

2025

AIR QUALITY OBJECTIVES REVIEW

PUBLIC CONSULTATION

PM_{10}

NO_2

$PM_{2.5}$

CO

SO_2

O_3

Pb



環境局
Environment Bureau



環境保護署
Environmental Protection Department

July 2019

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FOREWORD

The Government has all along been putting forward and implementing various emission reduction measures to improve air quality and safeguard public health on a sustainable basis. To attain the ultimate targets set under the World Health Organisation (WHO) Air Quality Guidelines (AQGs), the Government will review the Air Quality Objectives (AQOs) every five years in accordance with the law and assess the progress in improving air quality to aid deciding the AQOs for the next five year period.

Hong Kong's prevailing AQOs took effect on January 1, 2014, with a view to broadly attaining the AQOs by 2020. In mid-2016, we set up an AQOs Review Working Group (the Working Group)^[1] to undertake a series of assessments and discussions to evaluate the air quality improvement and set the AQOs to be attained in 2025. The Government completed the AQOs review in December 2018 and submitted a review report to the Advisory Council on the Environment (ACE) in February 2019. The review is on-going and the next review cycle is between 2019 and 2023.

This consultation document sets out the findings and recommendations of the AQOs review with a view to seeking public views on the recommendations. Please share with us your opinions within the 3-month public consultation period.

We would like to take this opportunity to thank the Members of the Working Group for their dedicated participation and precious advice which contributed to the smooth completion of the review.

Environment Bureau / Environmental Protection Department

July 2019

[1] The Working Group comprises some 60 members from the fields of air science, health professions, green groups, academics, chambers of commerce, professional bodies and trade representatives, as well as representatives from relevant Government bureaux/departments (B/Ds), including the leading Environment Bureau (ENB) and the Environment Protection Department (EPD), and the Development Bureau, the Transport and Housing Bureau, the Civil Engineering and Development Department, the Electrical and Mechanical Services Department, the Department of Health, the Marine Department, the Planning Department and the Transport Department.

Approach for the Review of Hong Kong's Air Quality Objectives



To progressively improve our air quality through the implementation of various emission reduction measures and setting of interim targets, with a view to meeting the ultimate targets of the WHO AQGs as our final goal.



At present, no country has fully adopted the ultimate targets of the WHO AQGs as its statutory air quality standards.



Six of the Hong Kong's prevailing AQOs are already set at the ultimate targets of the WHO AQGs. The Government's target is to broadly attain the level of the prevailing AQOs in 2020.



The review of the AQOs is a statutory and an on-going process. The current review assessed air quality improvements in 2025 and the scope for tightening the AQOs.



The next review will be conducted in the coming few years to assess the scope for further tightening the AQOs in 2030.

How is Hong Kong's air quality compared with other major Asian cities?

The air quality in Hong Kong is comparable with Taipei but better than Seoul.



BACKGROUND

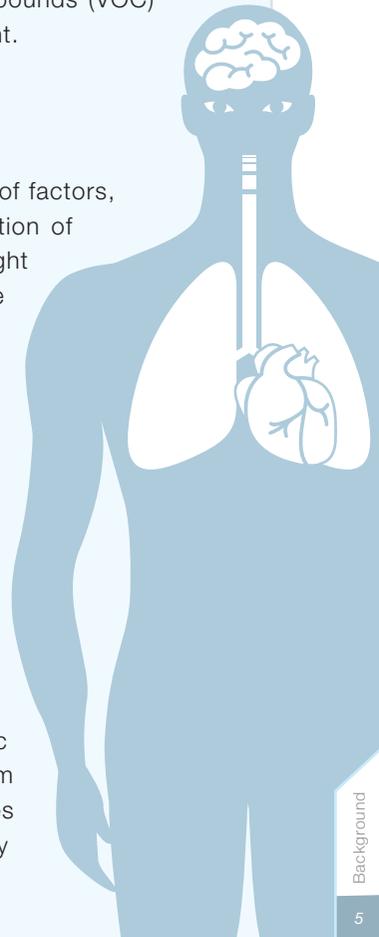
Air Pollution and Health Impacts



The common air pollutants in Hong Kong (e.g. sulphur dioxide (SO₂), nitrogen oxides (NO_x), suspended particulates, etc.) are mainly emitted from vessels, motor vehicles, power plants and industrial activities (see **Annex 1**). Ozone (O₃) is not directly emitted from pollution sources, but is formed by photochemical reactions of NO_x (such as nitric oxide and nitrogen dioxide (NO₂)) and volatile organic compounds (VOC) under sunlight.

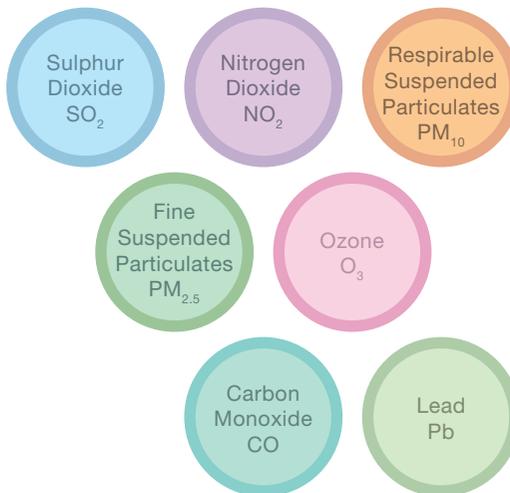
The impacts of air pollution on health depend on a number of factors, such as the concentrations of the pollutants and the duration of exposure, etc. There are many potential health hazards brought about by air pollution. For instance, NO₂, SO₂ and O₃ irritate the mucosa of eyes, nose, throat and lower respiratory tract. These air pollutants also aggravate the existing chronic respiratory diseases. Long-term exposure to these pollutants can reduce an individual's lung function and lower his resistance to respiratory infections. Studies also show that exposure to O₃ may trigger asthmatic attacks in people having asthma.

Respirable suspended particulates (RSP/PM₁₀), which are particulates with aerodynamic diameter of less than or equal to 10 micrometres (µm), can penetrate into the lungs and cause a broad range of adverse impacts on health. Fine suspended particulates (FSP/PM_{2.5}) with an aerodynamic diameter of 2.5µm or less can get into the circulatory system through the alveoli. Long-term exposure to these particulates may increase the risks of cardiovascular and respiratory diseases as well as lung cancer.



What are Air Quality Objectives (AQOs)?

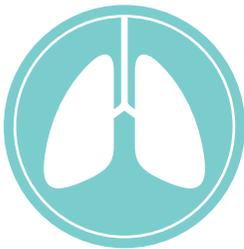
- ▶ AQOs refer to the short-term and long-term concentration targets of the 7 major air pollutants prescribed in Section 7A and Schedule 5 of the Air Pollution Control Ordinance (APCO) (Cap. 311):



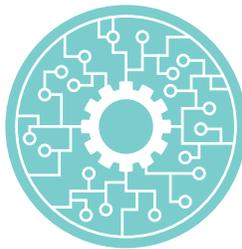
- ▶ There are altogether 12 AQOs for the above 7 air pollutants (see **Page 8** for details).
- ▶ The prevailing AQOs took effect on 1 January 2014.

World Health Organisation's Air Quality Guidelines

- ▶ The WHO has promulgated a set of AQGs for various key air pollutants based on a wealth of studies on the impacts of air pollution on health and the WHO AQGs were updated in 2005 [2].
- ▶ The WHO AQGs have established a set of air quality targets to enable various governments to, having regard to their local circumstances, gradually improve their air quality through setting their air quality standards at the interim targets (ITs) and advancing progressively towards the ultimate targets of the WHO AQGs, with a view to protecting public health.
- ▶ The WHO has recommended that countries should strike a balance between public health and local circumstances in setting their air quality standards, and take into consideration the practical situations, such as:



Health risk
attributed to air
pollution



Latest
technological
developments



Economic,
political and social
factors, etc.

At present, no country has fully adopted the ultimate targets of the WHO AQGs as its statutory air quality standards.

[2] The World Health Organisation (2006) Air Quality Guidelines Global Update 2005
http://www.euro.who.int/__data/assets/pdf_file/0005/78638/E90038.pdf?ua=1

Hong Kong's Prevailing AQOs

► Benchmarked against the interim and ultimate targets of the WHO AQGs (see **Table 1**)

Table 1: Hong Kong's prevailing AQOs and the ITs and ultimate targets of the WHO AQGs

Pollutant	Averaging Time	WHO AQGs ($\mu\text{g}/\text{m}^3$)				No. of exceedances allowed in Hong Kong's prevailing AQOs
		IT-1	IT-2	IT-3	Ultimate Target	
SO ₂	10-minute	—————			500	3
	24-hour	125	50	—	20	3
PM ₁₀	annual	70	50	30	20	Not applicable
	24-hour	150	100	75	50	9
PM _{2.5}	annual	35	25	15	10	Not applicable
	24-hour	75	50	37.5	25	9
NO ₂	annual	—————			40	Not applicable
	1-hour	—————			200	18
O ₃	8-hour	160		100	9	
CO	1-hour	—————			30,000	0
	8-hour	—————			10,000	0
Pb	annual	—————			0.5	Not applicable

 Hong Kong's prevailing AQOs are indicated in green cells. IT – Interim Target

Six of the Hong Kong's prevailing AQOs have adopted the ultimate targets of the WHO AQGs.

Uses of Hong Kong's AQOs

- ▶ The Hong Kong's AQOs are the goals for the Government to devise short-term air quality improvement plans while achieving the interim targets of the WHO AQGs progressively. In addition, they are also the benchmark for assessing air quality.
- ▶ In addition, the AQOs have the following statutory functions:
 - a benchmark for consideration of designated projects under the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499);
 - a key factor to be considered when deciding whether a licence should be issued to a specified process under the APCO.

While tightening Hong Kong's AQOs, the requirements and levels of air pollution control on future designated projects and specified processes should also be strengthened accordingly in order to meet the more stringent AQOs. As such, it is necessary to take into account the latest technological developments and applications, and identify practicable air quality improvement measures during the review of the AQOs.

Air Quality Trend

The Government has been implementing air quality improvement measures set out in the "A Clean Air Plan for Hong Kong" ^[3] to control emissions from various pollution sources, including power plants, industrial activities, road vehicles and vessels, with a view to **broadly attaining the prevailing AQOs by 2020**.

The concentrations of the key air pollutants in Hong Kong have reduced by about 30 per cent from 2013 to 2018.

Except for O₃ and NO₂, the AQOs for the remaining five air pollutants (i.e. SO₂, PM₁₀, PM_{2.5}, CO and Pb) have already been attained. With our sustainable efforts in implementing the emission control measures, the target of "broadly attaining the AQOs by 2020" still holds. However, the high roadside NO₂ level (whose annual average concentration is currently around two times of the AQO limit) as well as the rising trend of O₃ remain to be the key challenges of air pollution we need to tackle (see **Figure 1** and **Figure 2**).

Please refer to **Annex 2** for the AQOs compliance status at various Air Quality Monitoring Stations (AQMS) in 2018.

[3] The Environment Bureau (ENB) released "A Clean Air Plan for Hong Kong" in March 2013 to outline comprehensively the challenges Hong Kong is facing with regard to air quality and to give an overview of the relevant air quality improvement policies and measures. We have been implementing a wide range of measures covering land and sea transport, power plants and non-road mobile machinery to reduce air pollution. Besides, we have been strengthening collaboration between Guangdong and Hong Kong to deal with regional air pollution, and the information in "A Clean Air Plan for Hong Kong" was updated in June 2017. "A Clean Air Plan for Hong Kong" and the 2013-2017 Progress Report are available at the following websites:
https://www.enb.gov.hk/en/files/New_Air_Plan_en.pdf
https://www.enb.gov.hk/sites/default/files/CleanAirPlanUpdateEng_W3C.pdf

Figure 1: Changes in the concentrations of the key air pollutants at General AQMS in Hong Kong from 2013 to 2018

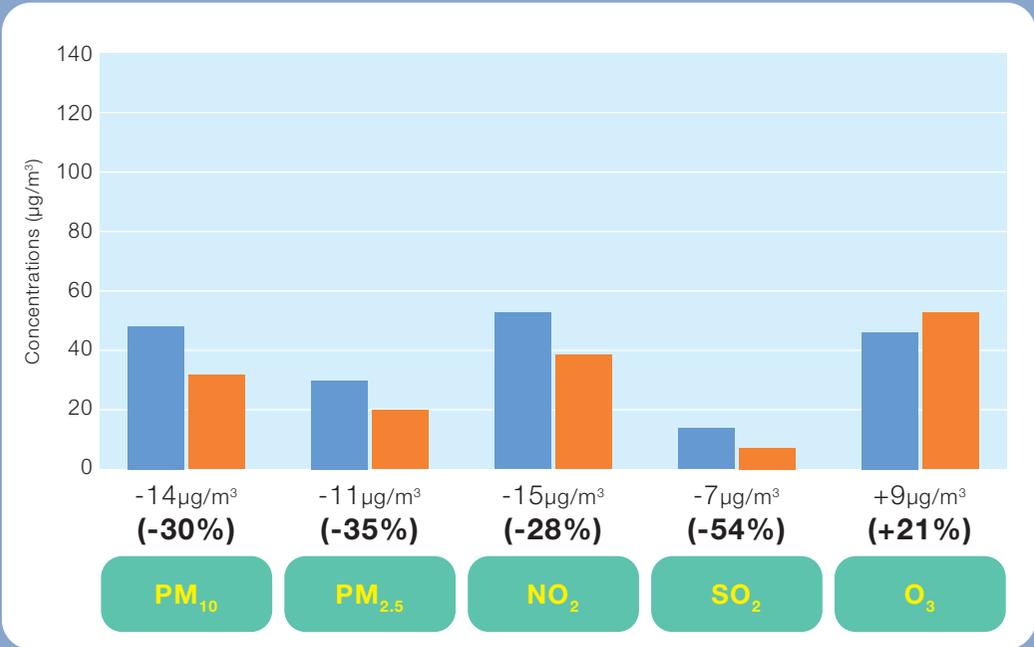
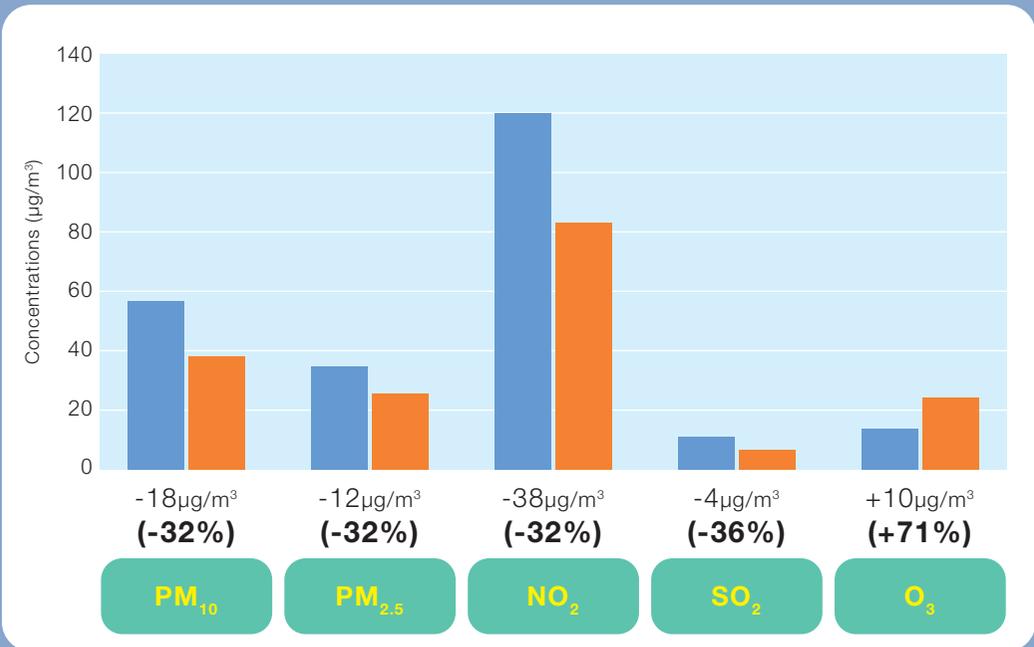


Figure 2: Changes in the concentrations of the key air pollutants at Roadside AQMS in Hong Kong from 2013 to 2018



► In 2018, the AQOs for the remaining five key air pollutants have already been attained except for O_3 and NO_2 , (see **Figure 3** and **Annex 2**).

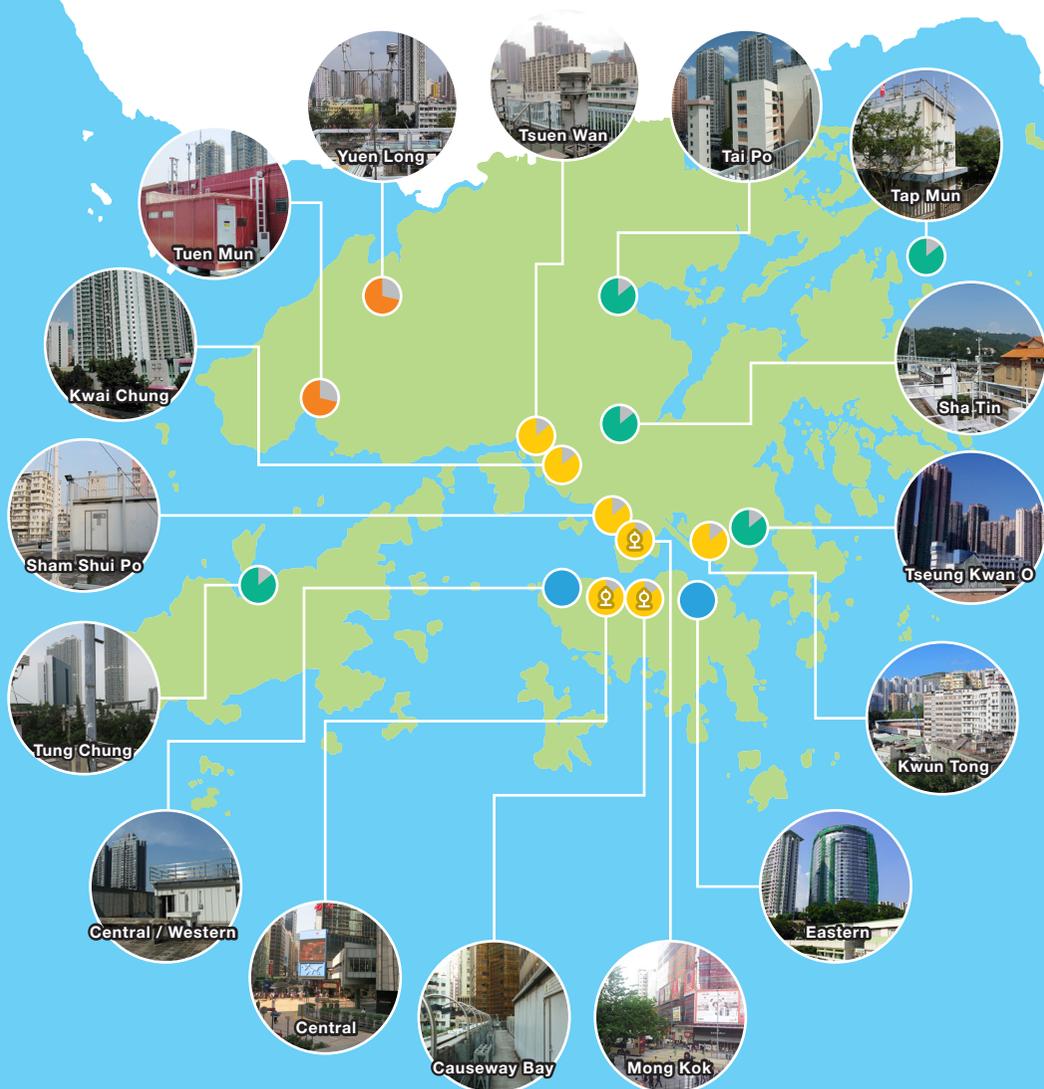


Figure 3:
The AQOs compliance status at various AQMS in 2018

Legend



Five key pollutants met their AQOs (except for NO_2 and O_3)



Six key pollutants met their AQOs (except for NO_2)



Six key pollutants met their AQOs (except for O_3)



All seven key pollutants met their AQOs



Roadside AQMSs



Question 1

Hong Kong's air quality has been improving in recent years. Are you aware of the improvements in air quality and visibility?



Aware



Slightly aware



Not aware

REVIEW PROCESS



Principles of the Review

- ▶ Having regard to the recommendations of the WHO and the practices of other advanced economies, the Government has adopted the following principles in reviewing Hong Kong's AQOs:



Safeguard public health based on the WHO AQGs



Progressively tighten the AQOs to the ultimate targets of the WHO AQGs through reviewing the AQOs once every 5 years

Review Work

- ▶ Explored practicable new air quality improvement measures having regard to the latest technological developments and applications.
- ▶ Assessed the extent of air quality improvement after implementing the new measures, and the associated health and economic impacts.
- ▶ Assessed the scope for tightening Hong Kong's AQOs.



Taking into consideration the target of broadly attaining the prevailing AQOs by 2020 and the statutory requirements to review the AQOs at least once every five years, the current review has assessed the air quality improvement in 2025 and the scope for tightening the AQOs.

AQOs Review Working Group

- ▶ There are some 60 members from the fields of air science, health professions, green groups, academics, chambers of commerce, professional bodies and trade representatives, as well as representatives from relevant government B/Ds.
- ▶ Four dedicated Sub-groups are tasked with reviewing and assessing different areas of work:



- ▶ The Road Transportation Sub-group, Marine Transportation Sub-group and Energy and Power Generation Sub-group were tasked with identifying possible new air quality improvement measures under their respective areas, and evaluating the practicability of implementing the possible new measures.
- ▶ The Air Science and Health Sub-group focused on assessing the air quality improvements, health and economic benefits in 2025 that might result from the implementation of possible new measures, with a view to determining the possible scope for further tightening the AQOs.

Review Process of Hong Kong's AQOs

Current Review Period (2014-2018)

2014

Prevailing AQOs took effect on 1 January 2014

2015

The ACE and the Panel on Environmental Affairs (EA Panel) of the Legislative Council were briefed on the work plan

2016

The review commenced and a Working Group was set up

AQOs review process

The review progress was reported to the ACE and EA Panel

2017

A public engagement exercise was conducted

2018

The review of the AQOs was completed

Public consultation and legislation amendment

A review report was submitted to the ACE

The review findings were reported to the ACE and EA Panel

A 3-month public consultation was launched

The Air Pollution Control Ordinance will be amended (if the AQOs are to be tightened)

2019

POSSIBLE NEW AIR QUALITY IMPROVEMENT MEASURES



Practicability of Implementing New Measures

Taking into consideration the target of broadly attaining Hong Kong's prevailing AQOs by 2020 and the statutory requirement to review the AQOs at least once every 5 years, the Working Group agreed to assess the air quality improvement in 2025 and the scope for tightening the AQOs in the current review. The dedicated Sub-groups have identified possible new air quality improvement measures and classified them into 4 main categories based on their practicability of implementation.



32 Short-term Measures

These measures are being implemented or considered by the Government and are likely to yield results by 2025 or earlier.



7 Medium-term Measures

These measures are considered for further deliberation in the next AQOs review cycle (i.e. 2019 to 2023).



13 Long-term Measures

These measures require more detailed planning or further study to evaluate the practicability for implementation beyond the next review cycle.



28 Other Measures

These measures, after being deliberated, are considered not practicable, short of air quality improvement benefits or not within the scope of the review.



Question 2

The WHO AQGs recommend governments of different places to continuously explore new air quality improvement measures and balance the development of the society, with a view to progressively tightening the air quality standards to achieve the WHO AQGs levels. Do you agree with this approach?



Agree



Partly agree



Not agree

Categories of Possible New Measures

In the course of reviewing the AQOs, we have considered a total of 80 possible air quality improvement measures. Please refer to **Annex 3** for details of these measures.

The Road Transportation Sub-group, Marine Transportation Sub-Group, and Energy and Power Generation Sub-group have explored a series of possible new air quality improvement measures, and deliberated on the practicability of implementing these measures by 2025.

The EPD has also explored a number of possible new measures through consulting stakeholders of other emission sources (including products containing VOC, non-road mobile machinery (NRMM), cooking fumes and civil aviation).

Moreover, new government initiatives targeting roadside emissions announced recently^[4] have also been considered in the review.

In exploring the practicability of implementing the measures, the following factors have been considered:



Among the possible new measures considered during the review, 32 of them are classified as short-term measures^[5] ◦

[4] These initiatives are expected to bring benefits to air quality improvement by 2025.

[5] 17 of the measures have quantifiable emission reduction results.

Among the 32 short-term new air quality improvement measures, some of them are closely related to our daily life. For instance:



Energy and Power Generation

- ★ To encourage the development of more waste-to-energy facilities for waste reduction and increase renewable energy.
-
- ▶ To progressively tighten the statutory emission caps of three key air pollutants (namely SO₂, NO_x and PM₁₀) from power plants.
 - ▶ To increase local gas generation to around 50% of the total fuel mix for electricity generation by 2020.



Marine Transportation

- ★ Ocean-going vessels (OGVs) at berth to use marine diesel with sulphur content not exceeding 0.1%.
-
- ▶ Hong Kong is the first port in Asia to mandate OGVs to switch fuel at berth. Since 2015, OGVs have been required to switch to low sulphur fuel (with sulphur content not exceeding 0.5%) while at berth.
 - ▶ Since 2019, vessels have been required to use low sulphur fuel within Hong Kong waters to further reduce their emissions.



Road Transportation

- ★ To foster pedestrian-friendly environment (e.g. widening of footpaths, construction of covered walkways and enhancing pedestrian connections) to encourage the public to walk.
-
- ▶ To phase out some 82,000 pre-Euro IV diesel commercial vehicles (DCVs) by end of 2019.
 - ▶ To limit the service life of newly registered DCVs to 15 years since 2014.



Other Emission Sources

- ★ To review the feasibility to impose VOC limits on non-regulated consumer products (e.g. general purpose cleaner, deodorant, disinfectant).
-
- ▶ To control the VOC contents of architectural paints/coatings, printing inks and six selected categories of consumer products in phases since 2007.

Note: ★ Recommended short-term new measures ▶ Other on-going measures

Consideration for Regional Emission Reduction

The Hong Kong Special Administrative Region (HKSAR) Government has been collaborating with the Guangdong authorities to improve regional air quality. In 2012, the Hong Kong and Guangdong governments set emission reduction targets for 2015 and emission reduction ranges for 2020 for 4 key air pollutants (including NO_x and VOC) in the Pearl River Delta (PRD) Region. At the end of 2017, both sides confirmed the attainment of the emission reduction targets in 2015 and finalised the reduction targets for 2020 (see **Table 2**). In the review, the finalised emission reduction targets for 2020 have been taken into account in assessing the air quality in 2025. Please refer to **Annex 4** for the methodologies of air quality, health and economic impact assessments.



Table 2: 2015 and 2020 Emission Reduction Targets for Hong Kong and the PRD Region

Pollutant	Region	2015 Emission Reduction Targets*	2020 Emission Reduction Targets*
SO ₂	HKSAR	-25%	-55%
	PRD Economic Zone	-16%	-28%
NO _x	HKSAR	-10%	-20%
	PRD Economic Zone	-18%	-25%
PM ₁₀	HKSAR	-10%	-25%
	PRD Economic Zone	-10%	-17%
VOC	HKSAR	-5%	-15%
	PRD Economic Zone	-10%	-20%

*Reductions are relative to the 2010 emission levels

REVIEW FINDINGS



Air Quality Assessment Results

The air quality assessment results for 2025 indicate that the implementation of the committed and new measures will bring about continuous reduction in the concentrations of PM₁₀, PM_{2.5}, NO₂ and SO₂. However, there will be a slight increase in the projected O₃ concentration in 2025^[6] because of the high regional background concentrations.

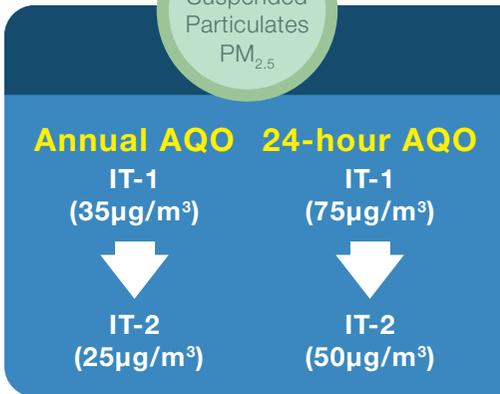
Possible Scope for Tightening AQOs

Hong Kong's prevailing six AQOs for NO₂ (both 1-hour and annual), SO₂ (10-min), CO (both 1-hour and 8-hour) and Pb have already been set at the most stringent WHO AQGs levels. Hence, the focus of the review is to explore possible scope for further tightening the prevailing AQOs that are set at WHO ITs, including the AQOs for PM₁₀ (both 24-hour and annual), PM_{2.5} (both 24-hour and annual), SO₂ (24-hour) and O₃, based on the 2025 air quality assessment results.

Fine Suspended Particulates (PM_{2.5})

The air quality assessment results show that:

- ▶ The annual average concentration of PM_{2.5} in 2025 could meet the next higher level of WHO IT at the WHO IT-2 (25µg/m³).
- ▶ The prevailing AQO for PM_{2.5} (24-hour) could be tightened from 75µg/m³ and 9 allowable exceedances to 50µg/m³ and 35 allowable exceedances to meet the next more stringent level of WHO IT-2.



The recommended tightening of the annual AQO for PM_{2.5} to IT-2 (25µg/m³) could effectively reduce health risks.

According to local studies, the health risks associated with long-term exposure to PM_{2.5} (in terms of annual mean concentration) is about ten times higher than that of the short-term exposure to PM_{2.5} (in terms of 24-hour concentration). According to the WHO AQGs, lowering the annual mean of PM_{2.5} from IT-1 to IT-2 could reduce the risk of premature death by about 6%.

[6] The projected slight increase in O₃ concentration from 2020 to 2025 is largely due to the reduction in nitric oxide (NO) emissions from motor vehicles as a result of the control measures being/to be implemented (phasing out diesel commercial vehicles, tightening vehicle emission standards, etc.). While such measures would help effectively reduce the concentrations of NO₂, which is one of the key air pollutants causing health impacts to the public, the reduction in NO would reduce the titration effect on O₃ (i.e. removal of O₃ from its reaction with NO), thereby leading to an increase in O₃ levels, especially in areas with high traffic flow.

How is the number of allowable exceedances in the 24-hour AQO for PM_{2.5} set at 35?

Chapter 8 of the WHO AQGs recommends that when determining the AQOs, a suitable number of allowable exceedances should be set to exclude the exceedances owing to uncontrollable circumstances.

Principles for setting the “number of allowable exceedances”

Chapter 8 of the WHO AQGs states that “when the [air quality] standards are to be legally binding, criteria must be identified to determine compliance. This is quantified through the number of acceptable exceedances over a certain period of time. Compliance criteria are defined in each place in order to compare the most representative data with the standards, and to minimize the designation of non-compliance owing to uncontrollable circumstances such as extreme weather”.

The WHO AQGs do not provide any recommendations on the number of allowable exceedances in setting the AQOs and ITs for the air pollutants concerned.

When Hong Kong is under the influence of unfavourable meteorological conditions (e.g. weather conditions caused by outer subsiding air or regional air pollution), the concentration levels of PM_{2.5} in Hong Kong could surge.

According to the 2025 air quality modelling results, the highest number of exceedances of the 24-hour concentrations of PM_{2.5} in the north-western part of Hong Kong against the IT-2 concentration level is 33. As some buffer is required, a more practical approach is to set the number of allowable exceedances to 35.

The review proposes tightening of the 24-hour AQO for PM_{2.5} to the IT-2 level (50µg/m³) while increasing the number of allowable exceedances to 35 times. Is this more lenient than the prevailing AQO set at the IT-1 level (75 µg/m³) with 9 allowable exceedances?

Historical data of our air quality monitoring network verify that the 24-hour AQO for PM_{2.5} (50µg/m³ and 35 exceedances allowed in a year) as recommended by the review is more stringent than the prevailing 24-hour AQO (75µg/m³ and 9 exceedances allowed in a year). Between 2011 and 2017, the ambient air quality monitoring network recorded 17 exceedances against the prevailing 24-hour AQO for PM_{2.5}, but 30 exceedances against the proposed new AQO. This suggests that our air quality, after attaining the prevailing AQO, has to continuously improve in order to meet the proposed new AQO.

Are there any international precedents for allowing 35 exceedances?

The European Union and the United Kingdom allow 35 exceedances for the 24-hour PM₁₀ standard.

Sulphur Dioxide (SO₂)

The SO₂ (24-hour) concentrations in 2025 could meet the next higher level of WHO IT, i.e. WHO IT-2 (50µg/m³), with the number of allowable exceedances kept at 3.

Sulphur
Dioxide
SO₂

24-hour AQO

IT-1
(125µg/m³)



IT-2
(50µg/m³)

Can the 24-hour AQO for SO₂ be tightened to the ultimate target in the WHO AQGs by increasing the number of exceedances?

The WHO's principle in setting the number of allowable exceedances is to exclude non-compliance owing to uncontrollable circumstances (Chapter 8 of the WHO AQGs) such as extreme weather. Unlike particulate matters (PM) which are subject to the influence of unfavourable meteorological conditions and regional air pollution, the ambient SO₂ is mainly affected by local emission sources, particularly power plants and vessels, while regional influence on the levels of SO₂ is not significant. The proposed tightening of the 24-hour AQO for SO₂ to the WHO IT-2 level (i.e. 50µg/m³) is more stringent than the standards of many advanced countries. The Government will continue to implement various measures to control SO₂ emissions and review further scope for tightening the AQO.

Respirable Suspended Particulates (PM₁₀) and Ozone (O₃)

As the regional background concentrations of PM₁₀ and O₃ are relatively high, the 2025 air quality assessment show that concentrations of these pollutants in most parts of Hong Kong in 2025 will still exceed the next higher WHO IT level. The Government will continue to work closely with the Guangdong Province to improve regional air quality and explore further tightening the relevant AQOs in the next review (i.e. 2019-2013).

The assessment results of various air pollutants in 2025 are shown in **Annex 5**.

PM₁₀

O₃



Question 3

What are your views on the proposed tightening of the AQOs for fine suspended particulates (PM_{2.5}) and sulphur dioxide (SO₂) as recommended in this review?

Understood

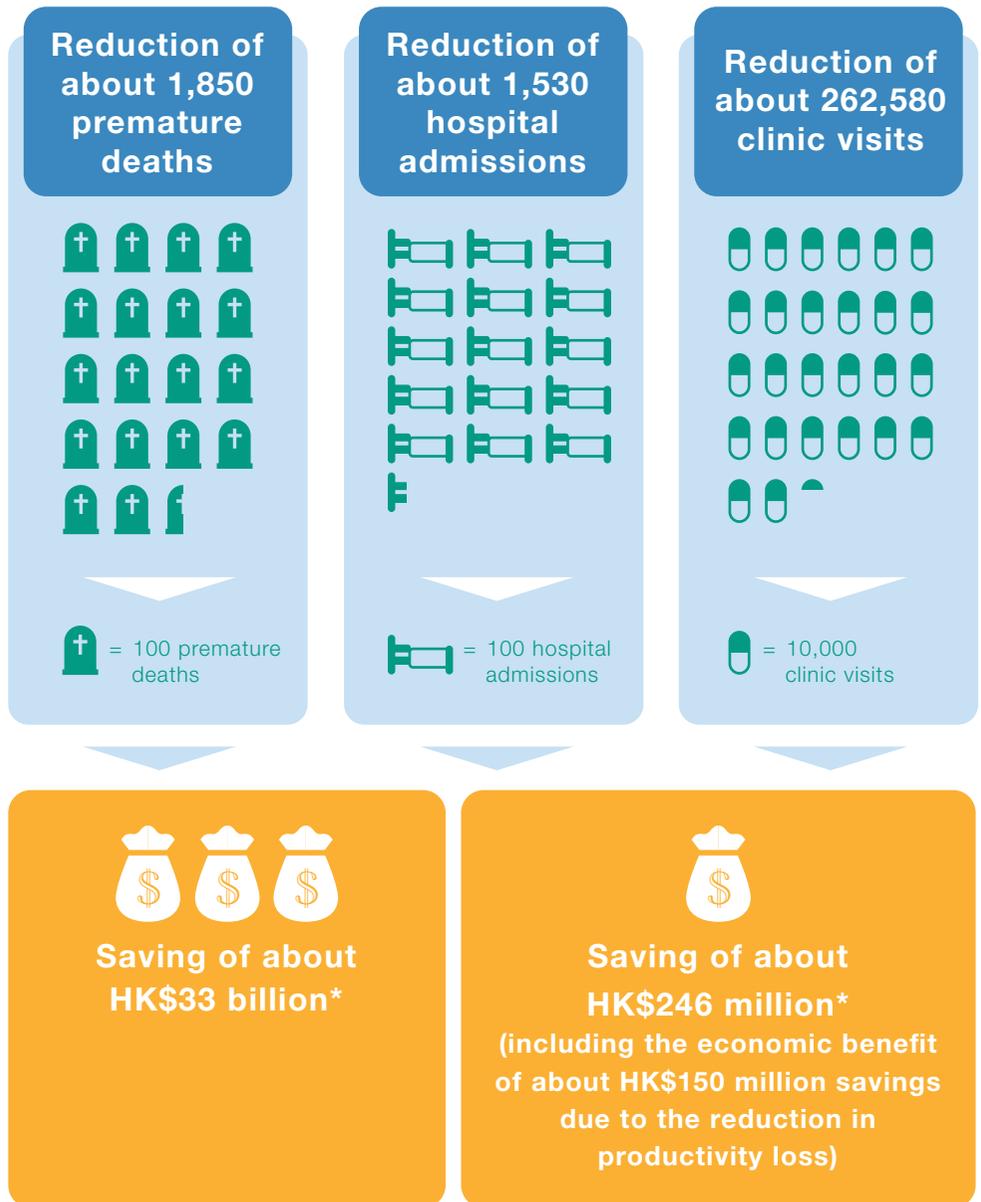
No
comment

Others

Please specify: _____

Findings of the Health and Economic Impact Assessment

According to the air quality assessment results for 2025, improvement in air quality can bring about the following health and economic benefits to Hong Kong, compared with 2015 baseline data:



* All costs are adjusted to the price level of 2017

Summary

Pollutant	Averaging Time	WHO AQGs ($\mu\text{g}/\text{m}^3$)				No. of exceedances allowed in Hong Kong's prevailing AQOs
		IT-1	IT-2	IT-3	Ultimate Target	
SO ₂	10-minute	—————			500	3
	24-hour	125	50	—	20	3
PM ₁₀	annual	70	50	30	20	Not applicable
	24-hour	150	100	75	50	9
PM _{2.5}	annual	35	25	15	10	Not applicable
	24-hour	75	50	37.5	25	9 → 35
NO ₂	annual	—————			40	Not applicable
	1-hour	—————			200	18
O ₃	8-hour	160			100	9
CO	1-hour	—————			30,000	0
	8-hour	—————			10,000	0
Pb	annual	—————			0.5	Not applicable

Green cells: Prevailing Hong Kong AQOs are indicated in green cells.

Orange cells: Proposed new AQOs and allowable number of exceedances are indicated in orange cells.

The Government will continue its work on air quality improvement. The scope for further tightening the AQOs will be assessed in the following review period (i.e. 2019-2023).



Question 4

In your opinion, what kind of work should be paid attention to and covered in the next review of the AQOs?



Same as the current review



No comment



Others

Please specify: _____

A wooden pencil with a green eraser and a silver ferrule lies diagonally across a light-colored wooden surface. Below the pencil, the top edge of a spiral-bound notebook is visible, featuring a brown cover and a gold-colored metal spiral binding. The text "SHARE YOUR VIEWS" is overlaid in white, bold, sans-serif capital letters on the right side of the image.

SHARE
YOUR
VIEWS

Share Your Views

You are welcome to submit your views directly using the online views collection form available on the website (www.aqoreview.hk). You may also download the views collection form or complete the form on the following page, and send it to the Environmental Protection Department **on or before 11 October 2019** by post, email or fax:

Website: www.aqoreview.hk

Email: aqoreview@epd.gov.hk

Fax No.: 2838-2155

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5 Gloucester Road
Wan Chai, Hong Kong

Online views
collection form



 Please scan

Important

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 paper. 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.

For more details about this review, please refer to the information provided in **Annex 6**.

For enquiries, please contact us on 2594-6267.

Review of the Air Quality Objectives Views Collection Form

Question 1

Hong Kong's air quality has been improving in recent years. Are you aware of the improvements in air quality and visibility?

Aware Slightly aware Not aware

Question 2

The WHO AQGs recommend governments of different places to continuously explore new air quality improvement measures and balance the development of the society, with a view to progressively tightening the air quality standards to achieve the WHO AQGs levels. Do you agree with this approach?

Agree Partly agree Not agree

Question 3

What are your views on the proposed tightening of the AQOs for fine suspended particulates (PM_{2.5}) and sulphur dioxide (SO₂) as recommended in this review?

Understood No comment Others

Please specify: _____

Question 4

In your opinion, what kind of work should be paid attention to and covered in the next review of the AQOs?

Same as the current review No comment Others

Please specify: _____

This is a corporate response (representing the views of a group or an organization)
 individual response (representing the views of an individual)

by _____
(name of person or organisation)

at _____ and _____
(telephone) (e-mail)

Note: If space is insufficient, please attach additional sheet(s).

Submission

Please submit your views on or before 11 October 2019.

Disclaimer

The names and comments (except personal information) provided by individuals or groups to the EPD in the course of the public consultation will be disclosed, either wholly or partly, to the public (including disclosure on the relevant websites). If you do not wish such information to be disclosed, please advise us at the time of submission.

Personal Information Collection Statement

1. The personal data provided by means of this form will only be used for the above public consultation conducted by the EPD.
2. You have the right of access and correction with respect to personal data as provided by means of this form. For enquiries or making correction concerning the personal data, please email to aqoreview@epd.gov.hk.

————— THANK YOU! —————

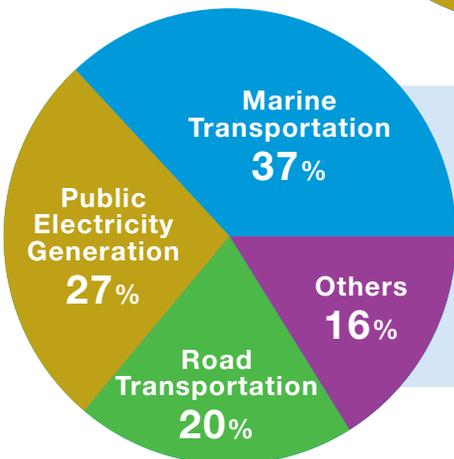
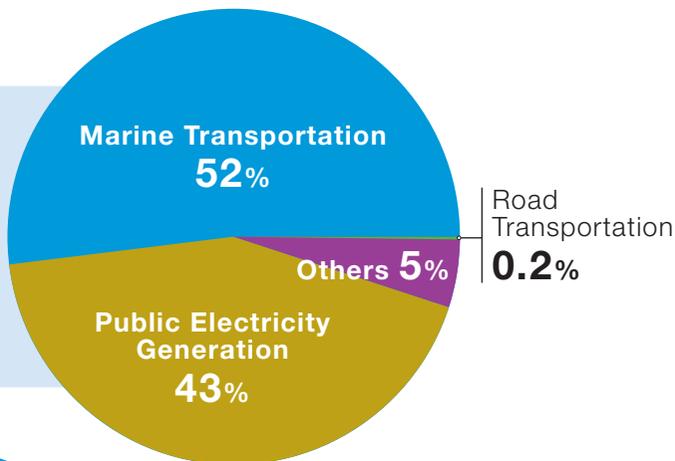
ANNEXES



Annex 1 – Hong Kong Air Pollutant Emissions in 2017

Sulphur Dioxide (SO₂)

Total Emission:
16,160 tonnes

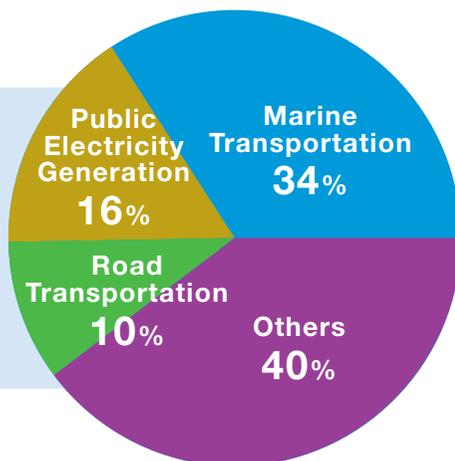


Nitrogen Oxides (NO_x)

Total Emission:
84,960 tonnes

Respirable Suspended Particulates (PM₁₀)

Total Emission:
4,020 tonnes



Annex 2 - AQOs Compliance Status at EPD's Air Quality Monitoring Stations in 2018

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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	—	—
Eastern	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	—	—
Kwun Tong	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	—	—
Sham Shui Po	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	—	—
Kwai Chung	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	—	—
Tsuen Wan	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tseung Kwan O	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓
Yuen Long	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓
Tuen Mun	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓
Tung Chung	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓
Tai Po	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	—	—
Sha Tin	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	—	—
Tap Mun	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓
Roadside Station												
Causeway Bay	✓	✓	✗	✓	✓	✗	✓	✓	✓	✓	✓	✓
Central	✓	✓	✗	✓	✓	✗	✓	✓	✓	✓	✓	✓
Mong Kok	✓	✓	✗	✓	✓	✗	✓	✓	✓	✓	✓	✓

Legend: ✓ Complied with the AQOs ✗ Not in compliance with the AQOs — Not measured

Annex 3 - Possible New Air Quality Improvement Measures

A. Short-term Measures – either on-going or already under consideration by the Government which are likely to yield results by 2025 or earlier

Road Transportation

1. Review the tunnel toll policy and level to alleviate traffic congestion, thereby reducing the emission caused by congestion at the tunnels
2. Establish a maintenance information database of vehicle tailpipe emission system
3. Raise awareness on the importance of vehicle maintenance and repair
4. Foster "pedestrian-friendly" environment (such as widening of footpaths, construction of covered walkways and enhancing the pedestrian connections) to encourage people to walk in existing new towns and urban areas (Note: Short to medium-term)
5. Foster "bicycle-friendly" environment and study into the provision of ancillary facilities for cycling (such as provision of cycling track network and bicycle parking spaces, park-and-ride facilities at public transport interchanges and bike-friendly policies to facilitate carriage of bicycles on public transport) in existing new towns and urban areas^[7] (Note: Short to medium-term)
6. Use urban planning and design solutions together with transport management to improve air ventilation in high density development
7. Enhance district-based publicity on bus route rationalisation*
8. Manage the growth of vehicles in particular private cars^[8]
9. Enhance enforcement against illegal parking
10. Review on-street metered parking fees

Remark: * Measures that have quantifiable emission reduction results.

[7] Cycling for commuting purposes in urban areas is not encouraged on road safety grounds

[8] "Raise the first registration tax and annual licence fees of more polluting vehicles" and "manage the growth of vehicles in particular private cars" were originally regarded as one item when deliberated at the RT Sub-group. As they are in fact two ideas, they are now separated into two items, i.e. "Manage the growth of vehicles in particular private cars" is now categorized as a short-term measure, while "Raise the first registration tax (FRT) of highly polluting vehicles" is categorised as "others"

11. Launch one-stop mobile app for the public to choose the most time-saving, economical and low-emission transportation mode^[9]
12. Launch one-stop mobile app for the public to access real-time information on car parking vacancies which helps them choose the best parking location and shorten the driving distance^[9]
13. Introduce ITS (e.g. manage traffic flow by traffic signal control, install smart sensors and surveillance cameras for illegal parking enforcement) (Note: Short, medium, to long-term, depending on individual ITS measure)
14. Raise public awareness on environmental protection, promote green living and encourage the public to use public transport systems as well as low emission transportation options

Marine Transportation

15. Ocean-going vessels (OGVs) at berth to use marine diesel with lower fuel sulphur content, e.g. not exceeding 0.1%*
16. Local vessels to use electricity from the power grid while at berth*

Energy and Power Generation

17. Encourage stakeholders in the commercial sector and the non-government sector, e.g. universities and hospital to adopt demand-side management measures*
18. Explore building energy efficiency measures for old existing buildings which are not covered by the Buildings Energy Efficiency Ordinance*
19. Encourage or provide incentives for the private sector to develop distributed renewable energy (RE)*
20. Facilitate distributed RE systems to connect to the power grid*
21. Encourage the development of more waste-to-energy facilities, such as waste incinerators, organic resources recovery centres, etc. for waste disposal as well as recovering energy for local use*
22. Increase the use of wind and solar energy in electricity generation*

[9] The Transport Department has launched an all-in-one mobile application "HKeMobility" since July 2018 which integrated the mobile applications namely "Hong Kong eTransport", "Hong Kong eRouting" and "eTraffic News". The public can acquire real-time traffic and transport information anytime and anywhere to plan their journeys in a single mobile app.

23. Replacement of coal-fired generating units by gas-fired units*
24. Upgrade burners of gas-fired generating units to improve fuel efficiency and emission performance*
25. Upgrade burners of gas-fired generating units to improve fuel efficiency and emission
26. Explore the use of waste materials such as corncobs, waste wooden pallets (i.e. biomass) as fuel*
27. Encourage major electricity users to reduce peak load demand so as to reduce the operation and emissions from coal-fired generating units for coping with peak load demand^[10]

VOC-containing products

28. Review the feasibility to impose VOC limits on consumer products that are not regulated under the Air Pollution Control (Volatile Organic Compounds) Regulation*
29. Review the feasibility to further tighten the VOC limits on regulated architectural paints*

Non-road mobile machinery

30. Explore the feasibility to further tighten the emission standards on non-road vehicles newly supplied to Hong Kong*

2018 Policy Address

31. Tighten the emission standards for newly registered motor cycles to Euro IV in 2020*
32. Launch an incentive-cum-regulatory scheme to progressively phase out Euro IV diesel commercial vehicles by end of 2023*

[10] In the light of the approval of the power companies' 2019-2023 Development Plans by the Government in July 2018, the power companies will replace their electromechanical meters by smart meters in seven years to support the energy efficiency & conservation initiatives (including reducing peak load demand) under the post-2018 Scheme of Control Agreements. Hence, this measure which was originally regarded as a long term measure when deliberated in the Energy and Power Generation Sub-group is now brought forward as a short-term measure.

B. Medium-term Measures – may be ready for further deliberation in the next AQOs review period of 2019-2023

Road Transportation

1. Conduct comprehensive review on the development of road transportation infrastructure and networks (such as construction of new tunnels and roads) to cope with population growth and to tackle road traffic congestion
2. Address the personal and operational needs of heavy vehicle drivers, such as provision of parking space and arrangement of meal and rest breaks at the Kwai Chung Container Terminals area, so as to reduce air pollution arising from idling engines

Marine Transportation

3. Impose emission standards on outboard engines of local vessels
4. Explore financial incentive and disincentive schemes to encourage liners to use less polluting OGVs calling Hong Kong ports

Non-road Mobile Machinery

5. Explore the feasibility to further tighten the emission standards on regulated machines newly supplied to Hong Kong

Cooking Fumes

6. Explore the feasibility of using new types of air pollution control equipment
7. Promote “low-emission” cooking (e.g. use of clean and efficient cooking stoves and healthy cooking style, etc.)

C. Long-term Measures – require detailed planning or further study to ascertain the practicability for implementation beyond the next review period

Road Transportation

1. Foster "pedestrian-friendly" environment (such as widening of footpaths, construction of covered walkways and enhancing the pedestrian connections) to encourage people to walk in new towns and new development areas (NDAs)
2. Foster "bicycle-friendly" environment and study into the provision of ancillary facilities for cycling (such as provision of cycling track network and bicycle parking spaces, park-and-ride facilities at public transport interchanges and bike-friendly policies to facilitate carriage of bicycles on public transport) in new towns and NDAs^[11]
3. Set up cycling and walking shared space at harbourfront areas
4. Electric vehicles pilot schemes - switching the existing vehicle fleet of selected routes to electric vehicles (EVs)
5. Implement electronic road pricing (ERP) scheme to tackle road traffic congestion at busy roads
6. Through proper land use planning to redress the current imbalance in home-job distribution and bring jobs closer to home so as to reduce commuting time and private car usage
7. Provide low-emission transport mode to the residents of NDAs

[11] There are no plans to provide bicycle park-and-ride facilities at public transport interchanges. Cycling for commuting purposes in urban areas is not encouraged on road safety grounds.

Marine Transportation

8. Explore the use of Liquefied Natural Gas (LNG) for marine vessels
9. Explore the use of biofuel (e.g. B5), fuel cell, Liquefied Petroleum Gas (LPG), compressed natural gas (CNG), methanol, nuclear and renewable energy, etc. for marine vessels
10. Explore the use of hybrid, diesel electric and electric vessels
11. Ocean-going vessels (OGVs) to use OPS while at berth at Cruise Terminal
12. Encourage academia to carry out studies on fuel and energy efficient measures in terms of operation and maintenance for local vessels; and collaboration between academia and local marine trade for the development of best practice guidelines and award system to facilitate adoption of the measures

Energy and Power Generation

13. Explore the use of old EV batteries as an electrical energy storage system for the power grid

D. Others – considered as not practicable, short of air quality benefits or not suitable to be considered under the current scope of the review

Road Transportation

1. Consider replacing the existing toll collection system with completely automatic systems
2. Propose to use chassis dynamometer for testing vehicle tailpipe emissions
3. Tighten the annual vehicle examination for private cars from over six years old to over three years old (or consider adopting vehicle kilometres travelled as the vehicle examination criterion)
4. Provide vehicle tailpipe emission testing equipment for rent by small and medium-sized vehicle repair workshops
5. Establish lower vehicle speed limits zones (e.g. 30km/h) in community roads, school zone and areas with elderly centres, to foster pedestrian environment^[12]
6. Tram or electric bus interchange schemes at busy road sections (e.g. Nathan Road) to replace the franchised bus services so as to reduce the number of buses and boarding/alighting passengers on the road section
7. Promotion of hybrid private cars
8. Exploring the use of new-energy vehicles
9. Provide information on the energy efficiency, emission performance and noise level of vehicles, etc., to facilitate the public to make a more environmentally-friendly choice
10. Set out objectives/policies to support the use of cleaner vehicle fuels
11. Extend the coverage areas of the existing low emission zones and their restriction to other vehicle types
12. Set up a continuous and effective priority road network for public vehicles
13. Review the policy on replacement of franchised buses
14. Provide funding to support District Councils for implementing air quality improvement projects
15. Raise the first registration tax and annual licence fees of more polluting vehicles^[13]

[12] This measure has been assessed together with "Foster "pedestrian-friendly" environment" as it carries the same spirit.

[13] See footnote [8].

Marine Transportation

16. River trade vessels to use on-shore power supply (OPS) while at berth at terminals
17. OGVs to use OPS while at berth at container terminals
18. Install emission reduction device (e.g. particulate filters) to reduce particulate matters (PM) emitted from local vessels
19. Impose control on nitrogen oxides (NO_x) emissions from engines of local vessels
20. Optimise port efficiency to shorten waiting and turnaround time of OGVs and river trade vessels at container terminals, river trade terminals and public cargo working areas (PCWA)
21. Slow-steaming of OGVs in Hong Kong waters
22. Remove floating rubbish for smooth operation of small local vessels^[14]
23. Government to expedite the approval process of new local vessels^[14]

Energy and Power Generation

24. Consider importing more nuclear electricity from the Mainland
25. Explore the idea of “SolarRoad” for promoting the use of solar energy
26. Explore the feasibility of using electric vehicles (EV) as electrical energy storage for power grid

Non-road Mobile Machinery

27. Explore the feasibility of retrofitting exempted regulated machines and non-road vehicles to improve their emission performance^[15]

Civil Aviation

28. Review on aviation emission control in the local context^[16]

[14] Not related to air quality improvement and not further discussed in the Marine Transportation Sub-group.

[15] EPD has further explored the feasibility and practicality of certain regulated machines such as generators and air compressors for retrofitting diesel particulate removal devices.

[16] This emission control has followed the international practice.

Annex 4 - Assessment Methodologies

Air Quality Assessment

- ▶ The Air Science and Health Sub-group endorsed the adoption of the updated “Pollutants in the Atmosphere and their Transport over Hong Kong” Modelling System (PATH-2016) in assessing the changes in air quality in 2025.
- ▶ **What is “Pollutants in the Atmosphere and their Transport over Hong Kong” Modelling System (PATH-2016)?**

PATH-2016 is a modelling system designed for assessing the impact of air pollutant emissions on the air quality at a certain location. It is extensively used in environmental impact assessment studies.

The current assessment has adopted the emission data and meteorological information in Hong Kong, the PRD Region and other Mainland areas outside the PRD region in 2015 as the input parameters of PATH-2016, and simulated the transport and chemical reactions of the air pollutants in 2015 which was adopted as the base year of this assessment. The air quality simulation results were then verified with EPD's air quality monitoring data to optimise the model accuracy.

- ▶ In assessing the changes in air quality in 2025, PATH-2016 has already used the latest official data/information of different regions. The emission data inputted by each region are as follows:



Areas of the Mainland outside the PRD Region

- ▶ Project the 2020 emissions based on the emission reduction targets. There are currently no emission estimations beyond 2020.

PRD Region

- ▶ Use the PRD Region's emission reduction targets for 2020 (see **Table 2**) as the 2025 emissions since the official projection beyond 2020 is currently not available.

Hong Kong

- ▶ Take into consideration the on-going and committed measures implemented by the Government, including:

- Phasing out some 82,000 old diesel commercial vehicles (i.e. pre-Euro, Euro I, Euro II and Euro III models) by the end of 2019. New diesel commercial vehicles first registered after 1 February 2014 are subject to a service life limit of 15 years.
- Starting from 1 January 2019, a new legislation has been implemented to mandate vessels to use low sulphur fuel within Hong Kong waters to further reduce the emission from vessels.
- Progressively tightening up the statutory emission caps on three key air pollutants, namely SO₂, NO_x, and PM₁₀, from power plants.

- ▶ Take into account the emission reduction potential of the short-term measures identified in the review (see **Annex 3** for the measures).

Meteorological information

Consider the pollutant emissions in different regions

“Pollutants in the Atmosphere and their Transport over Hong Kong” Modelling System (PATH-2016)

Simulate the air pollutants concentrations

Project the air quality in 2025

Health and Economic Impact Assessment (HEIA)

Health Impact Assessment

- ▶ Improvements in air quality can bring health benefits, such as reducing premature deaths^[17], hospital admissions, clinic visits and medical costs, particularly in relation to respiratory and cardiovascular diseases, thereby indirectly raising labour productivity.
- ▶ After detailed discussions, the Health and Economic Impact Assessment Task Force set up under the Air Science and Health Sub-group has agreed to conduct an HEIA based on a tool^[18] developed by the Chinese University of Hong Kong.

Economic Impact Assessment

- ▶ Economic benefits of the long-term health impacts

The estimation of the economic benefit of reducing premature deaths brought about by improved long-term air quality is based on the Value of Statistical Life (VOSL) method. VOSL refers to the amount of money an individual (or society) is willing to spend to save a life, which varies among different areas/countries. Therefore, the estimation based on the VOSL approach is only for indicative purpose.

- ▶ Economic benefits of the short-term health impacts

The reduction in the medical costs on hospital admissions and clinic visits brought about by improved short-term air quality, particularly in relation to respiratory and cardiovascular diseases, and the labour productivity raised indirectly are estimated.

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

[17] The number of short-term premature deaths is covered in the number of long-term premature deaths.

[18] The tool was developed by the Chinese University of Hong Kong under the study "Developing an Instrument for Assessing the Health and Economic Impacts of Air Pollution in Hong Kong" commissioned by the EPD, which was completed in 2016. The study report is available for download on the following website:

https://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/air/studydrpts/files/instrument_impacts_air_pollution.pdf

Annex 5 - Predicted Air Quality in 2025

Note:

IT – Interim Target of the WHO AQGs
AQG – Ultimate target of the WHO AQGs
HKAQO – Hong Kong Air Quality Objectives

Respirable Suspended Particulates (PM₁₀)

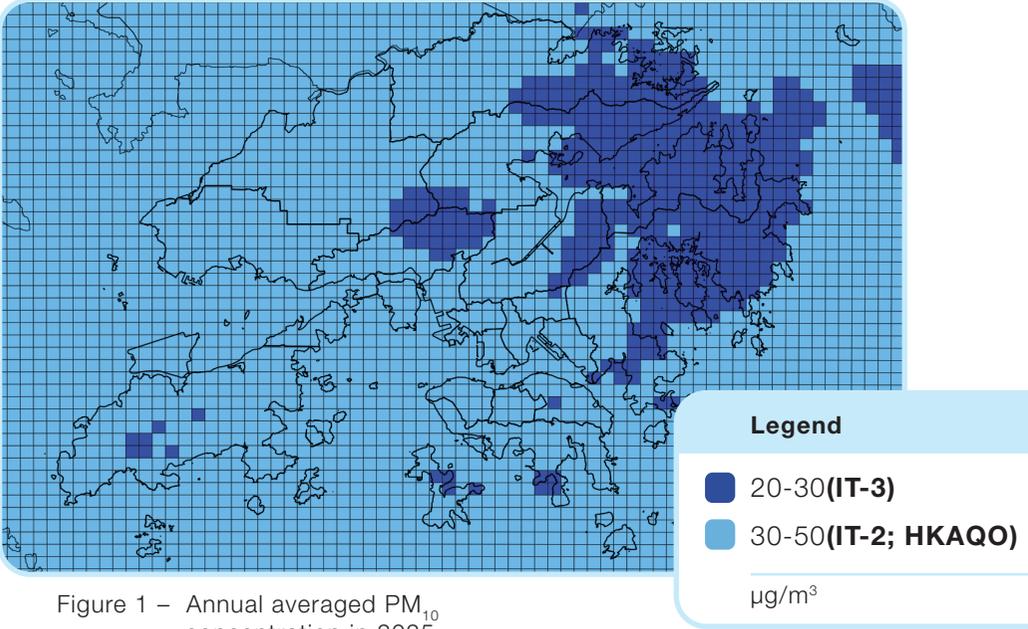


Figure 1 – Annual averaged PM₁₀ concentration in 2025

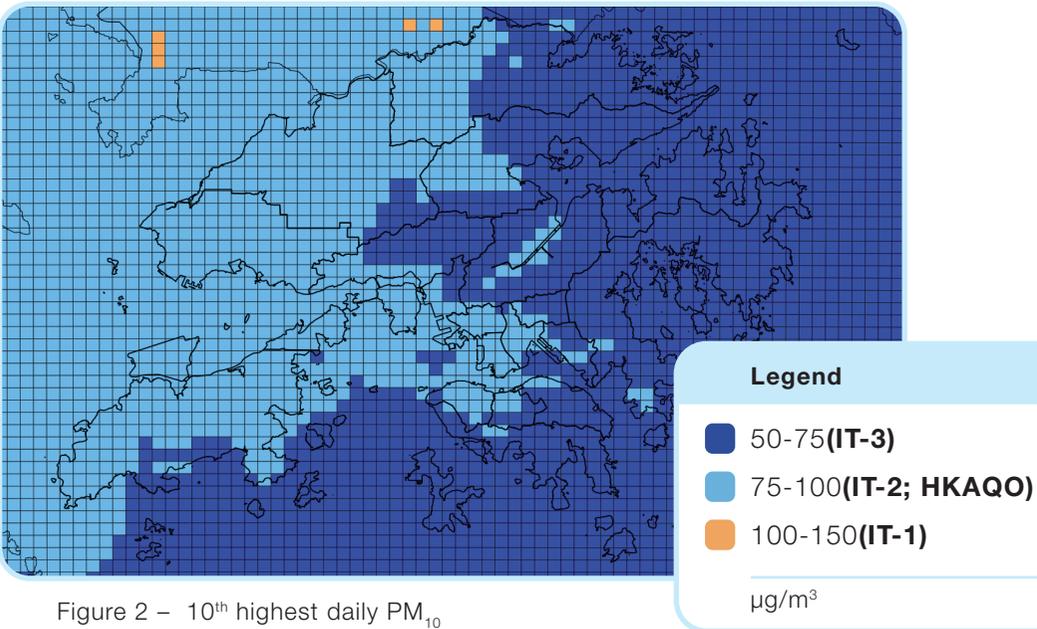
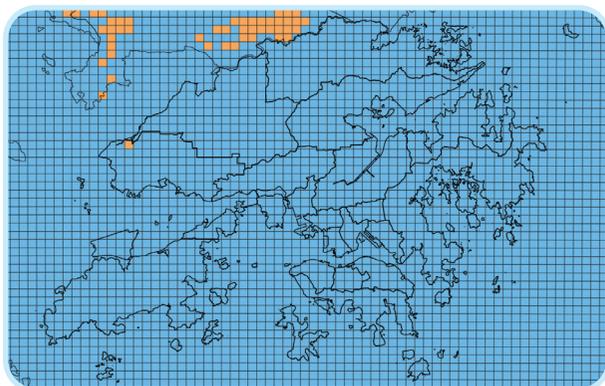


Figure 2 – 10th highest daily PM₁₀ concentration in 2025

Fine Suspended Particulates (PM_{2.5})

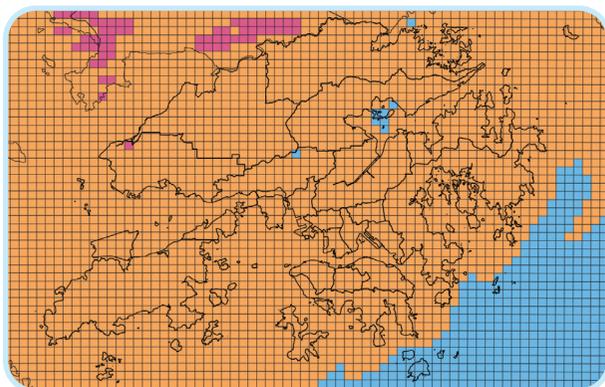


Legend

- 15-25 (IT-2)
- 25-35 (IT-1; HKAQO)

µg/m³

Figure 3 – Annual averaged PM_{2.5} concentration in 2025

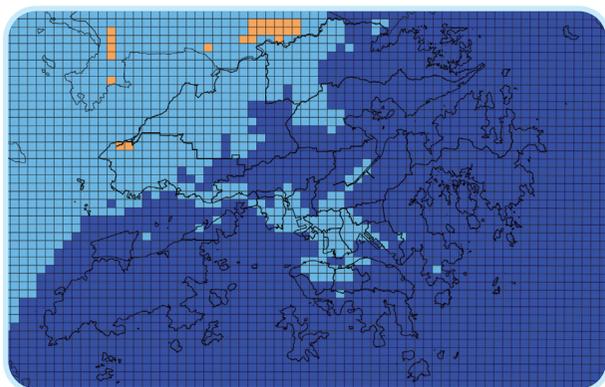


Legend

- 37.5-50 (IT-2)
- 50-75 (IT-1; HKAQO)
- 75-90

µg/m³

Figure 4 – 10th highest daily PM_{2.5} concentration in 2025



Legend

- 20-37.5 (IT-3)
- 37.5-50 (IT-2)
- 50-75 (IT-1; HKAQO)

µg/m³

Figure 5 – 36th highest daily PM_{2.5} concentration in 2025

Nitrogen Dioxide (NO₂)

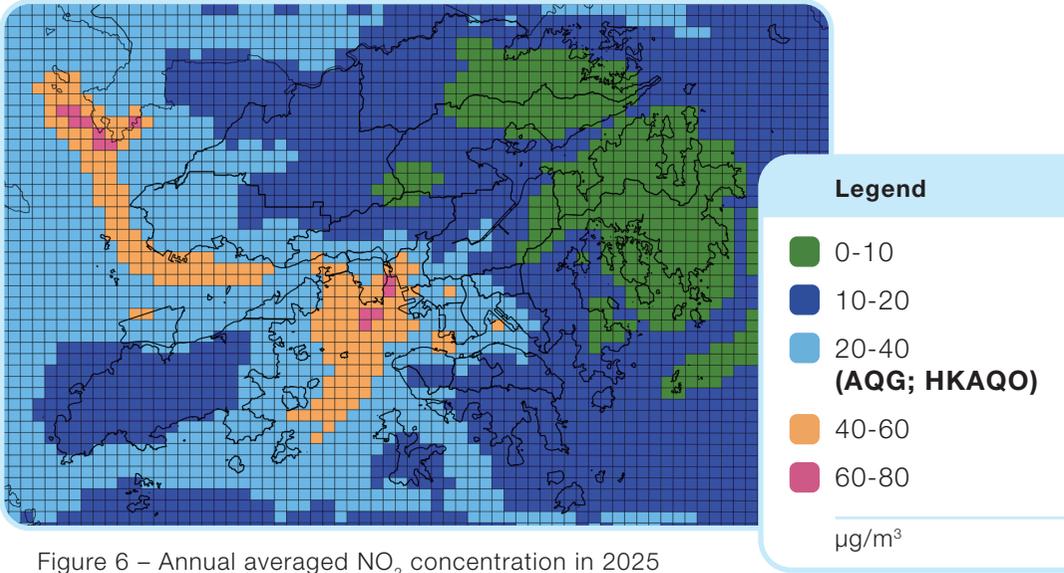


Figure 6 – Annual averaged NO₂ concentration in 2025

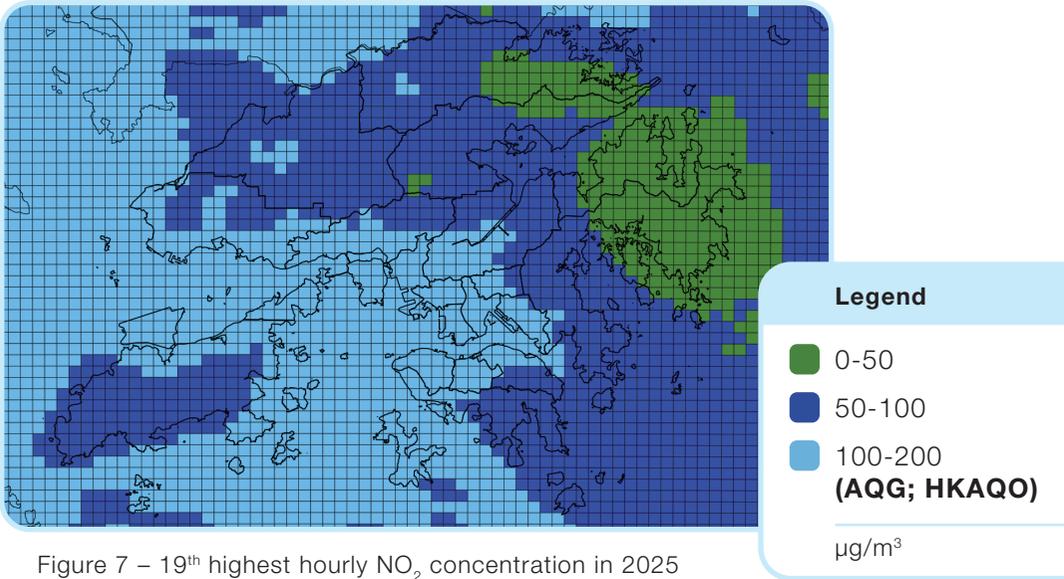


Figure 7 – 19th highest hourly NO₂ concentration in 2025

Sulphur Dioxide (SO₂)

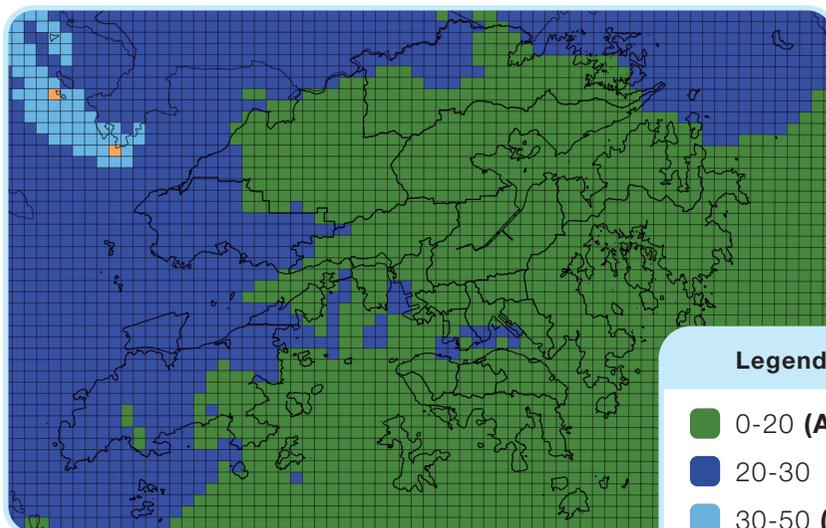


Figure 8 – 4th highest daily SO₂ concentration in 2025

Legend

- 0-20 (AQG)
- 20-30
- 30-50 (IT-2)
- 50-125 (IT-1; HKAQO)

µg/m³

Ozone (O₃)

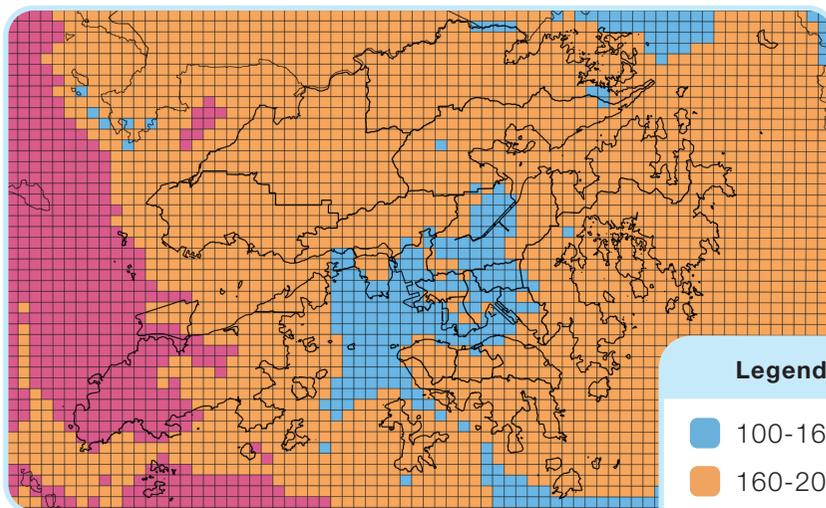


Figure 9 – 10th highest daily maximum 8-hour O₃ concentration in 2025

Legend

- 100-160 (IT; HKAQO)
- 160-200
- 200-250

µg/m³

Annex 6 – References



Please scan the below QR codes

Advisory Council
on the Environment



Work Plan of the
Review of Air Quality Objectives
- ACE Paper 7/2016



Progress of the
Review of Air Quality Objectives
- ACE Paper 12/2017

Appendix



Review of
Air Quality Objectives
- ACE Paper 1/2019

Appendix1

Appendix2

Panel on Environmental Affairs,
Legislative Council



Work Plan of the
Review of Air Quality Objectives
- LC Paper No. CB(1)705/15-16(03)



Progress of the
Review of Air Quality Objectives
- LC Paper No. CB(1)1164/16-17(07)



Review of Air Quality Objectives
- LC Paper No. CB(1)723/18-19(03)

