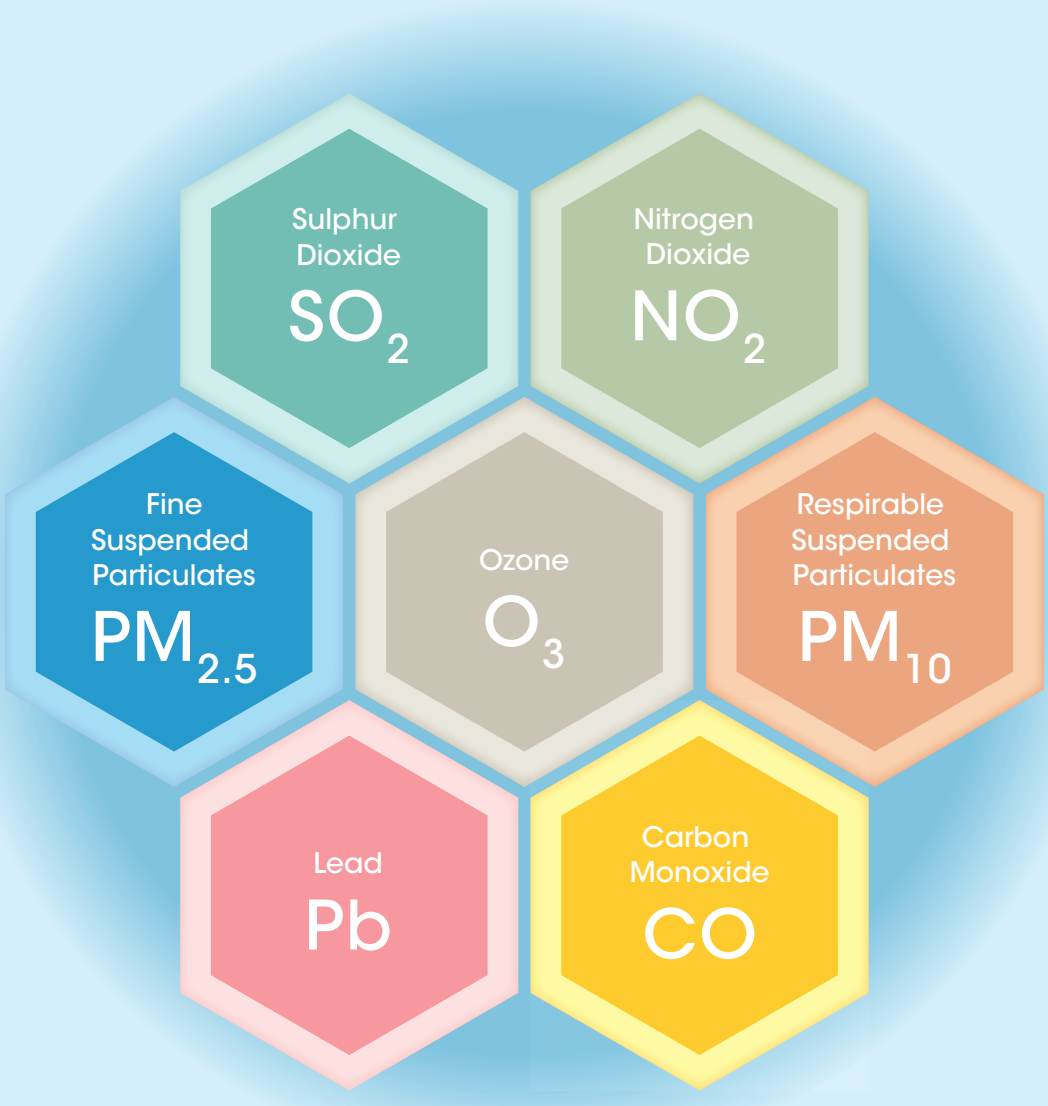
Under Section 7A of the Air Pollution Control Ordinance (Cap. 311) (APCO), the Secretary for Environment and Ecology is required to, starting from 1 January 2014, review the air quality objectives (AQOs) at least once every five years and submit a report of the review to the Advisory Council on the Environment (ACE) as soon as reasonably practicable. The Environment and Ecology Bureau had completed the previous AQOs review in December 2018 and submitted the review report to the ACE in 2019. The bill for the tightening of the AQOs was passed by the Legislative Council (LegCo) in 2021, and officially put into force on 1 January 2022.

The current review cycle is between January 2019 and December 2023. During the review, the Government has made reference to the principles of the Global Air Quality Guidelines (AQGs)[1] promulgated by the World Health Organisation (WHO) in September 2021, and adopted the recommended interim targets and AQG levels as benchmarks, to project the air quality improvement by 2030, with a view to evaluating the scope for further tightening of the prevailing AQOs and setting three new parameters introduced in the WHO AQGs.

[1] WHO Global Air Quality Guidelines http://www.who.int/publications/i/item/9789240034228

What are the Air Quality Objectives (AQOs)?

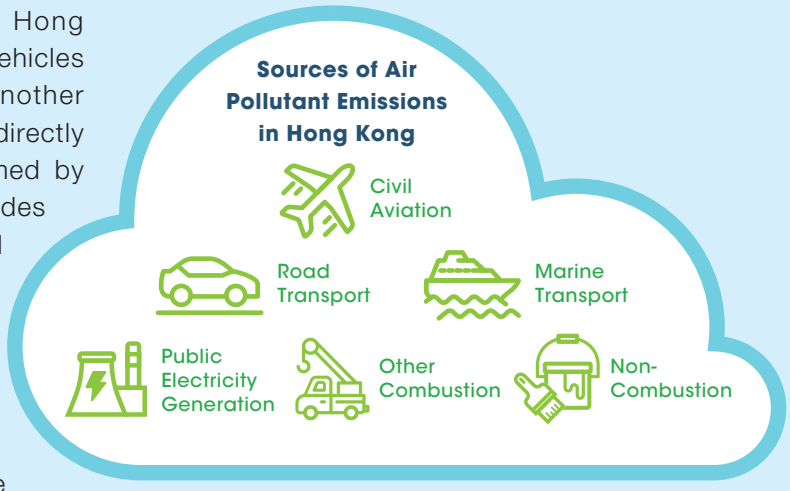
- AQOs refer to the short-term and long-term concentration targets of the seven major air pollutants prescribed in Section 7A and Schedule 5 of the APCO:



- In Hong Kong, there are altogether 12 prevailing AQOs covering the above seven air pollutants (see Page 8 for details).

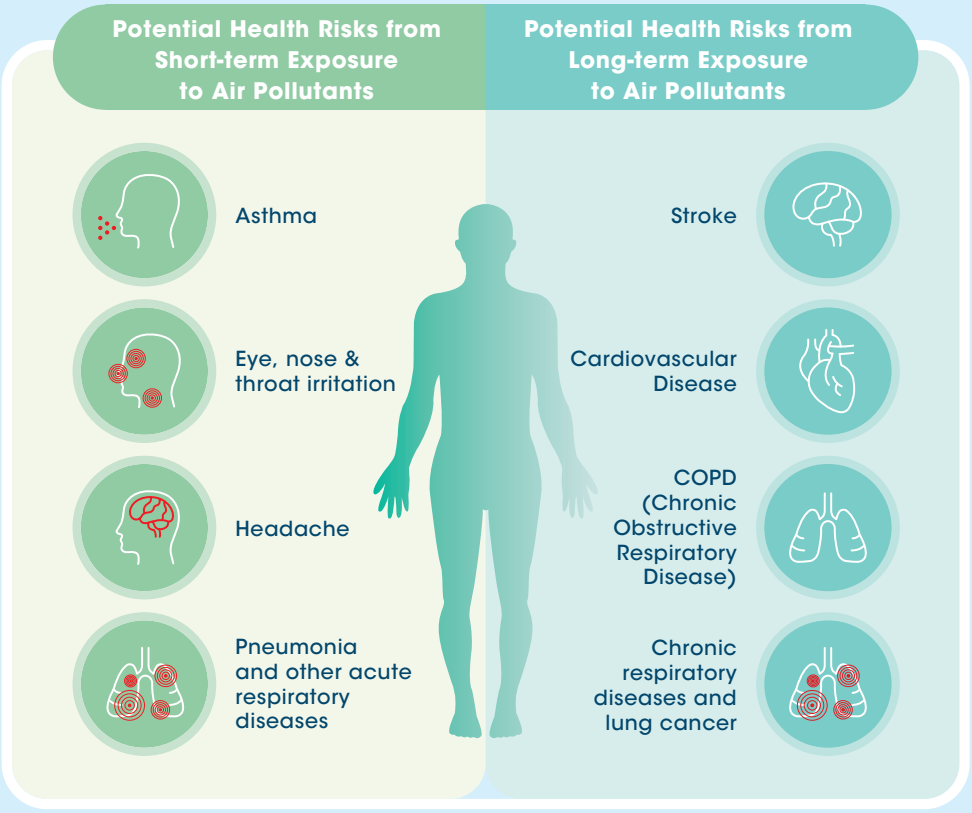
Impacts of Air Pollution on Health

The major air pollutant emissions in Hong Kong comes from power plants, motor vehicles and marine vessels (see **Annex 1**). Another common air pollutant, ozone (O_3), is not directly emitted from pollution sources, but formed by photochemical reactions of nitrogen oxides (NO_x) (such as nitric oxide and NO_2) and volatile organic compounds (VOCs) under sunlight.



The impacts of air pollution on health depend on a number of factors, including but not limited to the concentrations of air pollutants and the duration of exposure to polluted environments. Air pollution may cause health risks and hazards to a certain extent.

For instance, NO_2, SO_2 and O_3 would irritate the mucosa of eyes, nose, throat and lower respiratory tract. These air pollutants also exacerbate chronic respiratory diseases, with long-term exposure potentially reducing patients' lung function and weakening their resistance to respiratory infections. Studies also show that exposure to O_3 may provoke asthmatic attacks in patients with asthma.



Respirable suspended particulates (PM_{10}), which refers to suspended particulates in air with a nominal aerodynamic diameter of 10 micrometres (μm) or less, can get deep into our lungs and cause a wide range of adverse health impacts. Fine suspended particulates ($PM_{2.5}$), which refers to suspended particulates in air with a nominal aerodynamic diameter of 2.5 μm or less, can get into the circulatory system through the alveoli. Long-term exposure to these suspended particulates may increase the risks of cardiovascular and respiratory diseases as well as lung cancer.

The WHO Global Air Quality Guidelines

- Based on the cumulative results of the studies on air pollution and health, the WHO released the WHO AQGs in September 2021, imposing more stringent standards and introducing three new parameters (including the peak season level for O_3, 24-hour level for NO_2 and 24-hour level for CO).

- The WHO advises that every country should regard the achievement of the most stringent levels of the WHO AQGs as their ultimate goal, but this might be a difficult task for many countries. Therefore, gradual progress in improving air quality, marked by the achievement of interim targets, should be considered as a critical indicator of improving public health.

- The WHO recommends governments to consider their local conditions before adopting the suggested levels as legal air quality standards, including considerations on:

Scientific Evidence and Public Health

Technological Development and Economic Benefits

Sociopolitical Aspects

Hong Kong's Prevailing AQOs

Hong Kong's prevailing AQOs are benchmarked against the then latest *Air Quality Guidelines: Global Update 2005* of the WHO. Information on Hong Kong's prevailing AQOs and the WHO AQGs is set out in **Table 1**.

Table 1: Hong Kong's prevailing AQOs and the interim targets (ITs) and AQG levels of the WHO AQGs

Pollutant	Averaging Time	WHO AQGs (μg/m³)					No. of exceedances allowed per year under Hong Kong's AQOs
		IT-1	IT-2	IT-3	IT-4	AQG Level	
Sulphur Dioxide (SO_2)	10-minute	–				500	3
	24-hour	125	50	–	–	40	3
Respirable Suspended Particulates (PM_{10})	24-hour	150	100	75	50	45	9
	Annual	70	50	30	20	15	Not applicable
Fine Suspended Particulates ($PM_{2.5}$)	24-hour	75	50	37.5	25	15	35
	Annual	35	25	15	10	5	Not applicable
Nitrogen Dioxide (NO_2)	1-hour	–				200	18
	24-hour*	120	50	–		25	–
	Annual	40	30	20	–	10	Not applicable
Ozone (O_3)	8-hour	160	120	–	–	100	9
	Peak season*	100	70	–		60	–
Carbon Monoxide (CO)	1-hour#	–				30 000#	0
	8-hour	–				10 000	0
	24-hour*	7 000	–			4 000	–
Lead (Pb)	Annual	–				0.5	Not applicable

Note:

- ● Hong Kong's prevailing AQOs
- * New parameters in the WHO AQGs
- # As proposed under the WHO AQGs, the AQG level of CO (1-hour) is 35 000 μg/m³
- IT WHO AQGs interim target

Five of Hong Kong's prevailing AQOs have already pegged at the most stringent levels of the WHO AQGs.

Roles of Hong Kong's AQOs

- Hong Kong's AQOs are the goals for the phased air quality improvement plans devised by the Government. They also serve as benchmarks for assessing air quality.

- In addition, the AQOs have the following statutory functions:

  - benchmarks for approval of designated projects under the Environmental Impact Assessment Ordinance (Cap. 499)

  - a key factor to be considered when assessing specified process licence applications under the APCO

Applicants of environmental permits for designated projects or specified process licences are required to explore the feasibility of implementing the latest emission control and emission reduction technologies in their projects, so as to ensure that the projects and processes will not impede the achievement or maintenance of any relevant AQOs.

Air Quality Trend

Throughout the years, the Government has been committed to reducing air pollutant emissions in the region. Our efforts have yielded fruitful results, leading to the continuous improvement in Hong Kong's overall air quality. Between 2013 and 2022, the concentrations of Hong Kong's major air pollutants (including PM_{10}, $PM_{2.5}$, NO_2 and SO_2) have been reduced by 43% to 62% in the ambient air, while their concentrations have been reduced by 47% to 64% at the roadside. The air quality in 2022 is the best since the reunification.

> The concentrations of the major air pollutants in Hong Kong have been reduced by more than 40%-60% from 2013 to 2022.

The number of hours of reduced visibility in Hong Kong has also dropped significantly by 74% from the peak of 1 570 hours in 2004 to 401 hours in 2022, reflecting the effectiveness of emission reduction measures.

The air quality monitoring network operated by the Environmental Protection Department (EPD) comprises a total of 18 air quality monitoring stations (AQMS), including 15 general stations for monitoring ambient air quality and three roadside stations for monitoring roadside air quality. Please refer to **Figure 1**, **Figure 2** and **Annex 2** for the AQOs compliance status at various AQMS in 2022.

Figure 1: Changes in the concentrations of major air pollutants at Hong Kong's General AQMS in 2013 and 2022

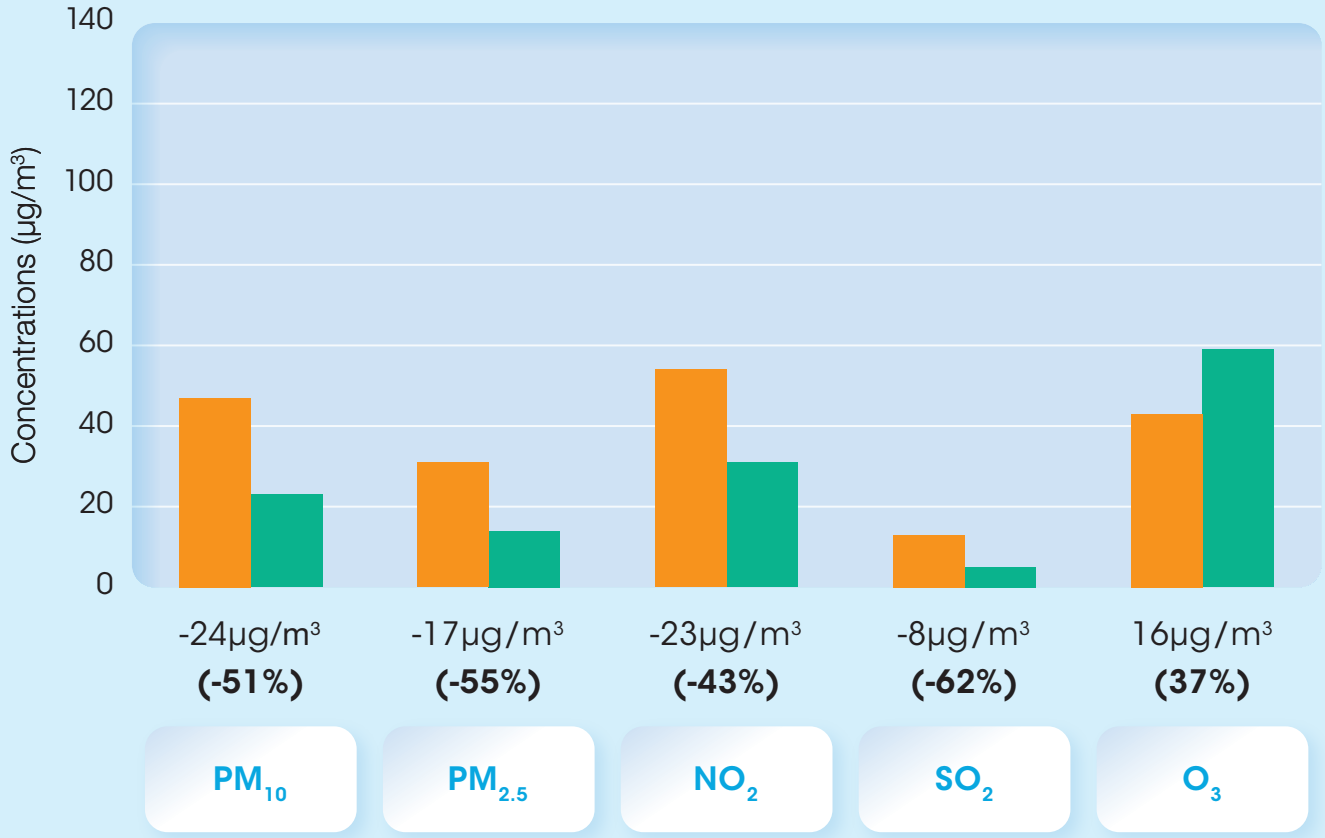
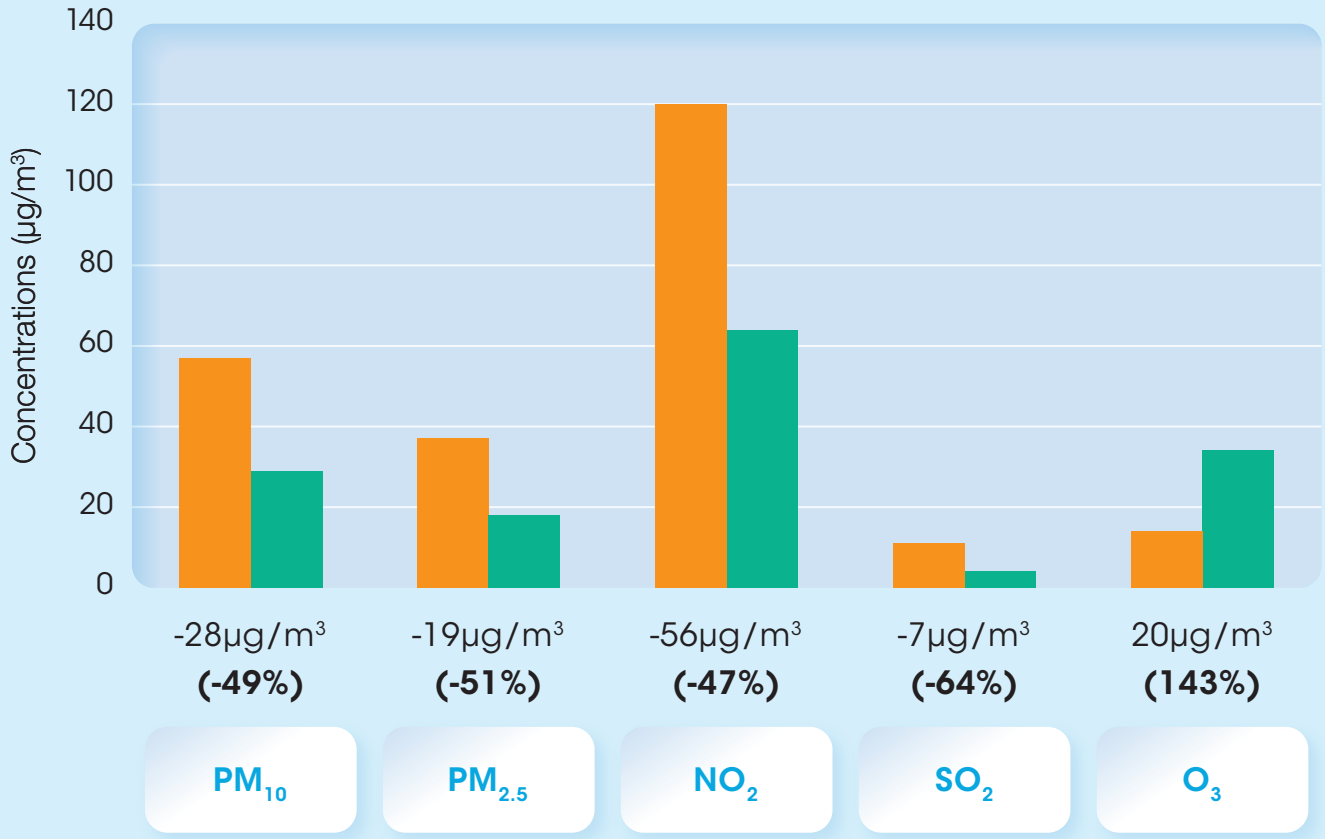


Figure 2: Changes in the concentrations of major air pollutants at Hong Kong's Roadside AQMS in 2013 and 2022



In 2022, except for O_3 and NO_2, the remaining five major air pollutants complied with the AQOs (see **Figure 3** and **Annex 2**).

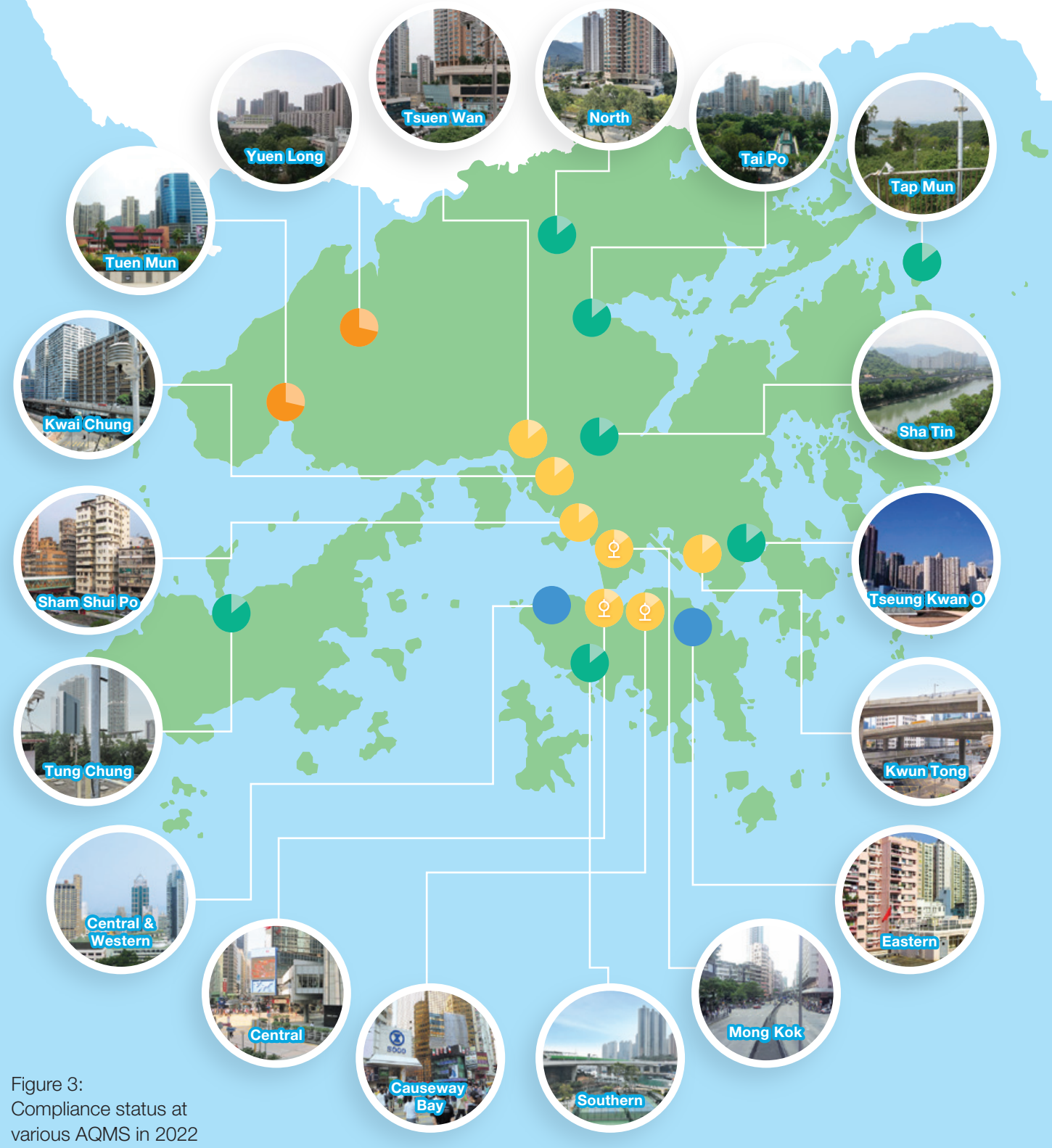


Figure 3:
Compliance status at various AQMS in 2022

Legend

- Five major pollutants complied with the AQOs (Except NO_2 and O_3)
- Six major pollutants complied with the AQOs (Except NO_2)
- Six major pollutants complied with the AQOs (Except O_3)
- All seven major pollutants complied with the AQOs
- Roadside AQMS

REVIEW PROCESS

Principles of the Review

- In the AQOs review, the Government has adopted the following guiding principles:

Benchmark against the WHO's latest guidelines, i.e. the WHO AQGs

Progressively tighten the AQOs through reviewing the AQOs at least once every five years for protection of public health

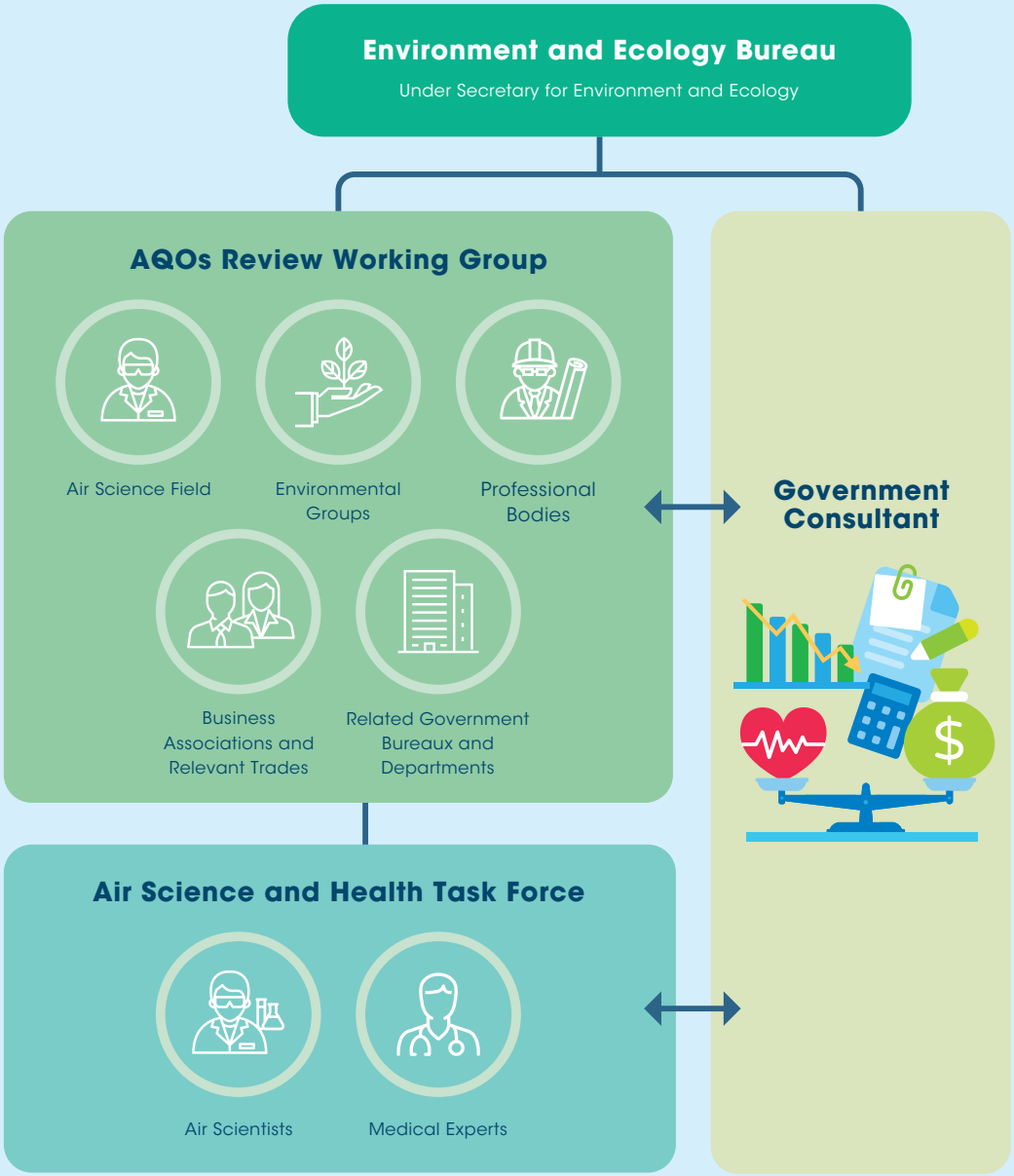
Review Work Process

- Explore practicable air quality improvement measures having regard to the latest technological development and applications.
- Assess the extent of air quality improvement and the associated health and economic impacts after implementing the proposed measures.
- Assess the scope for updating Hong Kong's AQOs by benchmarking against the WHO AQGs.

2019 has been adopted as the base year of the current review, so as to project air quality improvement by 2030 and assess the scope for further tightening the prevailing AQOs and setting the three new parameters introduced in the WHO AQGs.

The previous AQOs review used 2015 and 2025 as the base year and target year respectively, in order to assess the air quality improvement over the 10-year period and the scope for tightening the AQOs. **Given that the target year of the current AQOs review is 2030, why is the base year set at 2019 instead of 2020?**

We have first conducted air quality modelling using data from 2019 and 2020 respectively and compared the modelled air quality data with the measured data. It was found that the 2019 modelling results demonstrated a better agreement with the measured data than that of 2020. This might be due to the fact that there was some discrepancy in the 2020 data as a result of the impact of the epidemic and socio-economic activities. Subsequently, the consultant appointed by the Government submitted the air quality assessment methodologies for the current review to the Air Science and Health Task Force (the Task Force) and recommended to set 2019 as the base year. The methodologies were endorsed by the Task Force.



The Air Quality Objectives Review Working Group

- Led by the Under Secretary for Environment and Ecology, the Working Group comprises some 20 external members from the air science field, environmental groups, professional bodies, business associations and relevant trades, as well as officials representing related government bureaux and departments. It is tasked to engage stakeholders and gauge their views on the current review.

- The Working Group has deliberated on air quality improvement measures with substantial emission reduction impacts by 2030, and explored the scope for tightening the AQOs having regard to the findings of the air quality assessment and the health and economic impact assessment conducted by the consultant appointed by the Government.

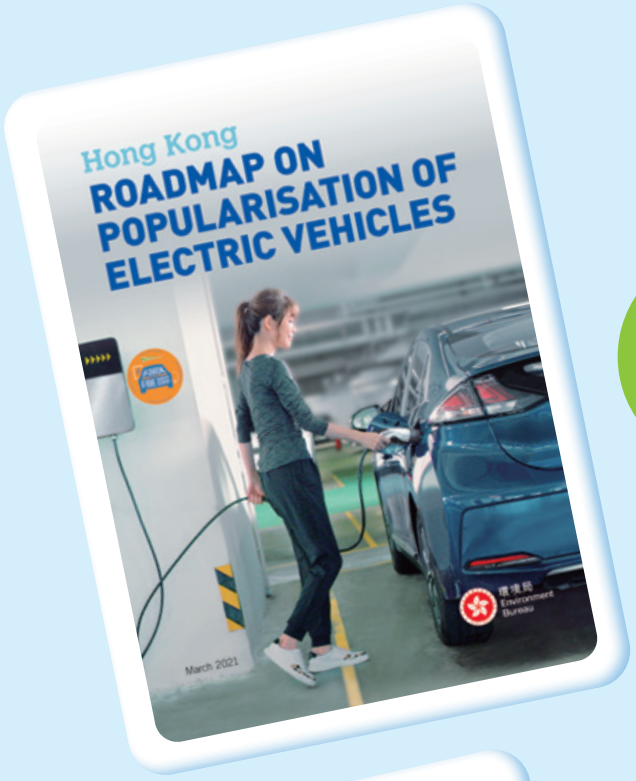
The Air Science and Health Task Force

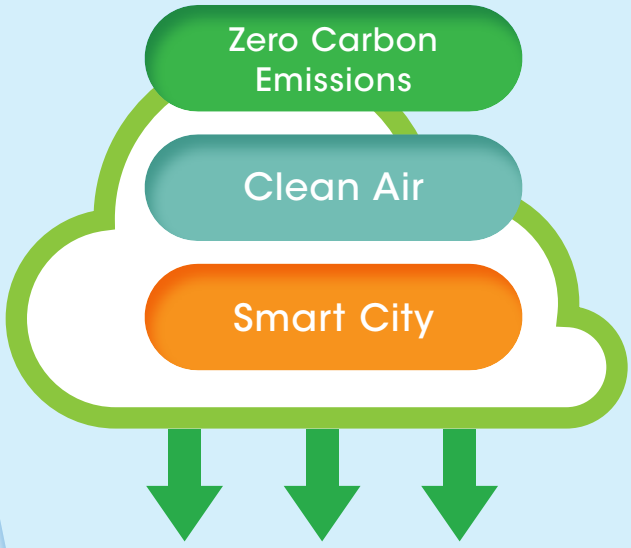
- The Air Science and Health Task Force comprising air scientists and medical experts has been established under the Working Group to advise on the methodologies and findings of the aforementioned assessments.

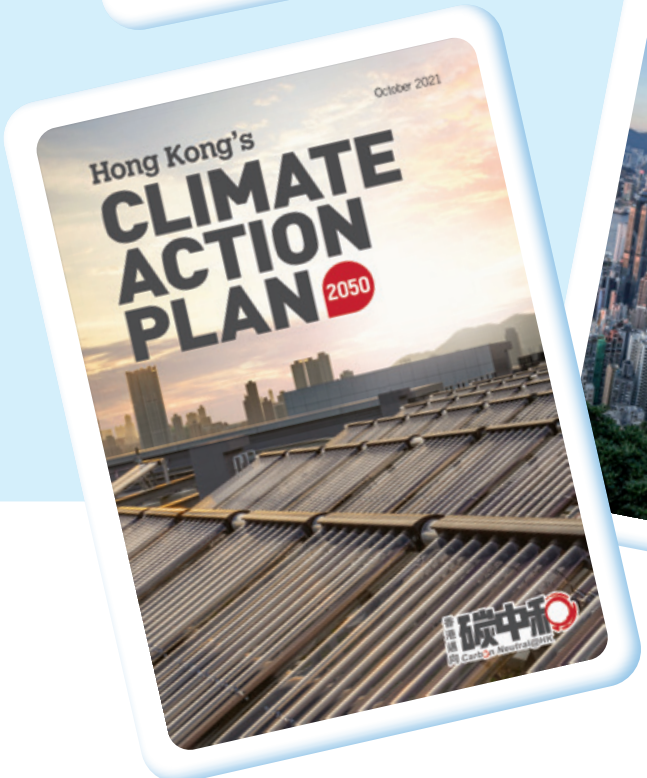
AIR QUALITY IMPROVEMENT MEASURES

The AQOs Review and the vision of "Zero Carbon Emissions • Clean Air • Smart City"

The current review has considered the key strategies and plans for carbon reduction and air quality improvement set out in the *Hong Kong Roadmap on Popularisation of Electric Vehicles*, *Clean Air Plan for Hong Kong 2035* and *Hong Kong's Climate Action Plan 2050* published by the Government in 2021, so as to ensure the review is in line with the Government's strategies and goals for combating climate change and achieving carbon neutrality.







Air Quality Improvement Measures

In the course of the review, the Working Group has considered different proposals under the sectors of road transportation, marine transportation, power generation and other emission sources. After discussion and deliberation, the Working Group has consolidated the proposals into 21 air quality improvement measures (details are at **Annex 3**).

The 21 air quality improvement measures cover different aspects and are closely related to the daily lives of the public. Examples include:

Power Generation

- Tightening of emission limits of power plants under the new low-carbon electricity generation strategy
- Reduction of energy consumption of new and existing commercial and residential buildings

Road Transportation

- No new registration of fuel-propelled and hybrid private cars in 2035 or earlier
- Electrification of public transport (e.g. franchised buses, public light buses and taxis) and commercial vehicles
- Development of electric vehicle charging network

Marine Transportation

- Tightening of sulphur content limit of locally supplied marine light diesel
- Use of liquefied natural gas by marine vessels

Other Emission Sources

- Tightening and extension of control on products containing VOCs, e.g. architectural paint and consumer products
- Tightening of emission standards on non-road mobile machineries newly supplied to Hong Kong

Consideration for Regional Emission Reduction

The Guangdong Provincial Government announced the *Guangdong Province 14th Five-Year Plan for Ecological and Environmental Protection* (the 14th Five-Year Plan)[2] in 2021, which set out the strategies for air quality policies and future air pollution mitigation pathways.

The Hong Kong Special Administrative Region (HKSAR) Government has been collaborating closely with the Guangdong provincial authorities to combat regional air quality issues. The two governments have also conducted a study on the post-2020 regional emission reduction targets and concentration levels, with a view to formulating targets or levels for 2025 and 2030.

In addition, the study on "Characterisation of Photochemical Ozone Formation, Regional and Super-Regional Transportation in the Greater Bay Area (GBA)" is also in progress, so as to gain an in-depth understanding on the origin of ozone formation and the regional and super-regional transportation characteristics in the GBA, and to facilitate the formulation of effective ozone mitigation strategies.

The current review has examined all announced and planned national clean air policies, as well as the pathways to promoting future air pollution mitigation as promulgated in the 14th Five-Year Plan. The regional emission reduction targets committed have also been considered when assessing the air quality in 2030. Please refer to **Annex 4** for the methodologies for air quality assessment and health and economic impact assessment.

[2] *Guangdong Province 14th Five-Year Plan for Ecological and Environmental Protection* https://gdee.gd.gov.cn/ghjh3128/content/post_3701714.html (Chinese only).

REVIEW FINDINGS

Air Quality Assessment Results

The results of the air quality assessment indicate that the implementation of the proposed air quality improvement measures will bring about continuous reduction in the concentrations of PM_{10}, $PM_{2.5}$, NO_2 and SO_2 in 2030. However, there will be a slight increase in the projected O_3 level in 2030 because of the high regional background concentration.

Taking into account the 2030 air quality assessment results, Hong Kong's prevailing AQOs and the interim targets and AQG levels of the WHO AQGs, we have arrived at the following results:

- Five Hong Kong's prevailing AQOs that have already been set at the AQG levels set out in the WHO AQGs (i.e. AQOs for NO_2 (1-hour), SO_2 (10-min), CO (both 1-hour and 8-hour) and Pb (annual)) will continue to be complied with;

- Of the remaining seven prevailing AQOs that are set under the interim targets set out in the WHO AQGs, five of them (i.e. AQOs for PM_{10} (both 24-hour and annual), $PM_{2.5}$ (both 24-hour and annual) and SO_2 (24-hour)) will reach their next higher levels or the AQG level; and

- Three new parameters introduced in the WHO AQGs (i.e. NO_2 (24-hour), O_3 (peak season) and CO (24-hour)) will be set as Hong Kong's AQOs.

This section will explain in detail the assessment results of AQOs not yet set at the AQG levels set out in the WHO AQGs.

Respirable Suspended Particulates (PM_{10})

The air quality assessment results show that:

- The annual average concentration of PM_{10} in 2030 could meet the next higher level at IT-3 (30 µg/m³).
- The concentration level of PM_{10} (24-hour) in 2030 could meet the next higher level at IT-3 (75 µg/m³), with the prevailing number of allowable exceedances of 9 times per year remaining unchanged.

Recommendation on tightening of AQOs: Respirable Suspended Particulates (PM_{10})

Fine Suspended Particulates ($PM_{2.5}$)

The air quality assessment results show that:

- The annual average concentration of $PM_{2.5}$ in 2030 could meet the next higher level at IT-3 (15 µg/m³).
- The concentration level of $PM_{2.5}$ (24-hour) in 2030 could meet the next higher level at IT-3 (37.5 µg/m³), while the number of allowable exceedances could be tightened to 18 times per year.

Recommendation on tightening of AQOs: Fine Suspended Particulates ($PM_{2.5}$)

Is Hong Kong's statutory AQOs for $PM_{2.5}$ similar to those of advanced countries/ cities in the world?

Hong Kong intends to tighten the statutory AQOs for $PM_{2.5}$ to IT-3 level set out in the WHO AQGs, which will be broadly in line with the current standards adopted in Japan, Singapore, Korea and the United States, and more stringent than that adopted in the European Union. Although the tightened AQOs for $PM_{2.5}$ will still be less stringent than those adopted in Canada and Australia, no country to our knowledge has adopted the AQG level (5 $\mu g/m^3$) set out in the WHO AQGs as its statutory air quality standard.

Sulphur Dioxide (SO_2)

The air quality assessment results show that the concentrations of SO_2 (24-hour) in 2030 could meet the more stringent AQG level (40 µg/m³) set out in the WHO AQGs, with the prevailing number of allowable exceedances of 3 times per year remaining unchanged.

Recommendation on Tightening of AQOs: Sulphur Dioxide (SO_2)

24-hour AQO
IT-2
(50 µg/m³)
⬇
AQG level
(40 µg/m³)

Projection results show that the concentration of SO_2 (24-hour) in 2030 could achieve the AQG level set out in the WHO AQGs.

Nitrogen Dioxide (NO_2) and Ozone (O_3)

The prevailing AQO for NO_2 (annual) (40 µg/m³) was set at the AQG level under the *Air Quality Guidelines: Global Update 2005*. The WHO AQGs have updated the AQG level for NO_2 (annual) and introduced four interim targets. The updated AQG level has been reduced to 10 µg/m³, which is one-fourth of that set out in the *Air Quality Guidelines: Global Update 2005*. The Government will continue to implement a series of measures to reduce air pollutant emissions from various sources, such as road transportation, marine transportation and power plants, and will explore the scope for further tightening the relevant AQOs in the next review.

As the regional background concentration of O_3 is relatively high, the air quality assessment results show that 8-hour concentration of O_3 in most parts of Hong Kong will still exceed the current AQO level (IT-1) in 2030. The Government will continue to work closely with the Guangdong Provincial Government to improve regional air quality, and explore the scope for further tightening the relevant AQOs in the next review.

Nitrogen Dioxide (NO_2)
Annual AQO
IT-1
(40 µg/m³)

Ozone (O_3)
8-hour AQO
IT-1
(160 µg/m³)

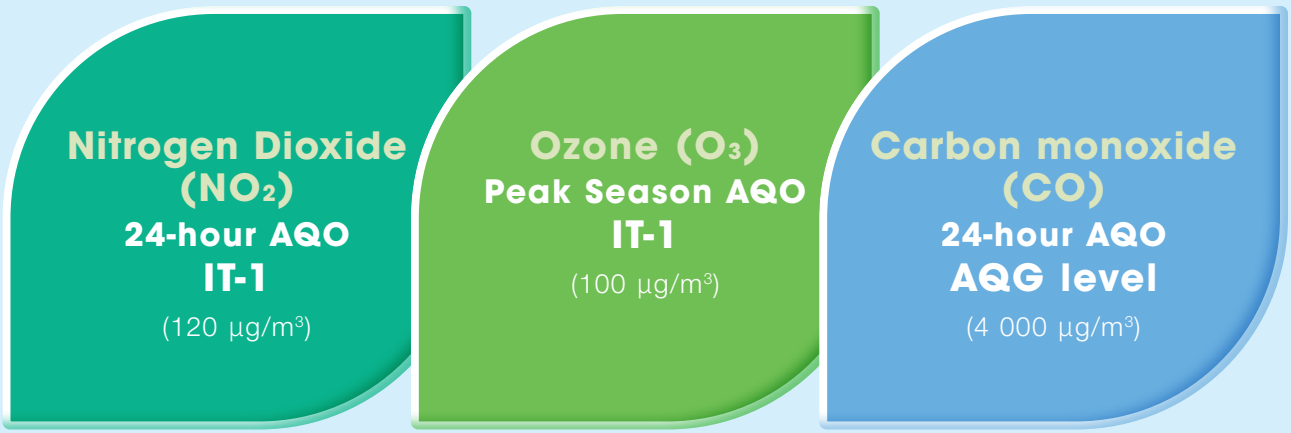
AQOs Newly Introduced in the WHO AQGs

The air quality assessment results show that the concentration level of nitrogen dioxide (NO_2) (24-hour) in 2030 could meet IT-1 (120 µg/m³), with a number of allowable exceedances of 9 times per year.

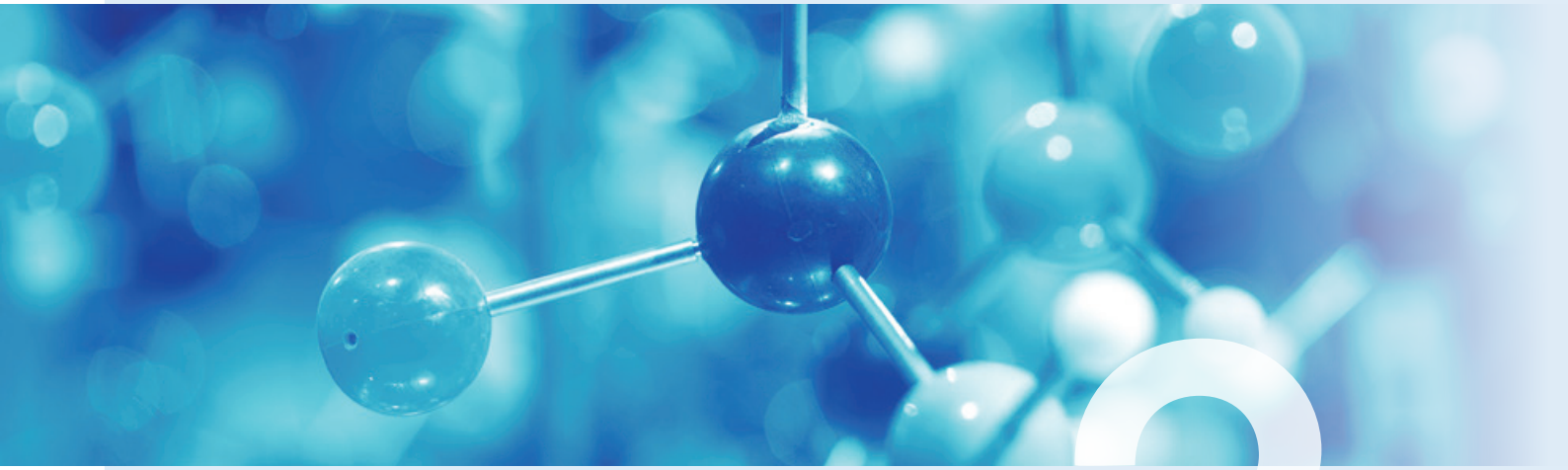
Due to the high regional background concentration of ozone, the air quality assessment results show that the peak season concentration level of ozone would be similar to that of the 8-hour level in 2030, thus failing to achieve IT-1. Nonetheless, targeting a phased improvement in ozone concentration, we still propose setting the AQO for peak season ozone at IT-1 (100 µg/m³).

According to historical data, the concentration levels of carbon monoxide (24-hour) have been well below the AQG level set out in the WHO AQGs. Therefore, it is recommended to set the AQO for carbon monoxide (24-hour) at the AQG level with no exceedance allowed.

In view of the guiding principle of the review to benchmark against the WHO AQGs and progressively tighten the AQOs for protection of public health, the Government proposes to set the following new AQOs having regard to the above assessment results:



The 2030 air quality assessment results are shown in **Annex 5**.



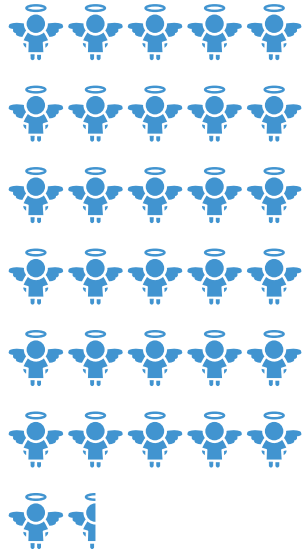
The WHO AQGs have introduced three new AQOs, including AQO for peak season ozone. The 2030 air quality assessment results show that the peak season ozone levels in all districts of Hong Kong could not meet the IT-1 level set out in the WHO AQGs. However, in the current review, the Government still proposes to introduce this new AQO and set it at the IT-1 level. Why? How can ozone level be reduced?

Ozone pollution is a complex regional air pollution issue. The study on "Characterisation of Photochemical Ozone Formation, Regional and Super-Regional (GBA)" is currently in progress, aiming to understand the origins of ozone precursors (in particular VOCs), ozone formation mechanisms and regional and super-regional transportation characteristics in the GBA to provide a scientific basis for formulating ozone mitigation strategies. Therefore, although the 2030 air quality assessment results show that the peak season ozone concentration could not meet the IT-1 level (100 µg/m^3) set out in the WHO AQGs, the Government still wishes to propose using the minimum threshold set by the WHO as a starting point, such that air quality can be continuously enhanced for better protection of public health via sustained collaboration among the governments of Guangdong, Hong Kong and Macau.

The Health and Economic Impact Assessment Results

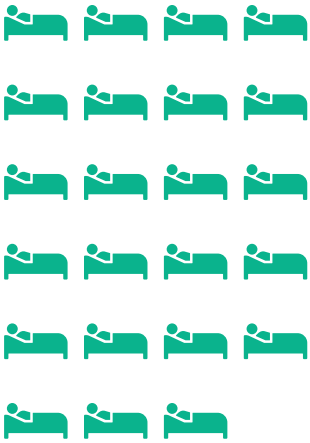
According to the 2030 air quality assessment results, improvement in air quality could bring about the following health and economic benefits to Hong Kong when compared with 2019 baseline data:

Reduction of about 3 150 premature deaths



= 100 premature deaths

Reduction of about 2 300 hospital admissions



= 100 hospital admissions

Reduction of about 927 900 out-patient visits

= 10 000 out-patient visits

Reduction of hospital admissions can save about **HK$43million**

Reduction of out-patient visits can save about **HK$232million**

* All costs are adjusted to the price level of 2019

Summary of Proposed Updating of AQOs

Pollutant	Averaging Time	WHO AQGs (μg/m³)					Number of exceedances allowed per year under Hong Kong's AQOs
		IT-1	IT-2	IT-3	IT-4	AQG level	
SO_2	10-minute	–				500	3
	24-hour	125	50	–		40	3
PM_{10}	24-hour	150	100	75	50	45	9
	Annual	70	50	30	20	15	Not applicable
$PM_{2.5}$	24-hour	75	50	37.5	25	15	35 → 18
	Annual	35	25	15	10	5	Not applicable
NO_2	1-hour	–				200	18
	24-hour*	120	50	–		25	9
	Annual	40	30	20	–	10	Not applicable
O_3	8-hour	160	120	–		100	9
	Peak season*	100	70	–		60	Not applicable
CO	1-hour	–				30 000#	0
	8-hour	–				10 000	0
	24-hour*	7 000	–			4 000	0
Pb	Annual	–				0.5	Not applicable

The Government will continue its efforts in improving air quality, and will explore the scope for further tightening the AQOs in the next AQOs review period (i.e. 2024-2028).

Notes:

- Hong Kong's prevailing AQOs.
- Proposed updates on Hong Kong's AQOs.

* New parameters in the WHO AQGs

\# As proposed under the WHO AQGs, the AQG level of CO (1-hour) is 35 000 μg/m³.

SHARE YOUR VIEWS

Share Your Views

1. Hong Kong's air quality has been continuously improving, with major air pollutants reduced by more than 40% to 60% over the past ten years, and the number of hours of reduced visibility gradually decreased from the peak of 1 570 hours in 2004 to 401 hours last year (a decrease of 74%). Are you aware of the above improvements?
   - ☐ Aware
   - ☐ Slightly aware
   - ☐ Not aware

2. The WHO recommends governments to consider their local conditions before adopting the suggested levels as legal air quality standards, including considerations on scientific evidence, public health, technological development, economic benefits and sociopolitical aspects. Do you agree with this approach?
   - ☐ Agree
   - ☐ Somewhat agree
   - ☐ Disagree

3. What are your views on the proposed tightening of five prevailing AQOs and introducing three new AQOs in the current review?
   - ☐ Agree
   - ☐ No comment
   - ☐ Other comments (please specify):

     _____

     _____

     _____

     _____

4. Do you have any suggestions for the next AQOs review?
   - ☐ Adopt the same method as the current review
   - ☐ No comment
   - ☐ Other comments (please specify):

     _____

     _____

     _____

     _____

Share Your Views

We welcome your valuable views! The online views collection form is available on aqoreview.hk. You may complete and submit it online directly, download it online or complete the form on the previous page, and send it to the Environment and Ecology Bureau on or before 31 October 2023 by email, fax or post.

Website: aqoreview.hk

Email: aqoreview@eeb.gov.hk

Fax: 2838-2155

Post: Air Policy Group (1), Environment and Ecology Bureau, 33/F, Revenue Tower, 5 Gloucester Road, Wan Chai, Hong Kong

Online Views Collection Form

Please scan:

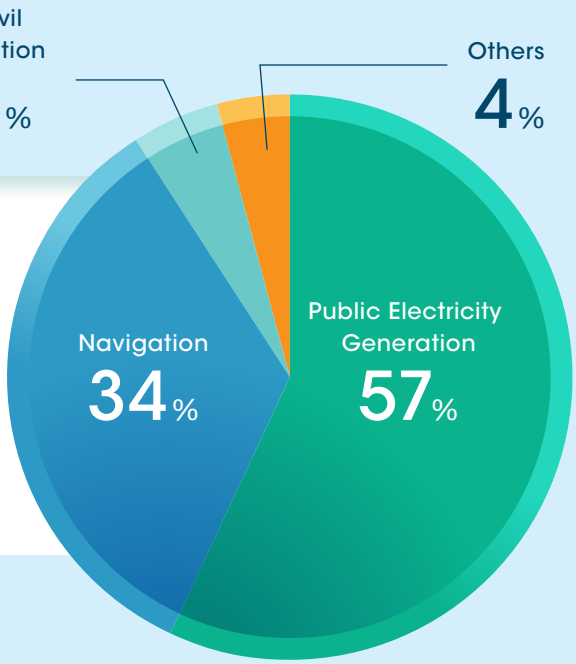
Important Notice

Please note that the Government would wish, either during private or public discussion with others or in any subsequent report, to be able to refer to and attribute views submitted in response to this consultation document. Any request to treat all or part of a response in confidence will be respected, but if no such request is made, it will be assumed that the response is not intended to be confidential.

Annex 1 – Hong Kong Air Pollutant Emissions in 2021

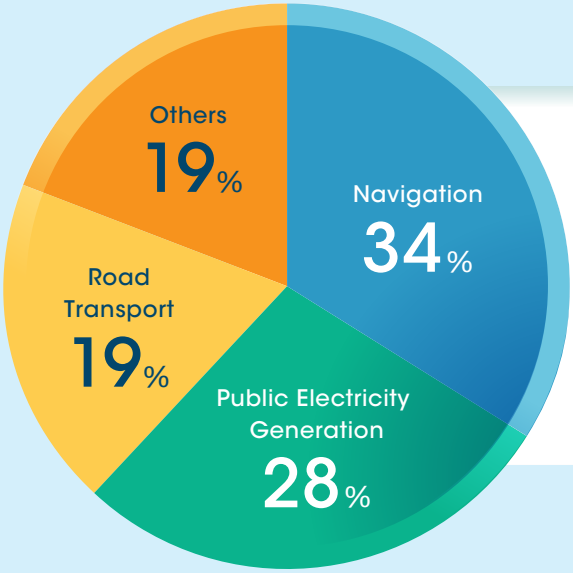
Sulphur Dioxide (SO_2)

Total Emissions:
4 760 tonnes



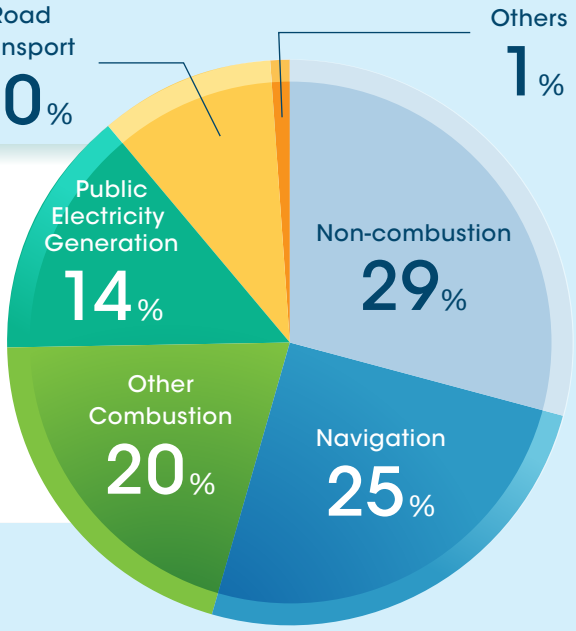
Nitrogen Oxides (NO_x)

Total Emissions:
53 620 tonnes



Respirable Suspended Particulates (PM_{10})

Total Emissions:
2 820 tonnes



Note:
The total percentage may not add up to 100% due to rounding.

Annex 2 – Compliance Status of AQOs at EPD's Air Quality Monitoring Stations in 2022

Station	Long-term				Short-term							
	PM_{10}	$PM_{2.5}$	NO_2	Pb	O_3	NO_2	PM_{10}	$PM_{2.5}$	SO_2		CO	
	1-year				8-hr	1-hr	24-hr	24-hr	10-min	24-hr	1-hr	8-hr
General Station												
Central & Western	√	√	√	√	X	√	√	√	√	√	–	–
Southern	√	√	√	–	X	√	√	√	√	√	√	√
Eastern	√	√	√	–	X	√	√	√	√	√	–	–
Kwun Tong	√	√	X	√	√	√	√	√	√	√	–	–
Sham Shui Po	√	√	X	√	X	√	√	√	√	√	–	–
Kwai Chung	√	√	X	√	√	√	√	√	√	√	–	–
Tsuen Wan	√	√	√	√	√	√	√	√	√	√	√	√
Tseung Kwan O	√	√	√	√	X	√	√	√	√	√	√	√
Yuen Long	√	√	√	√	X	√	√	√	√	√	√	√
Tuen Mun	√	√	√	√	X	√	√	√	√	√	√	√
Tung Chung	√	√	√	√	X	√	√	√	√	√	√	√
Tai Po	√	√	√	–	X	√	√	√	√	√	–	–
Sha Tin	√	√	√	–	X	√	√	√	√	√	–	–
North	√	√	√	–	X	√	√	√	√	√	√	√
Tap Mun	√	√	√	–	X	√	√	√	√	√	√	√
Roadside Station												
Causeway Bay	√	√	X	–	√	X	√	√	√	√	√	√
Central	√	√	X	–	√	X	√	√	√	√	√	√
Mong Kok	√	√	X	√	√	X	√	√	√	√	√	√

Notes:

"√" Complied with the AQOs

"X" Not complied with the AQOs

"–" Not measured

Annex 3 – Proposed Air Quality Improvement Measures

A. Road Transport

1. No new registration of fuel-propelled and hybrid private cars in 2035 or earlier
2. Electrification of franchised bus fleets and phasing out of conventional diesel franchised buses
3. Introduction of hydrogen fuel cell double deck buses
4. Electrification of public light buses
5. Electrification of taxis
6. Electrification of vehicles such as goods vehicles, light buses, non-franchised buses and motorcycles
7. Phasing out of aged diesel commercial vehicles
8. Electrification of the fleets of Government and public organisations
9. Development of electric vehicle (EV) charging network comprising public and private charging facilities
10. Training of professionals and mechanics in EV repair and maintenance, as well as handling of retired EV batteries
11. Development of green transport network
12. Introduction of green elements such as pedestrian-friendly and bicycle-friendly facilities to urban areas, new towns and new development areas

B. Marine Transport

13. Replacement of traditional ferries with new energy ferries

14. Tightening of sulphur content limit of locally supplied marine light diesel

15. Imposition of emission standards for new petrol-powered outboard engines

16. Use of liquefied natural gas for vessels

17. Ocean-going vessels to use marine fuel with sulphur content not exceeding 0.1%

C. Electricity Generation

18. Tightening of emission limits of power plants under the new low-carbon electricity generation strategy
19. Reduction of energy consumption of new and existing commercial and residential buildings

D. Other Emission Sources

20. Tightening and extension of control on products containing VOCs (e.g. architectural paint and consumer products)

21. Tightening of emission standards on non-road mobile machineries newly supplied to Hong Kong

Annex 4 – Assessment Methodologies

Air Quality Assessment

The Air Science and Health Task Force endorsed the adoption of the updated "Pollutants in the Atmosphere and their Transport over Hong Kong" (PATH) Modelling System in assessing the changes in air quality by 2030.

What is PATH?

PATH is a modelling system for assessing the impacts of air pollutant emissions on the air quality at specific locations, and is extensively used in environmental impact assessment studies.

With 2019 as the base year, the current assessment was conducted by inputting meteorological information and forecasting the emission data in Hong Kong, the Greater Bay Area, the Guangdong Province and other regions outside Guangdong to simulate the transport and chemical reaction of air pollutants in 2030 for projection of air quality condition. We have also compared the 2019 air quality modelling results with the monitoring data recorded at the EPD's air quality monitoring stations, which proved the accuracy of the modelling results.

In assessing the changes in air quality by 2030 using PATH, we have made reference to the latest official data/information of different regions, and inputted the emission data of each region by:

Regions outside the Guangdong Province

- Using the emission data of the regions in 2030 , which is obtained from other official sources

Guangdong Province

- Estimating the emissions in 2030 based on the emission reduction targets mentioned in the 14th Five- Year Plan of the Guangdong Province

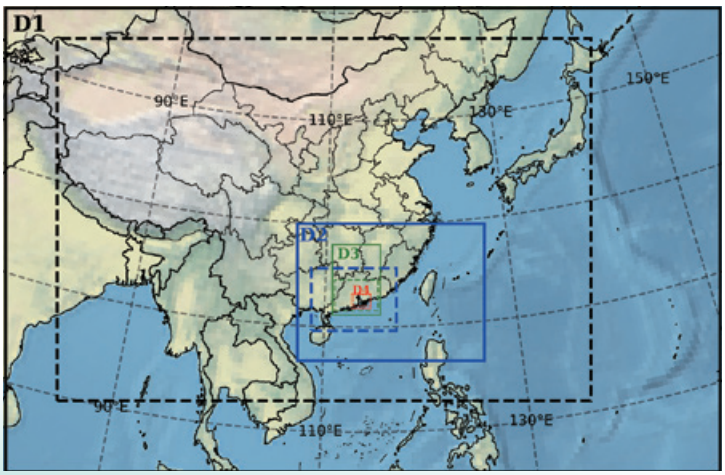
Hong Kong

- Considering the emission reduction potential of the air quality improvement measures proposed in the AQOs Reviews (see **Annex 3** for the measures); and
- Projecting the 2030 baseline emissions of other emission sources (e.g. aviation) based on the progress of the measures implemented and committed by the HKSAR Government and the Guangdong Provincial Government

Meteorological information

Consideration of the pollutant emissions in different regions

"Pollutants in the Atmosphere and their Transport over Hong Kong" Modelling System (PATH v2.1)



Domain boundary for metrological model

Domain boundary for emission & chemical transport model

Calculation of the concentrations of different pollutants

Projection of the air quality in 2030

Health and Economic Impact Assessment (HEIA)

- Improvements in air quality can bring health benefits, such as reducing premature deaths, hospital admissions and out-patient visits, particularly in relation to respiratory and cardiovascular diseases.

- HEIA can estimate the above health benefits and the associated medical costs that can be saved.

- The Air Science and Health Task Force has agreed to conduct an HEIA based on a tool developed by the Chinese University of Hong Kong.

There are various methodologies and approaches for assessing the health and economic impacts of air pollution, each with its specific assumptions as well as limitations.

Annex 5 – Projected Air Quality in 2030

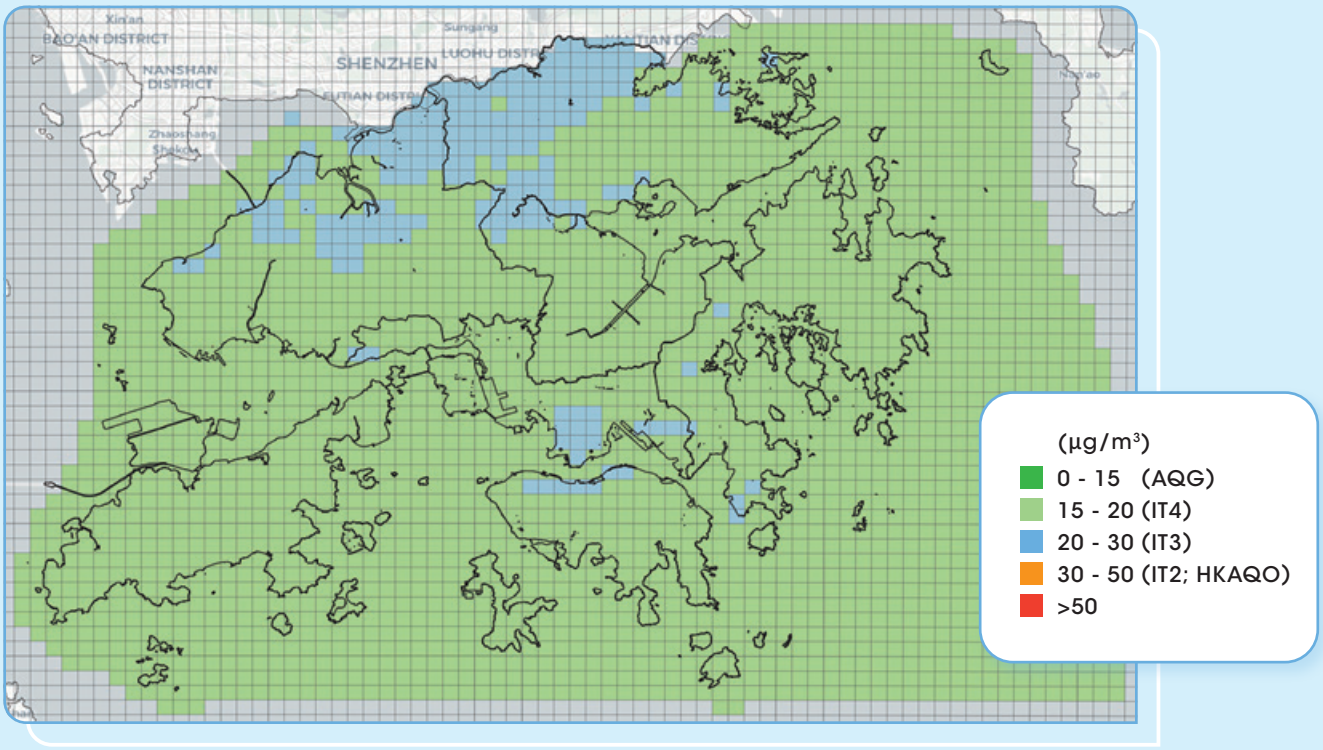


Figure 1 – Annual average PM_{10} concentration in 2030

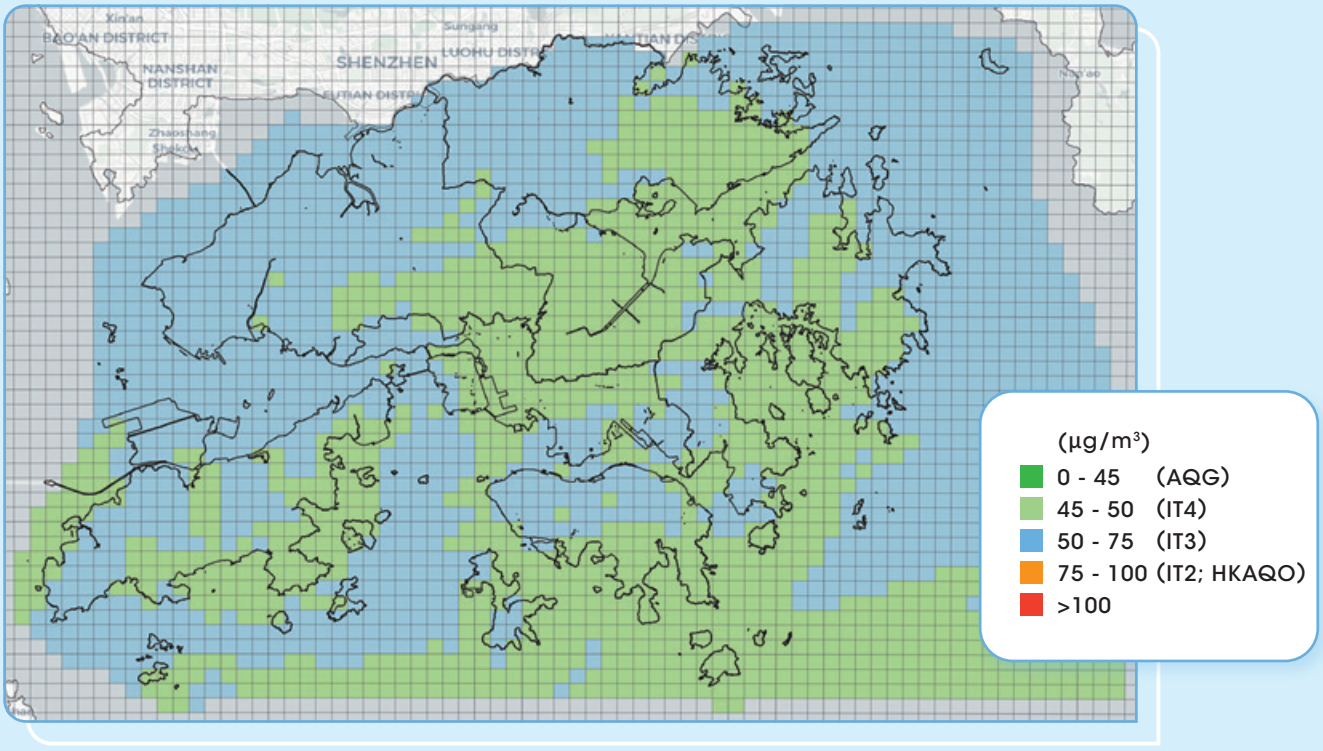


Figure 2 – 10th highest daily average PM_{10} concentration in 2030

Notes:

IT – Interim Target of the WHO AQGs

AQG level – Ultimate Target of the WHO AQGs

HKAQOs – Hong Kong Air Quality Objectives

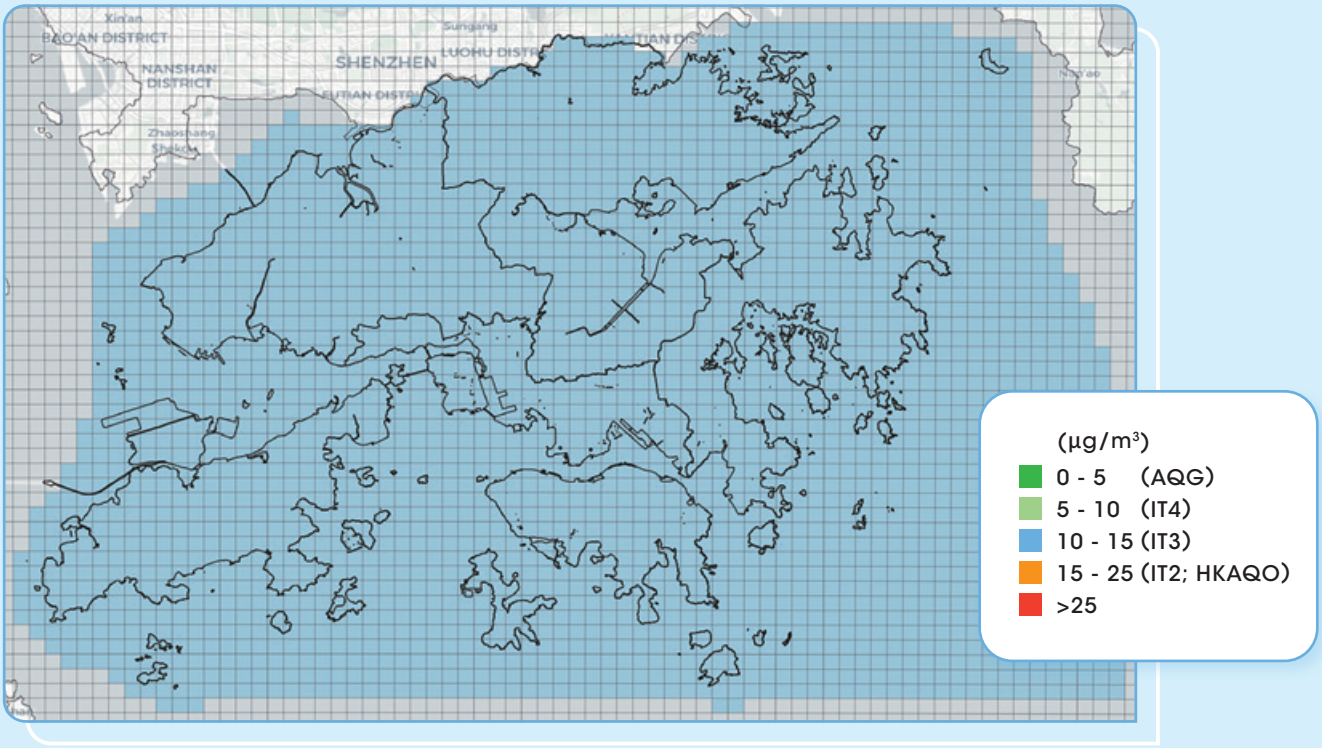


Figure 3 – Annual average $PM_{2.5}$ concentration in 2030

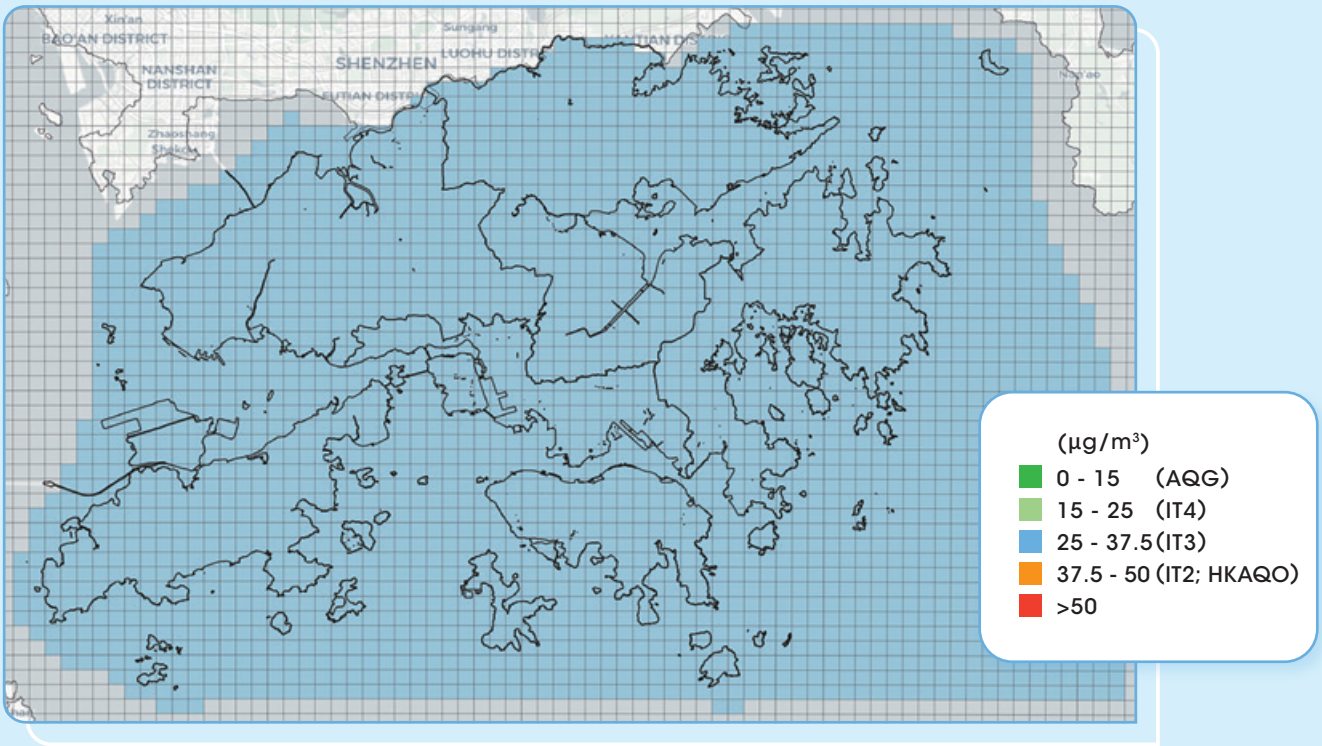


Figure 4 – 19th highest daily average $PM_{2.5}$ concentration in 2030

Notes:

IT – Interim Target of the WHO AQGs

AQG level – Ultimate Target of the WHO AQGs

HKAQOs – Hong Kong Air Quality Objectives

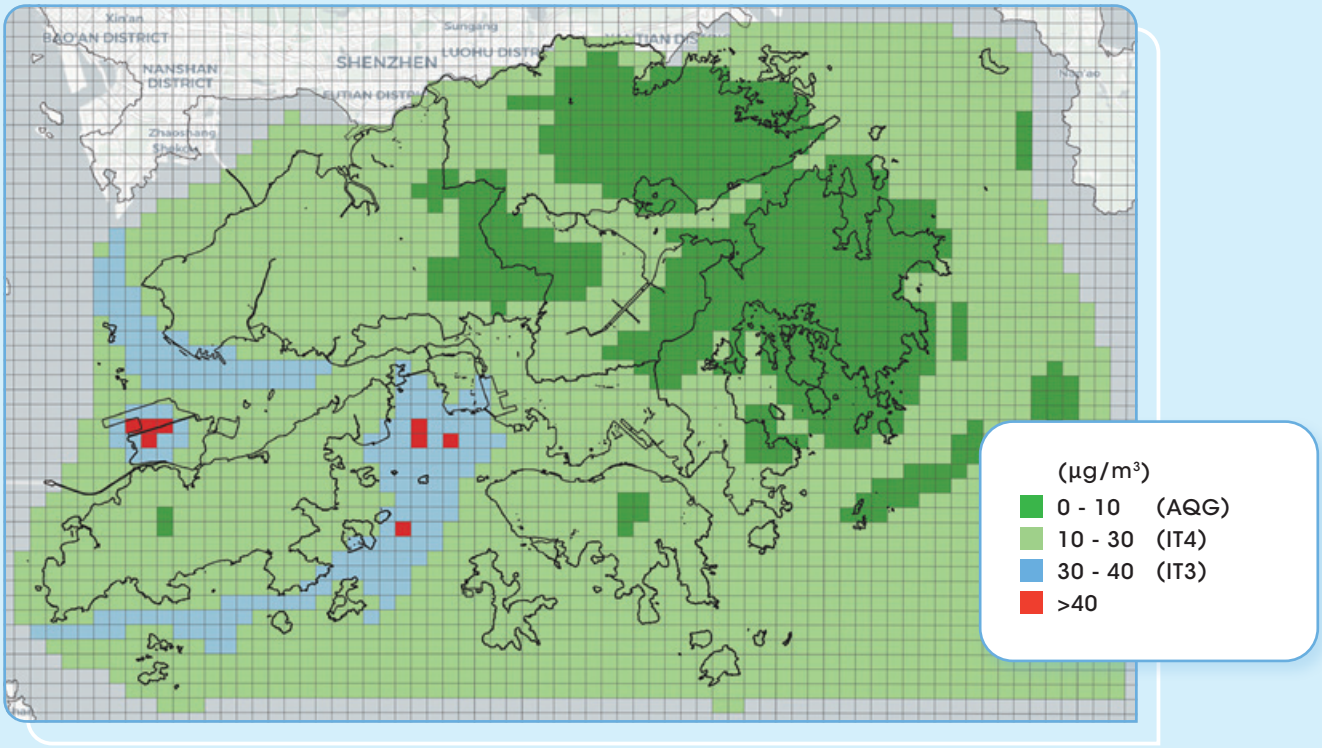


Figure 5 – Annual average NO_2 concentration in 2030

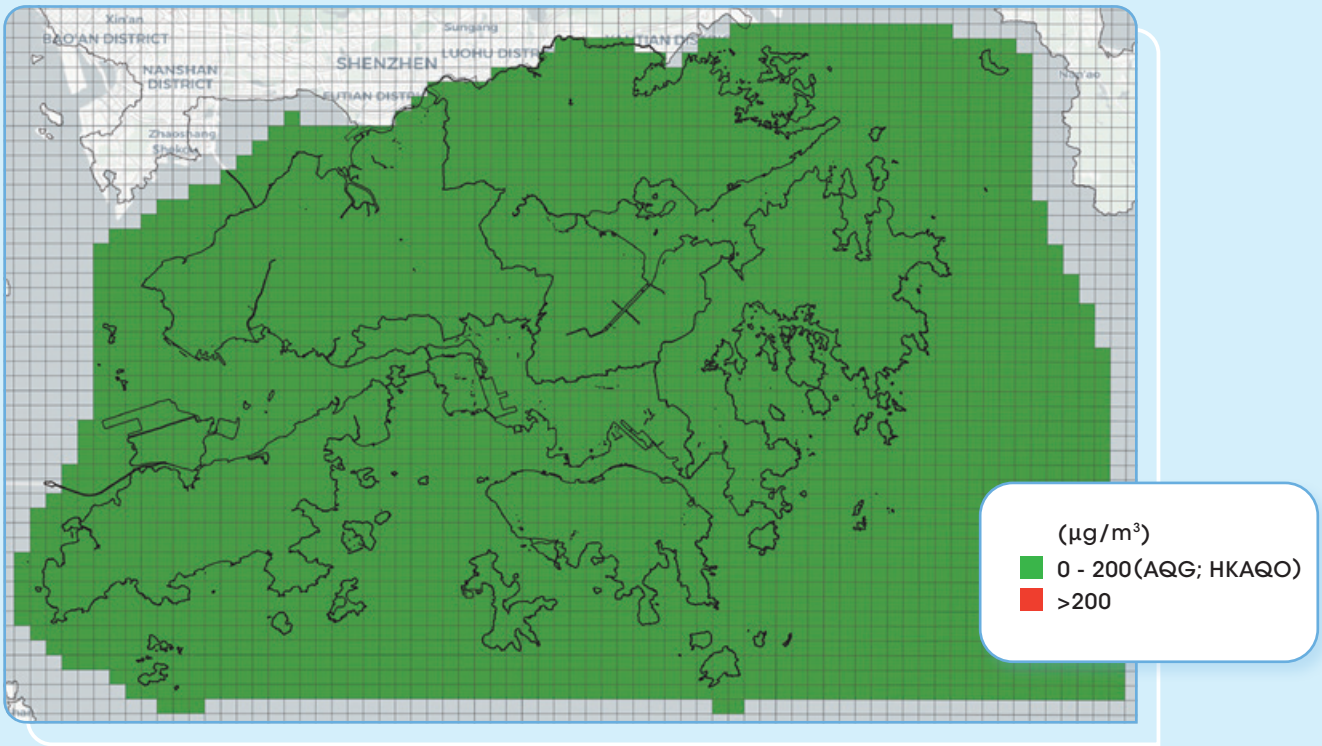


Figure 6 – 19th highest hourly average NO_2 concentration in 2030

Notes:

IT – Interim Target of the WHO AQGs

AQG level – Ultimate Target of the WHO AQGs

HKAQOs – Hong Kong Air Quality Objectives

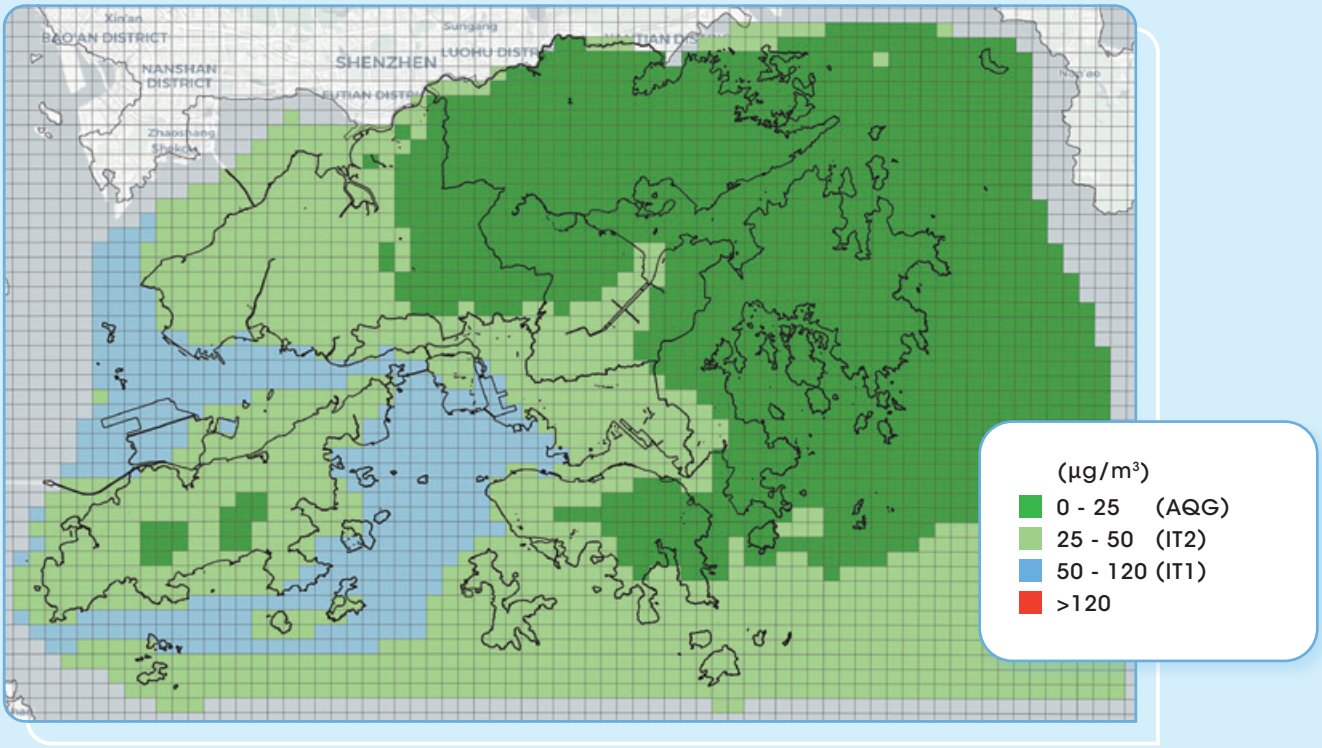


Figure 7 – 10th highest daily average NO_2 concentration in 2030

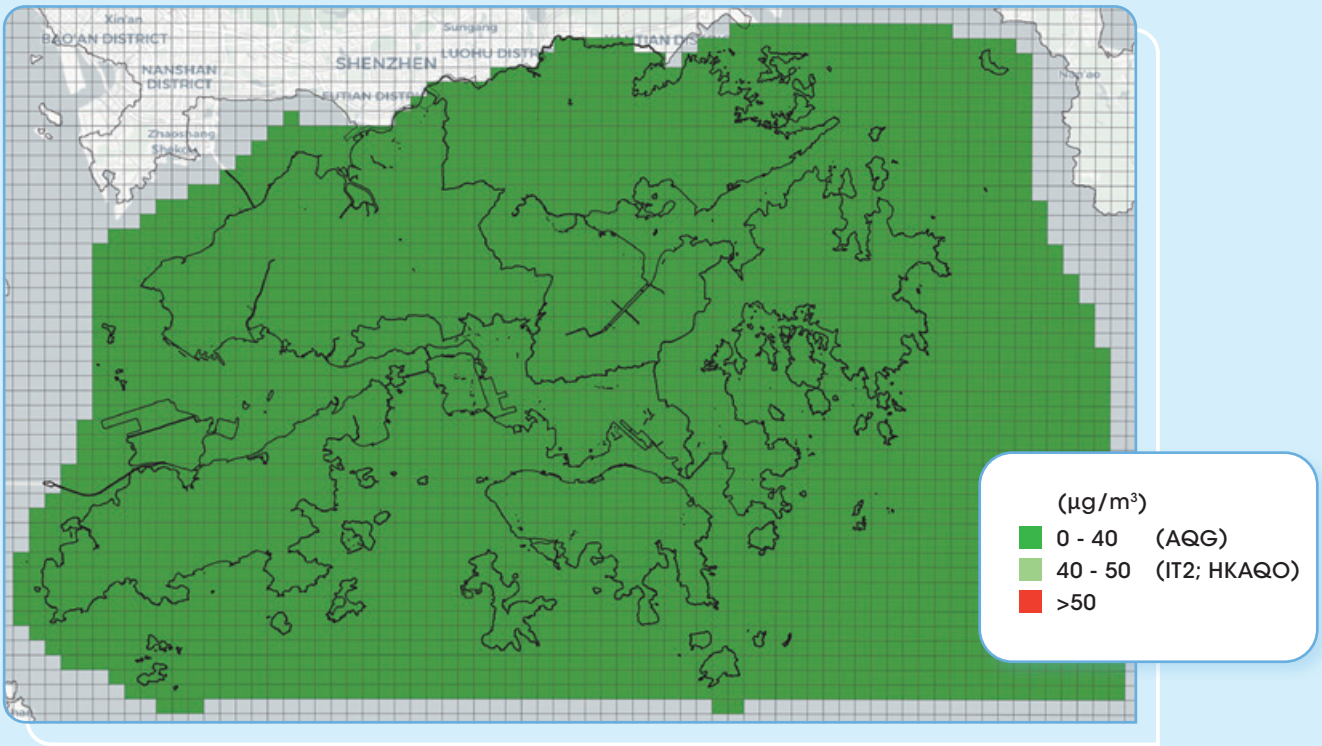


Figure 8 – 4th highest daily average SO_2 concentration in 2030

Notes:

IT – Interim Target of the WHO AQGs

AQG level – Ultimate Target of the WHO AQGs

HKAQOs – Hong Kong Air Quality Objectives

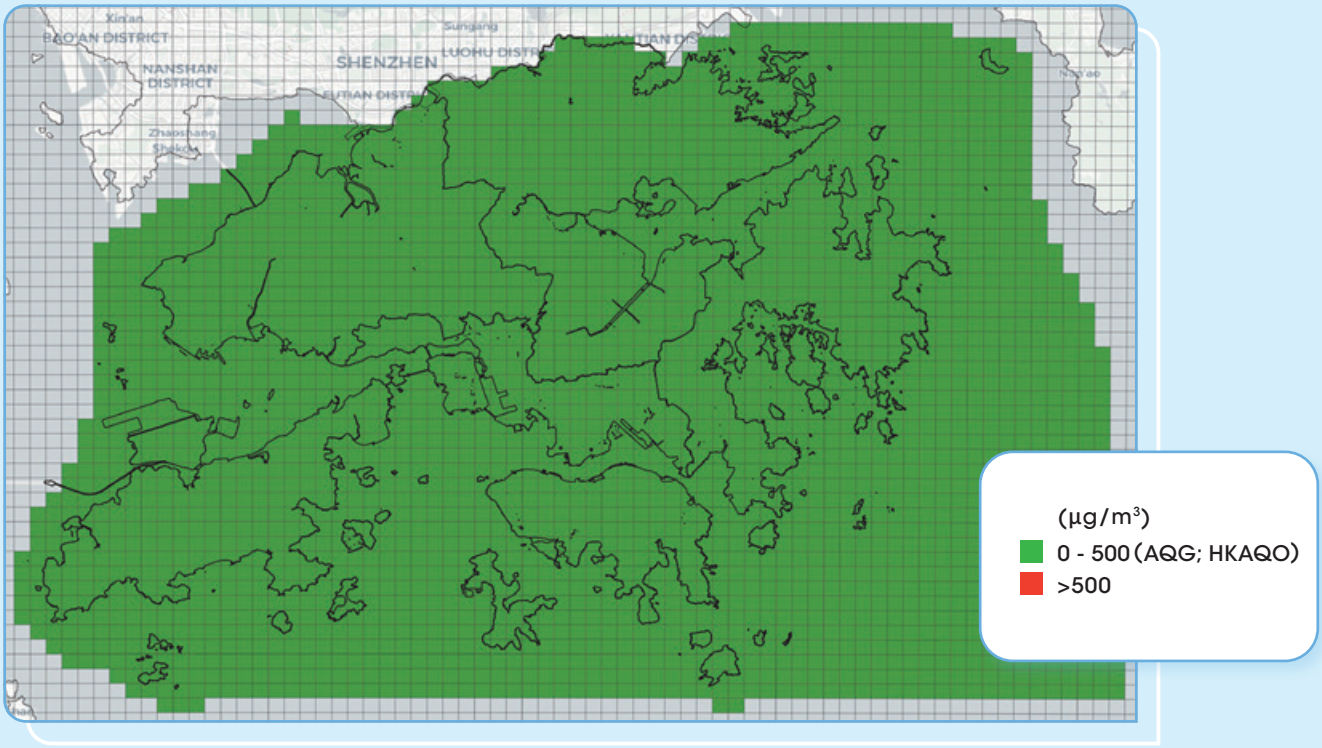


Figure 9 – 4th highest 10-minute average SO_2 concentration in 2030

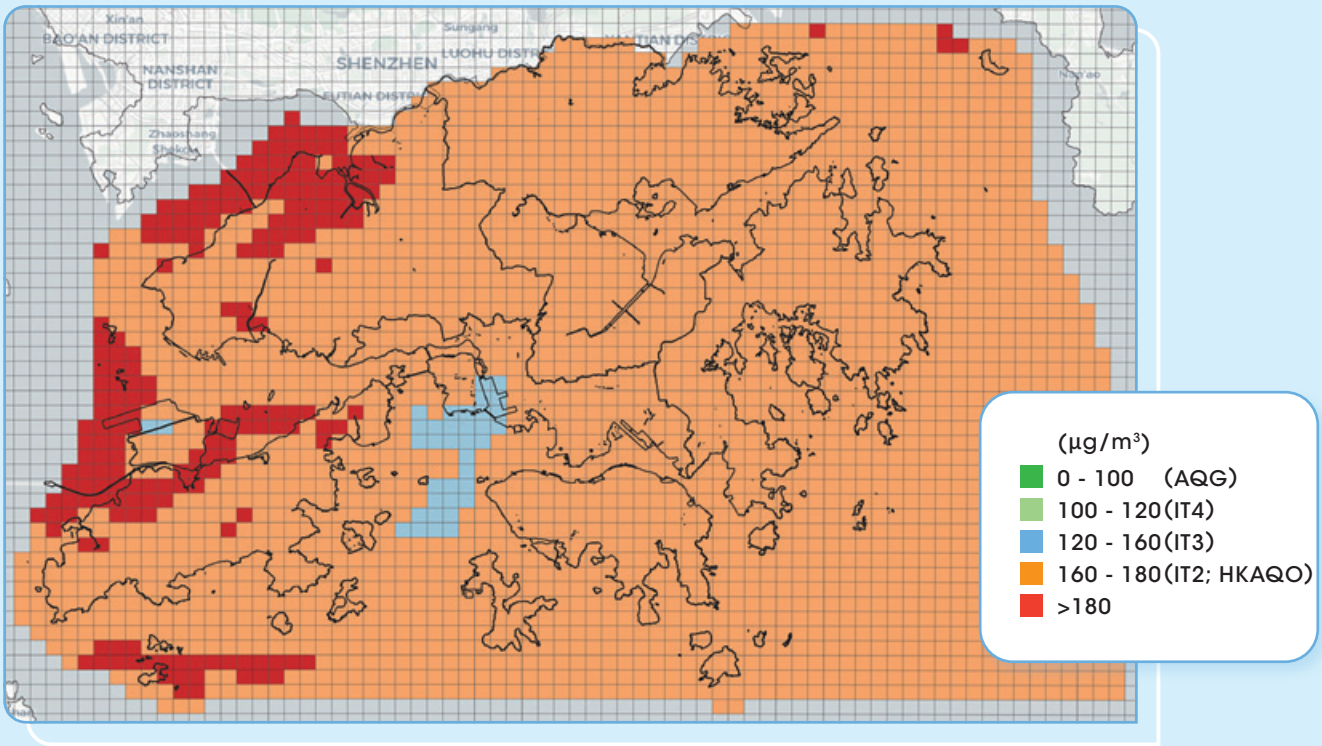


Figure 10 – 10th highest daily maximum 8-hour average O_3 concentration in 2030

Notes:

IT – Interim Target of the WHO AQGs

AQG level – Ultimate Target of the WHO AQGs

HKAQOs – Hong Kong Air Quality Objectives

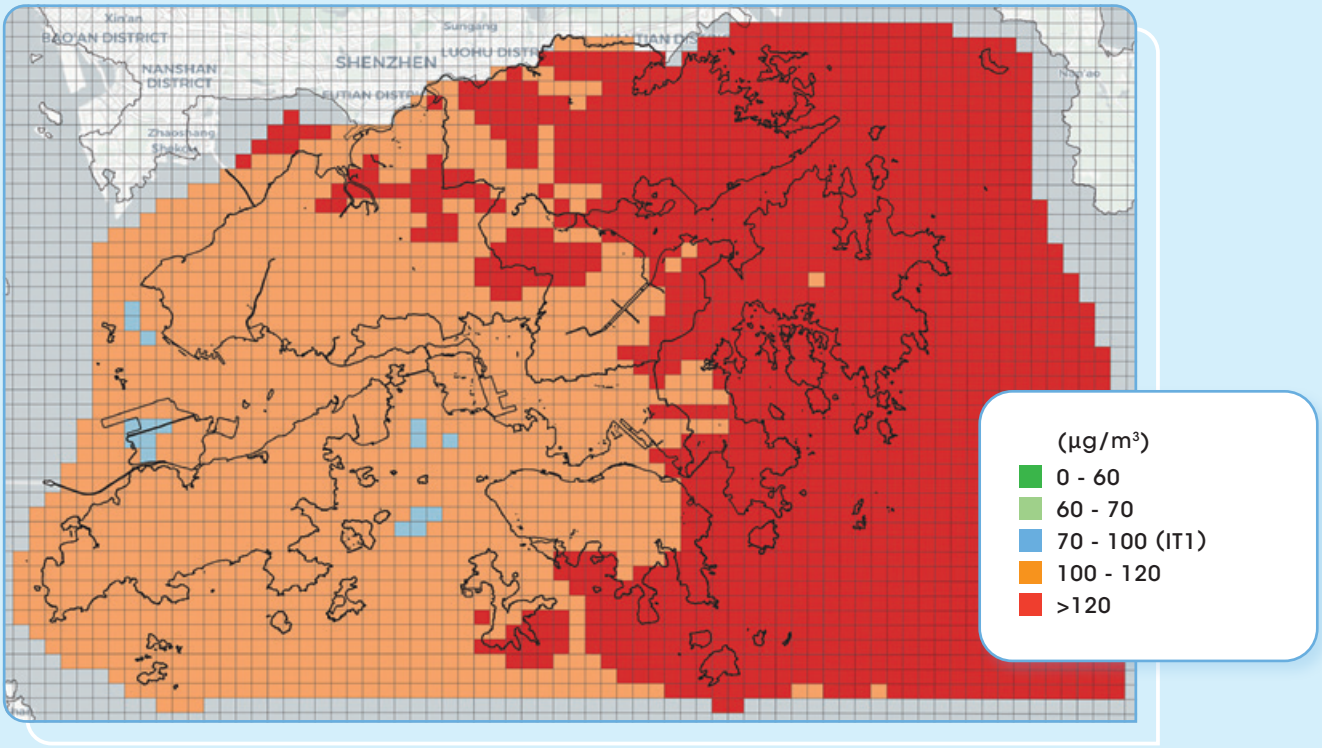


Figure 11 – O_3 concentration during the peak season in 2030

Notes:

IT – Interim Target of the WHO AQGs

AQG level – Ultimate Target of the WHO AQGs

HKAQOs – Hong Kong Air Quality Objectives