

**For discussion on  
17 October 2023**

**Legislative Council Panel on Environmental Affairs**

**Air Quality Improvement Strategies**

**Purpose**

This paper mainly briefs Members on the Government's strategies for improving air quality.

**Air quality in Hong Kong**

2. The Government has committed to implementing various emission reduction measures to gradually reduce the emissions of air pollutants over the past two decades. Hong Kong's air quality in 2022 was the best since the return to the motherland, and the overall air quality broadly complied with the Hong Kong's Air Quality Objectives<sup>1</sup> (AQOs). Compared with 2013, the annual average concentrations of respirable suspended particulates (PM<sub>10</sub>), fine suspended particulates (PM<sub>2.5</sub>), nitrogen dioxide (NO<sub>2</sub>), and sulphur dioxide (SO<sub>2</sub>) in ambient air have been reduced by 43% – 62%; while the concentrations at the roadside have been reduced by 47% – 64% during the same period; the annual averaged concentration of ozone has also gradually stabilised in the past few years; the number of hours of reduced visibility in Hong Kong has also dropped significantly by 74% from the peak in 2004. The aforementioned trend reflects the effectiveness of emission reduction measures.

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<sup>1</sup> Schedule 5 of the Air Pollution Control Ordinance (Cap. 311) prescribed the air quality objectives in the air control zone, including 7 air pollutants (namely sulphur dioxide, respirable suspended particulates, fine suspended particulates, nitrogen dioxide, ozone, carbon monoxide, and lead), setting 12 objectives by different averaging time. The prevailing objectives took effect on 1 January 2022.

## Review of Air Quality Objectives

3. To continuously improve air quality and better protect the public health, the Government launched the Air Quality Objectives Review at least once in every five years pursuant to Section 7A of the Air Pollution Control Ordinance (Cap. 311) (APCO). The Government established the Air Quality Objectives Review Working Group<sup>2</sup> (the Working Group) and commissioned the consultants in 2022 to assess the improvement of Hong Kong's air quality in 2030 and also explore the scope for further tightening of 12 prevailing AQOs and setting 3 new parameters<sup>3</sup>, based on the interim targets and air quality guidelines (AQG) levels of the World Health Organisation (WHO)'s WHO Global Air Quality Guidelines (the WHO AQGs) published in September 2021, as benchmarks.

4. On the basis of the various strategies and plans set out in the the Hong Kong Roadmap on Popularisation of Electric Vehicles, the Clean Air Plan for Hong Kong 2035 and the Hong Kong's Climate Action Plan 2050 (the Three Blueprints), published by the Government in 2021, the Working Group has consolidated 21 air quality improvement measures with significant emission reduction impact by 2030 (see **Annex 1**). Taking into account the air quality assessment and health and economic impact assessment results, we proposed to further tighten 5 prevailing AQOs and set 3 new parameters introduced in the WHO AQGs as elaborated below:

- (i) tighten the 24-hour AQO for sulphur dioxide (SO<sub>2</sub>) from Interim Target-2 (IT-2) level (50µg/m<sup>3</sup>) of the WHO AQGs to AQG level (40µg/m<sup>3</sup>) with the current number of exceedances allowed (3) remains unchanged;

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<sup>2</sup> The Air Quality Objectives Review Working Group comprises some 20 external members from the air science field, environmental groups, professional bodies, business associations and relevant trade, as well as official representatives from related government bureaux and departments.

<sup>3</sup> The 3 new parameters introduced in the WHO Guideline include peak season level for O<sub>3</sub>, 24-hour level for NO<sub>2</sub>, and 24-hour level for CO.

- (ii) tighten the annual AQO for respirable suspended particulates (RSP/PM<sub>10</sub>) from IT-2 (50µg/m<sup>3</sup>) to IT-3 (30µg/m<sup>3</sup>); and its 24-hour AQO from IT-2 (100µg/m<sup>3</sup>) to IT-3 (75µg/m<sup>3</sup>) with the number of exceedances allowed (9) remains unchanged;
- (iii) tighten the annual AQO for fine suspended particulates (FSP/PM<sub>2.5</sub>) from IT-2 (25µg/m<sup>3</sup>) to IT-3 (15µg/m<sup>3</sup>); and its 24-hour AQO from IT-2 (50µg/m<sup>3</sup>) to IT-3 (37.5µg/m<sup>3</sup>) with the number of exceedances allowed decreased from the current 35 to 18;
- (iv) add three new AQO parameters introduced by the WHO, namely the 24-hour AQO for nitrogen dioxide (NO<sub>2</sub>) and set at IT-1 (120µg/m<sup>3</sup>) with the number of exceedances allowed at nine; the peak season AQO for ozone (O<sub>3</sub>) and set at IT-1 (100µg/m<sup>3</sup>); the 24-hour AQO for carbon monoxide (CO) and set at AQG level (4 000µg/m<sup>3</sup>) with no exceedance allowed.

5. With the proposed update, 7 out of the 15 AQOs will be set at the most stringent level of the WHO AQGs<sup>4</sup> (see **Annex 2**).

6. In this regard, the Government reported the review findings to the Advisory Council on the Environment on 4 September 2023 and the Members unanimously supported the proposed updates of parameters. In parallel, a two-month public consultation has been launched on August 31, with 2 public consultation forums held on September 20 and 26, so as to garner views from professional bodies, trades, and concern groups. The overall public response on the recommendations has been positive.

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<sup>4</sup> The intended tightening of AQO for FSP to IT-3 set out in the WHO AQG will be broadly in line with the current standard adopted in Japan, Singapore, Korea and the United States, and more stringent than that adopted in the European Union. In accordance with the review findings, the annual AQO for NO<sub>2</sub> remains at IT-1, which is broadly in line with the current standard adopted in Singapore and the European Union, and more stringent than those adopted in Korea and the United States. To our knowledge, no countries have completely adopted the AQG levels set out in the WHO AQGs as their statutory air quality standards.

7. After considering the outcome of the public consultation, the Government will introduce the amendment bill on amending the APCO to the Legislative Council in 2024, with a view to implementing the new AQOs in January 2025.

### **Challenges ahead**

8. Despite that the air quality in Hong Kong has improved substantially, there remain the following challenges ahead:

- (i) Due to limited availability of channels on sea, Hong Kong is vulnerable to vessel emissions because many ships emit pollutants while berthing and sailing near populated areas; and
- (ii) Hong Kong is also affected by regional and super-regional pollution arising from sources in Guangdong and areas further away. The concentration of FSP has largely reduced and the problem of smog has been eased as a result of the long-term collaboration with the Guangdong Provincial Government to improve regional air quality. However, the concentration of regional ozone is still at a relatively high level.

9. To overcome these challenges and progressively implement the aforementioned 21 air quality improvement measures, the Government will tighten the sulphur content limits of marine light diesel and industrial diesel and lift the restriction on use of liquid and solid fuel in Sha Tin fuel restriction area, and continue to promote regional collaboration. The details of measures are delineated below:

## **Tightening the Sulphur Content Limits of Marine Light Diesel (MLD) and Industrial Diesel**

10. The Government has been imposing control on the sulphur contents of fuels to reduce SO<sub>2</sub> emissions and improve the air quality in Hong Kong. The Air Pollution Control (Marine Light Diesel) Regulation (“the MLD Regulation”) and the Air Pollution Control (Fuel Restriction) Regulations (“the FR Regulations”) limit the sulphur contents of locally supplied diesel fuel for vessels and industrial and commercial uses, respectively, to control SO<sub>2</sub> emissions from these sectors at source. Currently, the statutory cap on the sulphur content of locally supplied MLD is 0.05% (by weight), while the statutory cap on the sulphur content of liquid fuel for industrial and commercial use in Hong Kong is 0.005% (by weight).

11. Since 2019, the State has fully implemented the requirement for supplying diesel meeting China VI standards (i.e. with sulphur content not exceeding 0.001%), with a view to banning the sale of motor diesel below China VI standards, and aligning the sulphur content limit of vehicle diesel, ordinary diesel and oil for some marine vessels<sup>5</sup> to achieve “three-oil integration”. To further reduce emissions from the local vessels and industrial activities, and at the same time bring the diesel fuel standard of Hong Kong on par with other regions within the Pearl River Delta so as to facilitate Hong Kong’s integration into the Guangdong - Hong Kong - Macao Greater Bay Area (GBA), thus contributing to the environmental and ecological protection of the region, we propose to tighten the statutory cap on the sulphur content of locally supplied MLD and industrial diesel both to 0.001%, the same level as the statutory sulphur content limit for motor diesel. This would help Hong Kong to achieve “three-oil integration” as well.

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<sup>5</sup> “Some marine vessels” generally refer to non-OGVs including inland vessels and river-sea vessels that navigate in the inland river control area of the Mainland waters.

12. We propose to amend the MLD Regulation and the FR Regulations to tighten the statutory cap on the sulphur content of both locally supplied MLD and industrial diesel to 0.001%. To safeguard Hong Kong's competitiveness as an international marine transport centre, we also propose to introduce new provisions in the MLD Regulation to allow MLD importers (oil companies) and suppliers (i.e. oil distributors, oil retailers, oil traders) to continue to supply MLD with sulphur content higher than 0.001% but not exceeding 0.05% ("the restricted MLD") to OGVs. These provisions aim to ensure that the restricted MLD is only supplied to OGVs and to help make the supply of the restricted MLD traceable which can facilitate enforcement work. The relevant provisions include the following:

- (i) MLD importers and suppliers who supply the restricted MLD must register with the control authority ("the Authority", i.e. the Director of Environmental Protection) prior to supplying the said MLD;
- (ii) MLD importers are permitted to supply the restricted MLD to the registered MLD suppliers only; and
- (iii) MLD importers and suppliers who supply the restricted MLD to OGVs are required to submit reports to the Authority regarding information of their supply of the restricted MLD to OGVs regularly.

### **Lifting the Restriction on Use of Liquid and Solid Fuel in Sha Tin Fuel Restriction Area**

13. Sha Tin District is situated in valley areas which hinders effective dispersion of air pollutants. In the 1980s, many small and medium scale non-gaseous fuel users co-existed with nearby residents within the district, causing serious air pollution. To improve the situation, the Sha Tin fuel

restriction area (STFRA) was delineated under the FR Regulations, disallowing the use of liquid or solid fuel in any relevant plant (including furnace, engine, oven or industrial plant) in the STRFA except at a construction site or during emergency.

14. However, the planning and development of Sha Tin in the past few decades have transformed it into a primarily non-industrial area, with electricity and gaseous fuel set for use in general. Air monitoring data show that the ambient SO<sub>2</sub> level in Sha Tin has dropped significantly from 14 µg/m<sup>3</sup> in 1991 to 5 – 7 µg/m<sup>3</sup> in recent years, which is similar to or even lower than the average level in other districts of Hong Kong.

15. Results of computer model simulation show that the air quality of Sha Tin would remain similar to other districts like Tuen Mun and Tseung Kwan O upon lifting the restriction in the use of liquid or solid fuel. Hence, we consider it obsolete to retain the STFRA which causes unnecessary restrictions to some trades and public activities, and suggest lifting the restriction on use of liquid and solid fuels in STFRA.

16. Based on the above assessment, we propose to remove the relevant provisions in the FR Regulations regarding the requirements on restricting the use of liquid fuel and solid fuel in STFRA.

17. In drafting the above control proposals in paragraphs 12 and 16, the Government has considered holistically a range of factors such as the needs to improve Hong Kong's air quality and integrate into our national development, as well as the operational needs of the relevant trade (see **Annex 3** for detailed analysis).

18. We had been engaging various trades and stakeholders since 2021 to seek their views during the course of drafting the above control proposals. In addition, we commenced a two-month public consultation on the control proposals on 10 July 2023 to solicit comments from over 500 stakeholders, including oil importers, suppliers, vessel owners and

operators, the industrial and commercial trade, trade associations, green groups, government departments, professional and academic institutions, and other public and advisory bodies. Feedbacks received during the public consultation period were generally supportive, though some vessel operators expressed concerns on possible cost implications. Nevertheless, the consulted trades and stakeholders generally agree on the importance of aligning Hong Kong's fuel standards with the Mainland's policy as well as the benefits to Hong Kong's air quality as a result of improving fuel quality. The Development, Housing, Environment and Health Committee of Sha Tin District Council supported the proposal. We have reviewed and refined our proposals in the light of the comments received in the consultation.

### **Regional collaboration**

19. The Hong Kong Special Administrative Region (SAR) Government has been working closely with the Guangdong Provincial Government and the Macao SAR Government to improve regional air quality. The Guangdong and Hong Kong SAR Governments commenced a study titled "Post-2020 Regional Air Pollutant Emission Reduction Targets and Concentration Levels" in 2018 with a view to establishing the joint direction for addressing the regional air quality beyond 2020. The study was completed in 2022. In addition to confirming achievement of the emission reduction targets for 2020, the two Governments have established emission reduction targets for nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOC), the precursor pollutants to ozone formation, for the years of 2025 and 2030 to tackle the regional ozone problem (see **Table 1**).



**Table 1 Emission reduction targets of Guangdong and Hong Kong SAR in 2025 and 2030 (compared with 2019)**

Emission reduction targets	Pearl River Delta Economic Zone*		Hong Kong SAR	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
<b>2025</b>	12%	10%	20%	10%
<b>2030</b>	12% - 20%	10% - 19%	25% - 35%	15% - 20%

\* The Pearl River Delta Economic Zone (PRDEZ) includes Guangzhou, Shenzhen, Zhuhai, Dongguan, Zhongshan, Foshan, Jiangmen, Huizhou and Zhaoqing.

20. Apart from setting regional emission reduction targets for the precursor pollutants contributing to ozone formation, the Environmental Protection Department also launched a 3-year study (2021-24) titled “Characterisation of Photochemical Ozone Formation, Regional and Super-regional Transportation in the Greater Bay Area” in 2021. The study aims to identify the distribution and transport pathways of ozone and its precursor pollutants through scientific data analysis for formulating the policies and measures for control of regional ozone level. The study has collected data at various locations in Guangdong, Hong Kong and Macao over the past three years and is now in its final stage. The compiled data will be submitted to an expert panel composed of two national academicians and six air experts who are familiar with regional air quality in the Greater Bay Area for review and analysis.

### **Way forward**

21. The Government will implement the emission reduction strategies as set out in the Three Blueprints according to the targets, and review the air quality objectives at least once in five years to formulate the corresponding air quality management measures. We will also strengthen the collaboration with the GBA to tackle regional air quality management issues.

## **Advice sought**

22. Members are invited to note the air quality improvement strategies, and provide comment on paragraphs 7, 12 and 16 of the proposal.

**Environment and Ecology Bureau**  
**October 2023**

## 21 Air Quality Improvement Measures

Sector	No.	Measures
Road Transportation	1	No new registration of fuel-propelled and hybrid private cars in 2035 or earlier
	2	Electrification of franchised bus fleets and phase-out of conventional diesel franchised buses
	3	Introduction of hydrogen fuel cell vehicles
	4	Electrification of public light buses
	5	Electrification of taxis
	6	Electrification of goods vehicles, light buses, non-franchised buses, motorcycles, etc.
	7	Phase-out of old diesel commercial vehicles
	8	Electrification of Government's and public organisations' vehicle fleets
	9	Development of electric vehicle (EV) charging network comprising public and private charging facilities
	10	Training of professionals and mechanics on EV repair and maintenance and handling of retired EV batteries
	11	Development of green transport network
	12	Adoption of green features (including pedestrian-friendly and bicycle-friendly features) in urban areas, new towns and new development areas
Marine Transportation	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 by marine vessels
	17	Use of marine fuel with sulphur content not exceeding 0.1% by ocean-going vessels

Sector	No.	Measures
Power 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
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 2

### Hong Kong's Prevailing AQOs and Proposed Updates to the AQOs


Pollutant	Averaging Time	WHO AQGs ( $\mu\text{g}/\text{m}^3$ )					No. of exceedances allowed per year	
		Interim Target				AQG Level	Interim Target	AQG Level
		1	2	3	4			
Sulphur dioxide (SO <sub>2</sub> )	10-minute	---				500	3	---
	24-hour	125	50	---		40	3	---
Respirable suspended particulates (PM <sub>10</sub> )	24-hour	150	100	75	50	45	9	---
	Annual	70	50	30	20	15	Not applicable	---
Fine suspended particulates (PM <sub>2.5</sub> )	24-hour	75	50	37.5	25	15	35	18
	Annual	35	25	15	10	5	Not applicable	---
Nitrogen dioxide (NO <sub>2</sub> )	1-hour	---				200	18	---
	24-hour*	120	50	---		25	---	9
	Annual	40	30	20	---	10	Not applicable	---
Ozone (O <sub>3</sub> )	8-hour	160	120	---		100	9	---
	Peak Season*	100	70	---		60	---	Not applicable
Carbon monoxide (CO)	1-hour	---				30 000#	0	
	8-hour	---				10 000	0	
	24-hour*	7 000	---		4 000	---	0	
Lead (Pb)	Annual	---				0.5	Not applicable	---

**Notes :**

\* New parameters in the WHO AQGs

# As proposed under the WHO AQGs, the AQG level of CO (1-hour) is 35 000  $\mu\text{g}/\text{m}^3$ .

 Proposed updates on Hong Kong's AQOs are indicated in green cells.

 Prevailing Hong Kong AQOs are indicated in orange cells.

**Factors Considered for the Proposed  
Tightening of Sulphur Content Limits of MLD and Industrial Diesel  
and  
Lifting the Restriction on Use of Liquid and Solid Fuels in STFRA**

- (i) ***Emission reduction*** – The tightened cap would reduce the sulphur content of MLD by 98%. Based on an estimate of around 380 tonnes of SO<sub>2</sub> and 320 tonnes of RSP emissions by local vessels in 2020, the proposed tightening is expected to reduce the annual SO<sub>2</sub> and RSP emissions by about 370 tonnes (97%) and 5 tonnes (2%) respectively.
- (ii) ***Integration into national development*** – Upon implementation of the proposed control on MLD and industrial diesel, the sulphur content of diesel for motor, industrial and commercial as well as local and inland marine uses in Hong Kong will be 0.001%. This helps Hong Kong to accomplish the “three-oil integration”, dovetail with the Mainland’s policy, and facilitate Hong Kong’s integration into the Guangdong - Hong Kong - Macao Greater Bay Area (GBA), thus contributing to the environmental and ecological protection of the region.
- (iii) ***Technically feasible transition to using diesel with lower sulphur content*** – Upon a comprehensive analysis of data and comments collected from different parties including the relevant technical departments of the Government, oil companies, engine manufacturers and vessel operators who have switched to using MDL with Sulphur content not exceeding 0.001%, it is concluded that all vessels that could currently use MLD with maximum sulphur content at 0.05% are suitable for switching to use MLD with sulphur content limit at 0.001% without engine modification. Oil companies have also indicated that there would be adequate supply of both types of MLD. As for industrial diesel, at present, the locally supplied industrial diesel is the same as Euro V motor diesel, i.e. having a sulphur content not exceeding 0.001%. We therefore propose to tighten the statutory cap on sulphur content of industrial diesel from 0.005% to 0.001%. In fact, the amendment just reflects the actual market situation, and will not have technical implications on the industry.

(iv) ***Safeguarding fuel supply for OGVs*** – Hong Kong is one of the major bunkering ports in the world and Asia. When OGVs visit Hong Kong, apart from bunkering marine fuel oil (sulphur content not exceeding 0.5%<sup>6</sup>), some of them also bunker MLD (sulphur content not exceeding 0.05%) for meeting their operational needs or to fulfill fuel requirements for visiting other ports. To maintain the business and safeguard the competitiveness of Hong Kong as a major bunkering port in Asia, the MLD Regulation should continue to allow the supply of MLD with sulphur content not exceeding 0.05% to OGVs, which is still commonly used by and indeed already a “cleaner” fuel in the case of OGVs. The State also allows supply of such MLD at some Mainland ports<sup>7</sup> for OGVs despite the implementation of the “three-oil integration”.

(v) ***Affordable Costs*** – Our price review shows that the import price of MLD with maximum sulphur content at 0.001% is normally slightly higher than that at 0.05%, but the import prices of both have been very close to each other since 2014. Even in the past two years when international oil prices have been very volatile, the difference in the average import prices of the two types of MLD was still less than 5% most of the time. In February to July 2023, the difference was less than HK\$0.03 per litre (about 1% of the fuel price). It is expected that the actual cost implications to the vessel owners and operators upon the implementation of the proposal will depend on the difference between import and retail prices set by the MLD suppliers. Nevertheless, the possible fuel cost increase may be offset in long run by savings in operating and maintenance costs from using MLD with the sulphur content not exceeding 0.001%, which could for instance reduce wear and tear of engine cylinder liners. Overall the switch is not expected to have significant impact on the operation costs of the trade.

(vi) ***Avoiding causing unnecessary restrictions to some trades and public***

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<sup>6</sup> Since 1 January 2019, the Air Pollution Control (Fuel for Vessels) Regulation (Cap.311AB) requires all vessels to use compliant fuel (i.e. low sulphur fuel with sulphur content not exceeding 0.5% or liquefied natural gas), irrespective of whether they are sailing or berthing in Hong Kong.

<sup>7</sup> At present, some Mainland ports such as Zhoushan, Shanghai, Guangzhou, Dalian and Qingdao could supply MLD with sulphur content not exceeding 0.05% to OGVs.

*activities* – Upon the removal of the STFRA, the residents in the Sha Tin District could then conduct barbeque, and restaurant operators would be able to use non-gaseous fuels such as gelled alcohol, Bincho-charcoal and wax candle for food warming.