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Proposals to Update the Indoor Air Quality Objectives under the Indoor Air Quality Certification Scheme for Offices and Public Places

PURPOSE

This paper consults Members on our proposal to update the Indoor Air Quality (IAQ) objectives under the IAQ Certification Scheme for Offices and Public Places (the Scheme) to tally with the latest IAQ guidelines published by the World Health Organization (WHO).

BACKGROUND

2. The Government has all along been promoting public awareness of the importance in maintaining good IAQ. The Environmental Protection Department (EPD) has been implementing since 2003 the Scheme to encourage property owners and management to adopt good IAQ management practices in their premises. Premises that are used as offices or public places and served by mechanical ventilation and air conditioning (MVAC) system may join the Scheme. While the Scheme targets generally at the entire building as a unit, premises/building owners or management may choose to certify certain parts or floors of a building.

3. A set of IAQ objectives comprising 12 IAQ parameters has been established for assessing whether the IAQ of a premises can meet an Excellent or a Good Class IAQ under the Scheme. An Excellent Class IAQ represents a highly comfortable

environment, whereas a Good Class IAQ is an environment that can protect the health of public at large. The prevailing IAQ objectives are shown in the table below.

Parameter	Unit	Averaging Time	IAQ Objectives	
			Excellent Class	Good Class
Room Temperature	°C	8 hours	20 to < 25.5	< 25.5
Relative Humidity (RH)	%	8 hours	40 to < 70	< 70
Air Movement	m/s	8 hours	< 0.2	< 0.3
Carbon Dioxide (CO ₂)	mg/m ³ (ppmv)	8 hours	< 1,440 (<800)	< 1,800 (< 1,000)
Carbon Monoxide (CO)	µg/m ³ (ppmv)	8 hours	< 2,000 (< 1.7)	< 10,000 (< 8.7)
Respirable Suspended Particulates (PM ₁₀)	µg/m ³	8 hours	< 20	< 180
Nitrogen Dioxide (NO ₂)	µg/m ³ (ppbv)	8 hours	< 40 (< 21)	< 150 (< 80)
Ozone (O ₃)	µg/m ³ (ppbv)	8 hours	< 50 (< 25)	< 120 (< 61)
Formaldehyde (HCHO)	µg/m ³ (ppbv)	8 hours	< 30 (< 24)	< 100 (< 81)
Total Volatile Organic Compounds (TVOC) (see Para. 4 for alternative compliance arrangement for Good Class IAQ)	µg/m ³ (ppbv)	8 hours	< 200 (< 87)	< 600 (< 261)
Radon (Rn)	Bq/m ³	8 hours	< 150	< 200
Airborne bacteria	cfu/m ³	8 hours	< 500	< 1,000

4. For the parameter of TVOC, as an alternative, a premises may choose to measure 10 specified individual VOC species instead of the TVOC. Compliance with the respective objectives of the 10 VOC species, as set out in the table below is equivalent to meeting the objective of the TVOC.

VOC Species	Averaging Time	Objectives
Benzene	8 hours	16.1µg/m ³ (5 ppbv)
Carbon tetrachloride	8 hours	103µg/m ³ (16 ppbv)
Chloroform	8 hours	163µg/m ³ (33 ppbv)
1,2-Dichlorobenzene	8 hours	500µg/m ³ (83 ppbv)
1,4-Dichlorobenzene	8 hours	200µg/m ³ (33 ppbv)
Ethylbenzene	8 hours	1,447µg/m ³ (333 ppbv)
Tetrachloroethylene	8 hours	250µg/m ³ (37 ppbv)
Toluene	8 hours	1,092µg/m ³ (290 ppbv)
Trichloroethylene	8 hours	770µg/m ³ (143 ppbv)
Xylene (<i>o</i> -, <i>m</i> -, <i>p</i> -isomers)	8 hours	1,447µg/m ³ (333 ppbv)

5. Premises owners/management who wish to participate in the Scheme have to commission accredited IAQ Certificates Issuing Bodies (CIBs)¹ to carry out the certification, and submit an assessment report and an IAQ certificate to the IAQ Information Centre² for vetting and registration. The registered IAQ certificate and labels can be put up at prominent locations of a certified premises for public information.

6. Full certification of all IAQ parameters is required for a premises newly joining the Scheme and thereafter at a five-year interval. In the intermediate years (i.e. from the 2nd to 5th year), annual re-certification of only two specific IAQ parameters (i.e. CO₂ and PM₁₀) is required to renew the IAQ certificate³.

¹ IAQ Certificates Issuing Bodies (CIBs) are accredited under the Hong Kong Accreditation Service (HKAS), which are the only qualified parties to conduct the IAQ certification, and issue certification reports and certificates for the Scheme.

² The IAQ Information Centre has been set up by EPD since 2001 to promote IAQ awareness and provide information on IAQ to the public. It is also responsible for the administration and promotion of the Scheme.

³ Full certification of all IAQ parameters is however required in renewing the annual IAQ certificate under the following circumstances;

- (i) when there is a change to the usage of the premises/buildings which may adversely affect the IAQ (e.g. from office to gymnasium, shopping mall, or karaoke establishment, etc.); or
- (ii) when there is a major alternation, or change to the operation or maintenance, of the MVAC system; or
- (iii) when the application for renewing an IAQ certificate is submitted to the IAQ Information Centre later than three months upon the certificate expiry date.

7. Premises participating in the Scheme include offices, shopping malls, club houses, theatres / halls, sports venues, libraries, etc. Since the launch of the Scheme, the number of certified premises has increased 18 times from about 80 in 2004 to 1 562 in December 2017. The Government has also taken steps to promote good IAQ at government premises since 2009⁴. The number of Excellent Class and Good Class certificates in the last 5 years is in the table below.

Year	Certificates of Premises		Total Number of Certificates
	Excellent Class	Good Class	
2013	202	768	970
2014	230	912	1 142
2015	239	976	1 215
2016	270	1 127	1 397
2017	318	1 244	1 562

8. Annual IAQ Certificate Award Ceremony cum Technical Seminar has been organized since 2006 to commend organizations which have made efforts to achieve good IAQ. In addition, the EPD has conducted publicity activities (e.g. promotional messages on media and posters in public transport) to promote the Scheme, and educational activities (e.g. roving exhibitions and seminars) to share experiences and practices to achieve good IAQ.

REVIEW OF THE IAQ OBJECTIVES

9. The WHO published two IAQ guidelines in 2009 and 2010 respectively on dampness and mould⁵, and selected pollutants (viz. HCHO, radon, CO, NO₂, benzene, naphthalene, polycyclic aromatic hydrocarbons (PAHs), trichloroethylene and tetrachloroethylene)⁶. As the prevailing IAQ objectives of the Scheme were

⁴ A joint Development Bureau Technical Circular No. 5/2009 and Environment Bureau Circular Memorandum No. 2/2009 was issued in 2009, requiring all existing government premises served by central air-conditioning systems with a construction floor area exceeding 10,000 square meters to aim to achieve the Good Class of the IAQ Objectives and all new government premises to aim to achieve the Excellent Class of the IAQ Objectives. The joint circular was updated in April 2015, requiring all existing government buildings served by central air-conditioning systems to aim to achieve the Good Class of the IAQ Objectives wherever practicable.

⁵ WHO guidelines for indoor air quality: dampness and mould, WHO Regional Office for Europe, 2009.

⁶ WHO guidelines for indoor air quality: Selected pollutants, WHO Regional Office for Europe, 2010.

established in 2003, it is necessary to review the Scheme's objectives against the latest WHO's IAQ guidelines.

10. EPD conducted a review of the IAQ objectives, taking into account local circumstances and the practicability of adopting the latest WHO's IAQ guidelines. A number of studies have been commissioned by EPD to identify suitable measurement and assessment protocols; prepare technical guidelines for assessments and evaluate implications for the Scheme.

Proposed Update of the IAQ Objectives

11. We propose to update the IAQ objectives as set out in the ensuing paragraphs and as shown in **Annex**.

12. Three physical parameters, i.e. room temperature, RH and air movement, are proposed to be removed from the IAQ objectives as they are only related to comfort of the occupants and are not directly related to health protection.

13. Two short-term objectives of NO₂ (1-hour) and HCHO (30-minutes), which have been stipulated in WHO's IAQ guidelines (2010), are proposed to be added to the IAQ objectives to address health effects due to short-term exposure to the two pollutants.

14. A new IAQ parameter of mould is proposed to be added to the IAQ objectives to tally with WHO's IAQ guidelines (2009) for assessing the existence and possible factors that facilitate the growth of mould. A prescriptive compliance checklist is proposed for conducting mould assessment.

15. The objectives of CO, radon and PM₁₀ of the Good Class IAQ are proposed to be tightened with reference to WHO's IAQ guidelines (2010) to better protect public health.

16. As regards the alternative compliance arrangement for TVOC, as mentioned in paragraph 4 above, we propose to adopt the five VOC species as set out in WHO's IAQ guidelines (2010) (viz. benzene, naphthalene, PAHs, trichloroethylene and tetrachloroethylene) instead of the current ones in paragraph 4 above.

ASSESSMENT ON THE PROPOSED UPDATES

Measurement of short-term IAQ objectives of NO₂ and HCHO and mould assessment

17. EPD has studied suitable measurement protocols and instruments for measuring the 1-hour NO₂ and 30-minute HCHO. The studies revealed that portable analysers for measuring 1-hour NO₂ with acceptable performance are available in the market. There are also standard testing methods for measuring 30-minute HCHO and the five VOC species as mentioned in paragraph 15 above. EPD has consulted the CIBs on the measurement protocols and instruments identified to be suitable for measuring the two parameters. CIBs have not raised technical concern on the use of the instruments and measurement protocols for measuring and assessing these parameters.

18. As for mould, WHO's IAQ guidelines (2009) does not recommend any quantitative health-based guideline values or thresholds for acceptable levels of contamination with mould. Instead, WHO recommends conducting thorough inspection to assess the dampness and mould problems. EPD has formed an Expert Panel on Fungi Control in Offices and Public Places comprising relevant government departments, local academics and experts to develop a prescriptive checklist for mould assessment. EPD has already developed technical guidelines for CIBs to conduct mould inspection using the prescriptive checklist and guidance notes for property owners/management to prevent and control indoor mould. CIBs have been consulted during the development of the prescriptive checklist and technical guidelines; and their comments have been taken into account before the checklist (and the guidelines) are finalized. While carrying out a mould inspection, CIBs will conduct walkthrough inspection at the premises to identify whether there is any sign of mould growth and water problems; measure the RH and check if the property owners / management have implemented proper housekeeping and remediation measures to prevent mould growth and water problems.

Cost implications

19. It is estimated that the cost for the full certification of all IAQ parameters under the proposed revised IAQ objectives would increase by around 33% – 39%. About 77% of the premises currently joining the Scheme would face an increase of the full certification cost by not more than \$5,700. This additional cost is relatively small spanning across the five-year full certification cycle, as mentioned in paragraph 6 above.

IMPLEMENTATION PLAN

20. Before implementing the Scheme with the revised IAQ objectives, guidebooks for the IAQ certification, accreditation requirements / documents for CIBs to carry out the certification for the revised IAQ objectives have to be revised. Having consulted CIBs and the Hong Kong Accreditation Service on the preparation for the accreditation requirements, we propose to launch the revised IAQ objectives on **1 July 2019**.

21. The 5-year cycle for full certification of all IAQ parameters, as in the existing Scheme, will continue to be adopted. During the annual renewal of the IAQ certificate in the intermediate years (i.e. from the 2nd to 5th year), we propose to include mould inspection on top of the re-certification of the two IAQ parameters of CO₂ and PM₁₀.

22. It is proposed that premises newly joining the Scheme or which have completed their 5-year cycle for full certification on or after 1 July 2019 shall adopt the revised IAQ objectives. For other premises which have joined the Scheme before 1 July 2019, they may during the annual renewal of the IAQ certificate either continue to carry out the re-certification of two IAQ parameters under the prevailing IAQ objectives or to adopt the revised IAQ objectives by carrying out full certification of all IAQ parameters. This transitional arrangement will allow sufficient time for IAQ certificate holders to carry out necessary improvement / rectification works to migrate to the revised IAQ objectives. It is therefore expected that a complete switch over to the revised IAQ objectives will be attained by June 2024 at the latest.

23. To distinguish premises complying with the prevailing and revised IAQ objectives, IAQ certificates and labels of different design will be issued for premises certified under the revised IAQ objectives.

CONSULTATION

24. CIBs have been consulted throughout the review of the IAQ objectives, in particular on the measurement protocol of new IAQ parameters and mould inspection under the revised IAQ objectives. We have also conducted briefing sessions for key stakeholders, including government bureaux / departments, IAQ certificate holders,

property developers / management companies, IAQ service providers, academics, professional bodies, relevant trade and associations, etc., on the proposed revisions of the IAQ objectives in November 2017. Overall, they are in general supportive of the implementation of the revised IAQ objectives. Some stakeholders however raised concerns about the time and resources required to rectify any mould problems identified (and the causes of the mould problem, such as water condensation near air conditioning vents) in order to meet the new mould objective. As a 5-year transitional arrangement has been allowed for property owners / management to migrate to the new IAQ objectives, we consider that there should be sufficient time for the premises owners / management to plan and carry out the necessary remediation works, if required, to meet the new mould objective. In fact, proper housekeeping measures and operation of the MVAC system to maintain good IAQ will also be conducive to minimizing mould problem.

ADVICE SOUGHT

25. Members are invited to provide views on the proposed update of the IAQ objectives and the implementation plan as set out respectively in paragraphs 11 to 16 and 20 to 23.

Environmental Protection Department
May 2018

Proposed Update of the IAQ Objectives

Parameter	Unit	Averaging Time	WHO's IAQ Guidelines	Existing Objectives		Proposed Update		Remarks
				Excellent	Good	Excellent	Good	
Room Temperature	°C	8 hours	-	20 to < 25.5	< 25.5	To be removed		Only relating to human comfort, not directly relating to health
Relative Humidity	%	8 hours	-	40 to < 70	< 70			
Air Movement	m/s	8 hours	-	< 0.2	< 0.3			
Carbon Dioxide (CO ₂)	mg/m ³ (ppmv)	8 hours	-	< 1,440 (< 800)	< 1,800 (< 1,000)	No change		These parameters are not specified in WHO's IAQ guidelines
Ozone (O ₃)	µg/m ³ (ppbv)	8 hours	-	< 50 (< 25)	< 120 (< 61)			
Airborne bacteria	cfu/m ³	8 hours	-	< 500	< 1,000			
Total Volatile Organic Compounds (TVOC) (see Appendix for revisions to alternative compliance arrangements)	µg/m ³ (ppbv)	8 hours	-	< 200 (< 87)	< 600 (< 261)			
Nitrogen Dioxide (NO ₂)	µg/m ³ (ppbv)	8 hours	-	< 40 (< 21)	< 150 (< 80)			
	µg/m ³ (ppbv)	1 hour	200 (106)	---	---	100^b (53)	200^a (106)	New short-term objective added as per WHO's IAQ guidelines (2010)
Formaldehyde (HCHO)	µg/m ³ (ppbv)	8 hours	--	< 30 (< 24)	< 100 (< 81)	No change		No 8-hr concentration level is set in WHO's IAQ guidelines (2010)
	µg/m ³ (ppbv)	30 minutes	100 (81)	---	---			

Parameter	Unit	Averaging Time	WHO's IAQ Guidelines	Existing Objectives		Proposed Update		Remarks
				Excellent	Good	Excellent	Good	
Carbon Monoxide (CO)	$\mu\text{g}/\text{m}^3$ (ppmv)	8 hours	10,000 (8-hr); (8.7 (8-hr)) 7000 (24-hr) (6.1 (24-hr))	< 2,000 (< 1.7)	< 10,000 (< 8.7)	2,000 (1.7)	7,000^b (6.1)	Tighten the objective of Good Class IAQ as per WHO's IAQ guidelines (2010)
Respirable Suspended Particulates (PM ₁₀)	$\mu\text{g}/\text{m}^3$	8 hours	WHO's AQG for PM ₁₀ is also applicable ^c	< 20	< 180	20	100^c	
Radon (Rn)	Bq/m ³	8 hours	167 (excess lifetime risk of 1/1000)	< 150	< 200	150	167^b	
Mould	---	---	Inspection of indicators of dampness and mould growth in the premises ^d	---	---	Mould assessment in the form of a prescriptive checklist^d		New parameter added as per WHO's IAQ guidelines (2009)

a WHO guidelines for IAQ : Selected pollutants, WHO Regional Office for Europe, 2010.

b. A more stringent level than the guidance levels in the WHO guidelines for IAQ: Selected pollutants (2010) are set for the objectives of Excellent Class for 1-hour NO₂ and 30-minute HCHO. The level is set at around 75 percentile of the measured maximum levels in Good Class IAQ premises.

c WHO guidelines for IAQ : Selected pollutants (2010) recommends that WHO's Air Quality Guidelines (AQG) Global Update 2005 for particulates is also applicable to indoor air. The interim target (IT-2) of PM₁₀ (24-hour averaging limit) as specified in WHO's AQG is set for the objective of Good Class IAQ for PM₁₀. The Hong Kong Air Quality Objective (AQO) for PM₁₀ has also adopted the same level.

d WHO guidelines for IAQ : dampness and mould, WHO Regional Office for Europe, (2009) does not recommend any quantitative health-based guideline values or thresholds for acceptable levels of contamination with microorganisms but suggests that dampness and mould-related problems when occurred should be remediated to minimize the risk of hazardous exposure to microbes.

**Proposed Revisions to the
Alternative Compliance Arrangement for TVOC**

VOC Species	Averaging Time	Existing Objectives (for Good Class IAQ Only)	Proposed Update ⁽¹⁾
Benzene ⁽²⁾	8 hours	16.1µg/m ³ (5 ppbv)	17µg/m ³ (5.3 ppbv)
Carbon tetrachloride	8 hours	103µg/m ³ (16 ppbv)	To be removed
Chloroform	8 hours	163µg/m ³ (33 ppbv)	
1,2-Dichlorobenzene	8 hours	500µg/m ³ (83 ppbv)	
1,4-Dichlorobenzene	8 hours	200µg/m ³ (33 ppbv)	
Ethylbenzene	8 hours	1,447µg/m ³ (333 ppbv)	
Tetrachloroethylene ⁽²⁾	8 hours	250µg/m ³ (37 ppbv)	No change
Toluene	8 hours	1,092µg/m ³ (290 ppbv)	To be removed
Trichloroethylene ⁽²⁾	8 hours	770µg/m ³ (143 ppbv)	230µg/m ³ (43 ppbv)
Xylene (<i>o</i> -, <i>m</i> -, <i>p</i> -isomers)	8 hours	1,447µg/m ³ (333 ppbv)	To be removed
Naphthalene ⁽²⁾	8 hours	---	10µg/m ³ (1.9 ppbv)
Polycyclic Aromatic Hydrocarbons (as benzo(a)pyrene) ⁽²⁾	8 hours	---	1.2 ng/m ³ (1.2 x 10 ⁻⁴ ppbv)

- (1) The proposed revisions are applicable to both Excellent and Good Classes IAQ. If the sum of the five VOC species is less than or equal to 200 µg/m³, it is equivalent to complying with the Excellent Class IAQ.
- (2) These VOC species are specified in WHO guidelines for IAQ: Selected pollutants, WHO Regional Office for Europe, 2010 and the guidance levels have been adopted.