

For Discussion on
25 June 2018

LEGISLATIVE COUNCIL
PANEL ON ENVIRONMENTAL AFFAIRS

**Proposal to Update the Indoor Air Quality Objectives
under the “Indoor Air Quality Certification Scheme
for Offices and Public Places”**

PURPOSE

This paper briefs 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 Class or a Good Class IAQ under the Scheme. An Excellent Class IAQ represents a highly comfortable environment, whereas a Good Class IAQ represents 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 Good Class IAQ objective of TVOC, as an alternative, a premises may choose to measure 10 specified individual volatile organic compound (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 Good Class IAQ 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) accredited under the Hong Kong Accreditation Service (HKAS) 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 alteration, 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

7. Premises participating in the Scheme include offices, shopping malls, clubhouses, theatres/halls, sports venues, libraries, etc. Since the launch of the Scheme, the number of certified premises has increased 18 times from about 80 initially to 1 562 in December 2017. The Government also took the lead by requiring existing government buildings with central air conditioning systems to strive to achieve Good Class IAQ objectives as far as practicable⁴. 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, for enhancing public's awareness on IAQ and promoting the Scheme, EPD has conducted various publicity activities (e.g. promotional messages on media and posters in public transport), as well as educational activities (e.g. roving exhibitions and seminars) to share experiences and practices to achieve good IAQ.

later than three months upon the certificate expiry date.

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. By end of 2017, 80% of government premises with MVAC system have joined the Scheme.

9. To promote the Scheme more widely so as to increase its participation rate, we will broadcast promotional videos in different media (such as radio, television and railways); put up advertisements in public transport (such as buses, trams and railways); and organise roving exhibitions and seminars for promoting the importance of good IAQ and encouraging indoor premises to participate in the Scheme. Besides, we plan to enhance the promotion targeting particular prospective premises types (such as shopping malls, clubhouses, new buildings, etc.) This includes promoting the importance of improving IAQ to property developers and management companies so as to encourage them to establish good IAQ management as their corporate policy and to participate in the Scheme. To incentivize the property owners/management to participate in the Scheme, we plan to commend the certified premises through more channels, including publicising the certified premises at the IAQ Information Centre website, inviting property owners/management of the certified premises to attend seminars to share the good IAQ management of their premises to the public, thereby helping them to enhance their corporate image and publicise their good IAQ management. We believe that the participation rate of the Scheme can be further increased through the above work.

10. Premises not equipped with MVAC system (mainly residential buildings) can achieve good IAQ by natural ventilation through practices including maintaining good ventilation to reduce accumulation of indoor air pollutants, using low-emitting furniture and household products, etc.. Therefore, these premises are not included in the Scheme. Nevertheless, we will continue to promote to the public the importance and practices to maintain good IAQ through publicity and educational activities. Furthermore, we are preparing a new leaflet to provide guidance to the public on choosing low VOC (especially formaldehyde) emitting furniture and good practices to minimize exposure to VOCs from new furniture, as well as to encourage retailers to supply low-emitting furniture and provide relevant information to their customers. The leaflet is expected to be issued to the public and relevant trades within this year.

REVIEW OF THE IAQ OBJECTIVES

11. The prevailing IAQ objectives under the Scheme were established in 2003. Thereafter, 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.

12. In light of the IAQ guidelines published by WHO, 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 for different IAQ parameters, develop technical guidelines for assessments, and evaluate implications for the Scheme. EPD has completed the review and proposes to update the IAQ objectives as set out in the ensuing paragraphs and in **Annex**.

Proposed Update of the IAQ Objectives

13. We propose to update the IAQ objectives as follows:

- (i) 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 IAQ. Nevertheless, we have prepared a “Guidelines on Optimum Indoor Air Temperature, Relative Humidity and Air Movement” providing guidelines on the ranges of these three parameters to be set in a comfortable premises served with a MVAC system for reference by the professionals and building management, and encouraging them to regularly monitor the relevant data;

⁵ WHO guidelines for IAQ: dampness and mould, WHO Regional Office for Europe, 2009.

⁶ WHO guidelines for IAQ: Selected pollutants, WHO Regional Office for Europe, 2010.

- (ii) Two short-term objectives of NO₂ (1-hour) and HCHO (30-minutes), which have been stipulated in the WHO's IAQ guidelines (2010), are proposed to be added to the IAQ objectives;
- (iii) The objectives of CO, radon and PM₁₀ of the Good Class IAQ are proposed to be tightened with reference to the WHO's IAQ guidelines (2010) to better protect public's health;
- (iv) 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 the WHO's IAQ guidelines (2010) (viz. benzene, naphthalene, PAHs, trichloroethylene and tetrachloroethylene) to replace the current species in paragraph 4 above; and
- (v) A new IAQ parameter of mould is proposed to be added to the IAQ objectives to tally with the WHO's IAQ guidelines (2009) for assessing the presence of mould and possible factors which are conducive to the growth of mould. A prescriptive compliance checklist⁷ is proposed for conducting mould assessment.

ASSESSMENT ON THE PROPOSED UPDATES

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

14. EPD has studied suitable measurement protocols and instruments for measuring the 1-hour NO₂ and 30-minute HCHO. The studies

⁷ Moisture is the main factor that causes mould growth. Therefore, the prescriptive mould compliance checklist includes the measurement of RH in the premises which should be kept below 70%. The measurement methods and requirements are the same as that in the existing Scheme.

revealed that portable analysers for measuring 1-hour NO₂ with good 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 13(iv) 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 the measurement protocols for measuring and assessing these parameters.

15. As for mould, the WHO's IAQ guidelines (2009) does not recommend any quantitative health-based guideline values or thresholds for acceptable levels of contamination with mould.⁸ 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. We have consulted the CIBs and their comments have been taken into account when developing the checklist and technical guidelines. 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

16. 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

⁸ As the relations between dampness, microbial exposure and health effects could not be quantified precisely, the WHO does not recommend any quantitative health-based guideline values or thresholds for acceptable levels of mould contamination.

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

17. Before implementing the Scheme with the revised IAQ objectives, guidebooks for the IAQ certification and 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**.

18. 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.

19. 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.

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

CONSULTATION

21. 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 (including investigating and rectifying 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.

CONSULTATION WITH ADVISORY COUNCIL ON THE ENVIRONMENT

22. We consulted the Advisory Council on the Environment (ACE) on 4 June 2018. The ACE supported the implementation of the revised IAQ objectives.

ADVICE SOUGHT

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

paragraphs 13 and 17 to 20.

**Environmental Protection Department
June 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^a (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^a	
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) is set for the objectives of Excellent Class for 1-hour NO₂ and 30-minute HCHO. The level is set at around the 75th 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. Compliance with the respective objectives of the five individual VOC species is required for attaining Good Class. If the sum of the five VOC species is less than or equal to 200 µg/m³ at the same time, it is considered as meeting the requirement of 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.