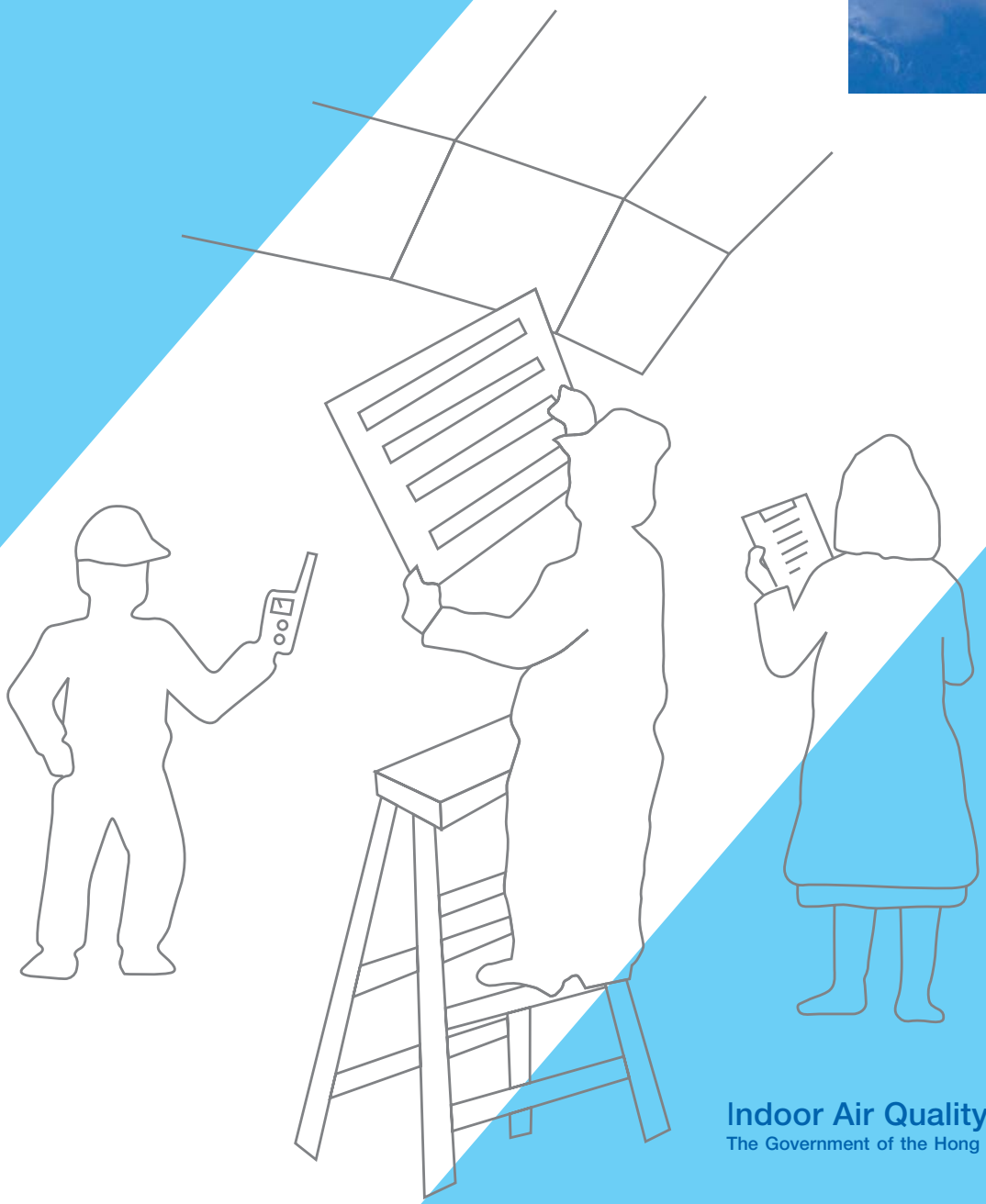
A Guide on Indoor Air Quality Certification Scheme

for Offices and Public Places



Indoor Air Quality Management Group
The Government of the Hong Kong Special Administrative Region

A Guide
on
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September 2003

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PURPOSE

This guide sets out the procedures to participate in the Indoor Air Quality Certification Scheme for Offices and Public Places.

BACKGROUND

2. To improve the indoor air quality (IAQ) and promote public awareness of the importance of IAQ, we have implemented an IAQ Management Programme. One of the core tasks of the Programme is to launch a voluntary IAQ Certification Scheme for Offices and Public Places (hereafter refers as "Certification Scheme").

3. Key features of the Certification Scheme are –

(a) a 2-level IAQ objectives (Excellent Class and Good Class) is used as the benchmark to assess IAQ of premises/buildings;

(b) a voluntary and self-regulatory approach is adopted for annual certification;

(c) participation is free but premises/building owners or management are responsible for all expenses, including but not limited to, employing competent examiners to assess IAQ of their premises/buildings against the IAQ objectives;

(d) competent examiners will issue an IAQ certificate for premises/building owners or management to register with the IAQ Information Centre if the IAQ objectives are complied with. The certificate should be put up at a prominent location for the public information;

(e) the certificate is valid for 12 months. For certificate renewal, a full set of parameters on IAQ objectives be measured once every 5 years, and for the 4 years in between, only carbon dioxide and respirable suspended particulates need to be measured annually if certain conditions are met;

(f) certification is generally made on the basis of a building as a unit. Nevertheless, premises/building owners or management can choose to certify certain parts or certain floors of a building; and

(g) premises/building owners or management have to manage post-certification IAQ to ensure IAQ is maintained at the certified level.

APPLICABILITY

4. In general, buildings or totally enclosed areas for the use as offices or public places which are served by mechanical ventilation and air conditioning (MVAC) system may join the Certification Scheme. MVAC system means the equipment, distribution network and terminal that provide, either collectively or individually, the processes of heating, cooling, humidification, dehumidification, ventilation or air-purification or any other associated processes to a conditioned space. It does not cover window-type air-conditioners or split-type air-conditioners. Public places is defined as “any theatre, place of public entertainment of any kind, or other place of general resort, admission to which is obtained by payment or to which the public have or are permitted to have access”. Examples of eligible buildings are office buildings, shopping malls, hotels, restaurants, theatres, cinemas and funeral parlours, etc.

5. The certification is generally made on the basis of a building as a unit. Nevertheless, premises/building owners or management can choose to certify certain parts or certain floors of a building. Where a shopping mall or scheduled premises[1] listed under Schedule 2 of the "Public Health and Municipal Services Ordinance" (Cap. 132) forms part of the building, it is required to be certified separately. The location of the certified premises/buildings must be clearly stated in the application form and the certificate.

CERTIFICATION STEPS

6. The following steps should be taken to participate in the Certification Scheme:

(a) owner/management of premises/building to engage a competent examiner;
(b) competent examiner to carry out a walk-through inspection to check if the premises/building have any IAQ problem;
(c) owner/management of the premises/building to rectify the IAQ problems with the assistance of the competent examiner, if any;
(d) competent examiner to conduct IAQ measurement and carry out remedial action if necessary;
(e) competent examiner to certify the premises/building in compliance with IAQ objectives and issue a certificate;
(f) owner/management of the premises/building to send to the Indoor Air Quality Information Centre the certificate for registration and a copy of the certification report for record;

[1] As at August 2003, the scheduled premises listed are restaurants, dancing establishment, theatres, cinemas, funeral parlours and factory canteens.

(g) Indoor Air Quality Information Centre to return the certificate to owner/management of the premises/building with a registration number for display in a prominent location for the public information;

(h) owner/management of the premises/building to manage post certification IAQ; and

(i) owner/management of the premises/building to initiate annual re-certification.

The application procedures are summarised in a flowchart at **Annex 1**.

Step 1 – Engage a Competent Examiner

7. Under the Certification Scheme, a competent examiner is defined as:

(a) For certification of commercial buildings and public places

A registered professional engineer (RPE) in building services, gas, chemical, environmental, marine and naval architecture or mechanical discipline who is registered under the Engineers Registration Ordinance (Cap. 409).

(b) For certification of government and quasi-government buildings*

(i) Requirement (a) above; or

(ii) A public officer appointed in writing by the Director of Architectural Services or the Director of Electrical and Mechanical Services, as having relevant qualification and experience in carrying out IAQ certification.

* including government leased/owned premises within a commercial or a joint venture building.

8. The IAQ Information Centre is maintaining a **non-exhaustive** list of consultancy firms with expertise in IAQ. The list is available at the IAQ Information Centre and its website http://www.iaq.gov.hk/ .

9. Since IAQ is a complex subject requiring expertise from various disciplines, specialists may be required at different stages of the certification process. During the IAQ certification, the competent examiner will lead a team of relevant personnel and is responsible for the following activities:

(a) carry out a walkthrough inspection of premises/building to check if there are any IAQ problems;

(b) provide recommendations, general advice or relevant information on practices commonly adopted to address the IAQ problems, if any;

(c) conduct IAQ measurement;

(d) certify the premises/building if the measurement results are in compliance with the IAQ objectives; and

(e) advise owner/management of the premises/building to manage post-certification IAQ as set out in paragraph 41 of this guide.

10. To strive for a higher certification quality, we are developing a quality assurance programme under which only parties accredited by an independent and defined accreditation body will be qualified for conducting IAQ certification. We will consult stakeholders concerned in due course. This quality assurance programme will be for the longer term as the pool of IAQ professionals takes time to build up.

Step 2 – Conduct Walkthrough Inspection

11. The competent examiner will gain first-hand visual appreciation for the building's hygienic and maintenance condition through a walkthrough inspection. It is recommended that the competent examiner should conduct the walkthrough inspection together with the owner/ management of the premises/building. A non-exhaustive checklist is provided in **Annex 2** to facilitate the inspection. Competent examiners should exercise their professional judgment to modify the checklist according to different premises/building uses and previous inspection experience as well as to develop tailor-made checklists for specific situations. Reference could also be made to Chapter 7 of Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places.

Step 3 – Rectify any IAQ Problems

12. If any IAQ problems are identified, the owner/management of the premises/building should rectify them with the assistance of the competent examiner. Reference could be made to Chapters 7 and 8 of the Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places.

Step 4 – Conduct IAQ Measurement

13. The competent examiner may proceed to carrying out IAQ measurement after the walkthrough inspection if he/she considers that there are no obvious irregularities or the irregularities have been rectified.

IAQ Parameters

14. A total of 12 IAQ parameters as listed in Table 1 shall be measured. These include 3 physical parameters (room temperature, relative humidity, and air movement), 8 chemical parameters (carbon dioxide (CO_2), carbon monoxide (CO), respirable suspended particulates (PM_{10}), nitrogen dioxide (NO_2), ozone (O_3), formaldehyde (HCHO), total volatile organic compounds (TVOC), and radon (Rn)), and 1 biological parameter (airborne bacteria). We will also include an additional parameter, airborne fungi with an indicative level of 500 cfu/m^3, for both "Good" and "Excellent" Classes in the next review for the Certification Scheme.

Sampling Criteria

15. Measurement should not be made in any part of the premises/building where it is totally enclosed but not served by MVAC system, such as store rooms, plant rooms, switch rooms, or kitchens (in the case of restaurants), etc.

Sampling Period

16. Measurement should be made on an 8-hour basis except otherwise specified. Where it is not practicable to take 8-hour continuous measurement, surrogate measurement (i.e. an intermittent measurement strategy based on the average of half-hour measurements conducted at four time-slots) is accepted. Competent examiners should take into account the operation pattern of the premises/building when choosing the four time-slots. As a guideline, the four time-slots should be evenly distributed over the business hours for office buildings whereas for public places they should cover the worst-case scenario such as periods of highest occupancy.

Number of Sampling Points

17. The guidelines for the minimum number of sampling points required are:

Total floor area to be certified (served by MVAC system) (m^2)	**Minimum Number of Sampling Points**
< 3,000	1 per 500 m^2
3,000 - < 5,000	8
5,000 - < 10,000	12
10,000 - < 15,000	15
15,000 - < 20,000	18
20,000 - < 30,000	21
≥ 30,000	1 per 1,200 m^2

However, competent examiners should exercise their professional judgment to take additional samples if necessary.

18. As outdoor air measurement data may provide hints on whether outdoor pollutants contribute to poor IAQ, all the IAQ parameters (except air movement) should, in parallel, be monitored outdoors in close proximity to the fresh air intakes of the study areas. At least one sample should be taken. Where accessible, samplers/monitor inlets should be located approximately 1 m off the edge of the fresh air duct inlets and enclosed in appropriate shelters to avoid direct sunlight and moisture. Other representative locations should be considered if the fresh air intake is not accessible.

Siting Indoor Monitoring Locations

19. Since IAQ may be affected by the effectiveness of the MVAC systems, the susceptibility of the occupants, and the potential sources expected from the occupant density or activities, sampling points should in general be chosen using the following criteria:

(a) distributed among individual MVAC zones;
(b) include areas under complaints; and
(c) cover areas with both high and low occupant density.

20. During field data collection, monitors should be sited at the selected sampling location using the following general guidelines:

(a) representing the primary workstation layout and work activities;
(b) of minimal disturbance of work activities within the study area;
(c) at least 0.5 m from corners or windows;
(d) at least 0.5 m from walls, partitions, and other vertical surfaces (e.g. file cabinets);
(e) not directly in front of air supply diffusers, induction units, floor fans, or heaters, or the exhaled breath of the operator, etc.;
(f) not under direct sunlight that will impact instrumentation;
(g) preferably not in hallways or passageways;
(h) at least 1 m from localised sources such as photocopiers, printers, cigarette smokers, etc.;
(i) not within 3 m of an elevator if sampled at a corridor / lobby;
(j) not within 2 m of doors;
(k) not obstructive to, or interfering with, occupant egresses from the study area under normal or emergency situations;
(l) not at the junction connected to stations of public transport facilities; and

(m) placing inlets of samplers at a height of about 1.1 m above the floor.

Measurement Methods

21. The detailed methods for measuring the 12 IAQ parameters for the purpose of the Certification Scheme are set out in **Annex 3**.

Sample Management

(a) Real-time monitoring data

22. The data collected by real-time monitors should be taken every 5 minutes either with data logging devices or by recording properly in a field data log sheet. The instrument operating conditions should also be properly recorded in a field log sheet.

(b) Integrated sample

23. Before sampling, a unique identification code should be assigned to each sample collected. The identification code will indicate the type of sample, the sampling location, and whether the sample is a primary or duplicate sample. Information on the types of sampling equipment, pump airflow rates, start/stop times, sampling conditions, names of technicians, and other appropriate sample collection information should also be documented.

24. After sampling, the chemical samples as collected in sampling tubes / filters / bags / canisters, etc. should be treated, stored and analysed as per manufacturers' recommendations if available, or otherwise, within a maximum period of 5 days. To ensure sample integrity, appropriate precautions against damage, deterioration and contamination of samples during transportation, storage and handling should be taken. For bacterial samples, they should be delivered to the microbiology laboratory within 24 hours for incubation.

Quality Control

25. Competent examiners should ensure the competence of all who participate in the IAQ survey and certification process. All measurements should be conducted using calibrated instrument/equipment and the calibration should be conducted according to manufacturer's specifications where available. Also, the calibration standards should have a well-defined traceability to certified reference materials (CRMs), if available.

26. Real-time monitors should be checked before use. Time must be allowed for the real-time monitors to reach steady state before taking measurements. Records should be maintained for each of the real-time monitors, including the following minimum data:

(a) manufacturer's name, serial number or other unique identification;

(b) real-time monitors' compliance with the product specifications;
(c) the manufacturer's instructions;
(d) dates, results and copies of reports and certificates of all calibrations, adjustments, and the due date of next calibration;
(e) the maintenance plan and maintenance carried out to date; and
(f) any damage, malfunction, modification or repair to the monitors.

27. To ensure the data quality, a quality control (QC) plan including sample preparation and handling, calibration, data processing, etc. should be prepared. At least one sample or 10% of the total field samples for each certification job, whichever is larger, should serve as field blanks and accompany the samples to the field and back to the laboratory, without being used for sampling. Similarly, at least one sample, or 10% of the total field samples for each certification job, whichever is greater, should be collected as duplicate samples. To prevent contamination or deterioration of the integrated samples, the chain-of-custody log detailing the storage and treatment of samples prior to analysis should be prepared.

Compliance Requirements

28. The 8-hour average IAQ Objectives in Table 1 will be used as the benchmark for assessing compliance, except for the alternative measurement of TVOC for Good Class objective as set out in paragraph 29 below. The compliance requirements are –

(a) at least 80% of the sample points of each of the parameters comply with the relevant IAQ objectives;
(b) for each of the chemical and biological parameters, no sample points should exceed more than 50% of the relevant IAQ objectives; and
(c) for each of the physical parameters, no sample points should exceed more than 10% of the relevant IAQ objectives, or fall outside 10% of the upper or lower limit if a range is used.

29. For Good Class IAQ objective, the TVOC objective is also considered met if the measurements of 10 more commonly found individual VOCs are in compliance with the requirements set out in Table 2. Details are –

(a) if the level of TVOC measured exceeds the level in Table 1, measurement of individual VOCs as listed in Table 2 may be carried out in the failed sampling points;
(b) measurements of individual VOCs should be conducted with analytical methods based on the USEPA's organic (TO) compendium procedures;
(c) a TVOC-failed sampling point complying with all the 10 individual VOCs

objectives in Table 2 will be regarded as a passed sampling point in respect of TVOC; and

(d) the number of passed sampling points of TVOC measurements and of individual VOC re-measurements will be added together when calculating the 80% compliance percentage.

Non-compliance Areas

30. The owners/management of the premises/buildings, with the assistance of the competent examiners, should carry out remedial actions on those non-compliance areas. Competent examiners may carry out IAQ re-measurements for those failed parameters after remedial actions have been taken.

Step 5 – Sign off IAQ Certificate

31. If the IAQ objectives are met, the competent examiner may sign off the "Certificate of Indoor Air Quality for Offices and Public Places" (a sample each of the Excellent Class and Good Class Certificates are at **Annex 4**). The competent examiner should download the electronic copy of the certificate from the IAQ Information Centre at http://www.iaq.gov.hk/, and colour print the certificate on "vellum laid" paper of 100 gram per square meter (GSM). All entries in the certificate should be type printed. Paper sample can be obtained from the IAQ Information Centre. The competent examiner should then issue the certificate together with a certification report (**Annex 5**) to the owner/management of the premises/building.

32. Except for measurement of PM_{10} and CO_2 for the purpose of certificate renewal (see paragraphs 42 to 43 below), competent examiners are required to complete the certification process 12 months after the first IAQ parameter is measured. If a set of IAQ compliant data is only available one year beyond the first IAQ parameter is measured, competent examiners would need to re-measure the full set of the 12 IAQ parameters.

33. The competent examiner is also required to advise owner/management of the premises/building to adopt appropriate post-certification measures to ensure that IAQ is maintained at the certified level (please see paragraph 41 below).

34. A number of buildings have already measured IAQ in accordance with the requirements set out in the previous draft consultation documents. Since some of the certification preparatory work and measurements may have been completed in accordance with the standards and methods suggested in the draft documents, there will be a one-off arrangement for first time applications possessing a full set of IAQ compliant data within 12 months after the launch of the Certification Scheme. For this one-off arrangement, the data will

be considered compliant if the measurement methodologies and other certification details can comply with this Certification Guide, or any previous editions of the IAQ Guidance Notes or IAQ Certification Guide. The one-off arrangement is:

(a) if the commencement date of the IAQ measurement is within 12 months before the launching date of the Scheme, the competent examiner may sign off the certificate with a starting date set at the date on which the competent examiner signs it; or

(b) if the commencement date of the IAQ measurement is beyond 12 months before the launching date of the Scheme, CO_2 and PM_{10} will have to be re-measured. Provided that the re-measurement data of CO_2 and PM_{10} comply with the requirement, the competent examiner may sign off a certificate with a starting date set at the date the competent examiner signs the certificate.

The above arrangements are applicable provided that there are no major alternations or changes to operation and management of the MVAC system after measurements have been taken; and that there is no change to the usage of the premises/buildings which may adversely affect the IAQ.

Step 6 – Apply for Registration

35. Upon receipt of the certificate and the certification report from the competent examiner, the owner/management of the premises/building should submit the following documents to the IAQ Information Centre (see paragraph 48 for its address):

(a) the original copy of an application form (**Annex 6**);

(b) the original copy of the certificate issued by the competent examiner; and

(c) a duplicate copy of the certification report.

Facsimile copy is not accepted.

Step 7 – Complete Registration

36. The IAQ Information Centre is responsible for inserting a registration number on the certificate and upload the information contained in the certificate to the Centre web page for public inspection. The Centre will keep a copy of the certification report for record only.

37. Upon receipt of the application form and the certificate, the Centre will endeavour to –

(a) return the certificate to the owner/management of the premises/building with a registration number within 7 working days upon receipt if the application form and the certificate contain all the information required; or
(b) issue a letter requesting supplementary information within 5 working days upon receipt if the information on the application form or the certificate is incomplete.

38. Upon receipt of the certificate returned from the Centre, the owner / management of the premises/building should display the certificate at a prominent location of the premises/building for the public information.

39. A certificate is valid for a period of 12 months, starting on the date the competent examiner signs off the certificate.

40. Owners/management of the premises/buildings have to remove the IAQ certificates from displaying at the premises/buildings within 7 days after the expiry of the certificates. They are required to return the expired certificates to the IAQ Information Centre for record.

Step 8 – Manage Post-Certification IAQ

41. The competent examiner is responsible to advise the owner/management of the premises/building on how to manage post-certification IAQ. The owner/management of the premises/building should endeavour to adopt the following measures to ensure that IAQ is maintained at the certified level:

(a) develop an IAQ management programme (please refer to Chapter 5 of Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places);
(b) ensure proper operation and maintenance of the MVAC system according to the checklist in **Annex 7**;
(c) exercise good housekeeping;
(d) ban smoking where practicable;
(e) take appropriate measures to control emission of pollutants during major alteration and renovation; and
(f) use products/equipment with low emission of indoor air pollutants.

Step 9 – Initiate Certificate Renewal

42. Within three months before the expiry of the current certificate, the owner/ management of the premises/building may engage a competent examiner to start the re-certification measurements. A renewed certificate could be prepared for certification purpose if the compliance requirements as stipulated in paragraphs 28 to 30 are met. The validity period of the renewed certificate will be counted from the first day after the expiry date of the last certificate.

43. For the first to the fourth annual re-certification (i.e. the second to the fifth year), only CO_2 and PM_{10} are required to be measured in accordance with the respective IAQ objectives in Table 1 and certified by competent examiners. Competent examiners must also confirm that there is no change to the usage of the premises/buildings which may adversely affect the IAQ and that there is no major alteration, or change to the operation or maintenance, of the MVAC system. For the fifth annual re-certification (i.e. the sixth year), competent examiners will need to measure and certify the full list of IAQ parameters in Table 1 to start another 5-year cycle.

44. However, the full list of IAQ parameters must be measured for the purpose of re-certification under the following circumstances:

(a) 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

(b) when there is a major alteration, or change to the operation or maintenance, of the MVAC system; or

(c) when the application for registration renewal is submitted to the IAQ Information Centre three months after the previous certificate has expired.

45. Where a full set of 12 parameters are required to be measured because of the circumstances set out in paragraph 44 above, competent examiners are required to complete the certification process within 12 months after the first IAQ parameter is measured. The starting date of the certificate will be the date the competent examiner signs the certificate. This will be regarded as starting a new 5-year cycle.

46. The registration procedures for certificate renewal and post IAQ management requirement are the same as the first time application as set out in Steps 6 and 8 above (paragraphs 35 to 41) and the contents of the re-certification report are set out in **Annex 5**.

FEES

47. Participation in the scheme is free of charge. However, owners/management of premises/buildings are responsible for all expenses associated with participating in the scheme (e.g. cost for employing the competent examiner for certification and undertaking remedial actions, etc.).

ENQUIRIES

48. For any enquiries related to the Certification Scheme, please contact the IAQ Information Centre at:

Indoor Air Quality Information Centre
1/F, HKPC Building
78 Tat Chee Avenue
Kowloon Tong, Kowloon

Telephone : 2788 6177
Fax : 2788 6181
Email : enquiry@iaq.gov.hk
Homepage : http://www.iaq.gov.hk/

TABLE 1: IAQ OBJECTIVES FOR OFFICES & PUBLIC PLACES

Parameter	Unit	8-hour average [a]	
		Excellent Class	Good Class
Room Temperature	°C	20 to < 25.5 [b]	< 25.5 [b]
Relative Humidity	%	40 to < 70 [c]	< 70
Air movement	m/s	< 0.2	< 0.3
Carbon Dioxide (CO_2)	ppmv	< 800 [d]	< 1,000 [e]
Carbon Monoxide (CO)	$\mu g/m^3$	< 2,000 [f]	< 10,000 [g]
	ppmv	< 1.7	< 8.7
Respirable Suspended Particulates (PM_{10})	$\mu g/m^3$	< 20 [f]	< 180 [h]
Nitrogen Dioxide (NO_2)	$\mu g/m^3$	< 40 [g]	< 150 [h]
	ppbv	< 21	< 80
Ozone (O_3)	$\mu g/m^3$	< 50 [f]	< 120 [g]
	ppbv	< 25	< 61
Formaldehyde (HCHO)	$\mu g/m^3$	< 30 [f]	< 100 [f, g]
	ppbv	< 24	< 81
Total Volatile Organic Compounds (TVOC)	$\mu g/m^3$	< 200 [f]	< 600 [f]
	ppbv	< 87	< 261
Radon (Rn)	Bq/m^3	< 150 [i]	< 200 [f]
Airborne Bacteria	cfu/m^3	< 500 [j, k]	< 1,000 [j, k]

Legends:

a. In some cases, it may not be practicable to take 8-hour continuous measurement. In these circumstances, surrogate measurement (i.e. an intermittent measurement strategy based on the average of half-an-hour measurements conducted at four time-slots) is also accepted.
b. EMSD (1998), Guidelines on Energy Efficiency of Air Conditioning Installations
c. Indoor Air Quality guideline value for Japan (Law of Maintenance of Sanitation in Building) and South Korea (Public Sanitary Law).
d. US EPA (1996), *Facilities Manual: Architecture, Engineering, and Planning Guidelines.* Maximum Indoor Air Concentration Standards.
e. Indoor Air Quality guideline value for Australia (Interim National Indoor Air Quality Goals), Canada (Indoor Air Quality in Buildings: A Technical Guide), Japan (Law of Maintenance of Sanitation in Building), South Korea (Public Sanitary Law), Singapore (Guidelines for Good Indoor Air Quality in Office Premises/building), Sweden (Ventilation Code of Practice) and Norway (Recommended Guidelines for Indoor Air Quality).
f. Finnish Society of Indoor Air Quality and Climate (2001), *Classification of Indoor Climate 2000: Target Values, Design Guidance and Product Requirements.*
g. WHO (2000), *Guidelines for Air Quality*
h. EPD (1987), Hong Kong Air Quality Objectives under the Air Pollution Control Ordinance (Cap. 311)
i. US EPA(1987): US EPA Guideline for Radon in Homes due to Natural Radiation Sources (Note: 4 pCi/L or 150 Bq/m^3 is EPA Action Level)
j. ACGIH (1986), ACGIH committee activities and reports "*Bioaerosols: Airborne viable microorganisms in office environments: sampling protocol and analytical procedures",* Applied Industrial Hygiene.
k. The exceedance of bacterial count does not necessarily imply health risk but serve as an indicator for further investigation.

TABLE 2: IAQ OBJECTIVES FOR INDIVIDUAL VOCS (FOR GOOD CLASS TVOC OBJECTIVE ONLY)

Compound	Good Class
Benzene	5 ppbv [a] (16.1 μg/m^3)
Carbon tetrachloride	16 ppbv [b] (103 μg/m^3)
Chloroform	33 ppbv [b] (163 μg/m^3)
1,2-Dichlorobenzene	83 ppbv [c] (500 μg/m^3)
1,4-Dichlorobenzene	33 ppbv [c] (200 μg/m^3)
Ethylbenzene	333 ppbv [c] (1,447 μg/m^3)
Tetrachloroethylene	37 ppbv [a,c] (250 μg/m^3)
Toluene	290 ppbv [a] (1,092 μg/m^3)
Trichloroethylene	143 ppbv [a,d] (770 μg/m^3)
Xylene (*o*-, *m*-, *p*-isomers)	333 ppbv [e] (1,447 μg/m^3)

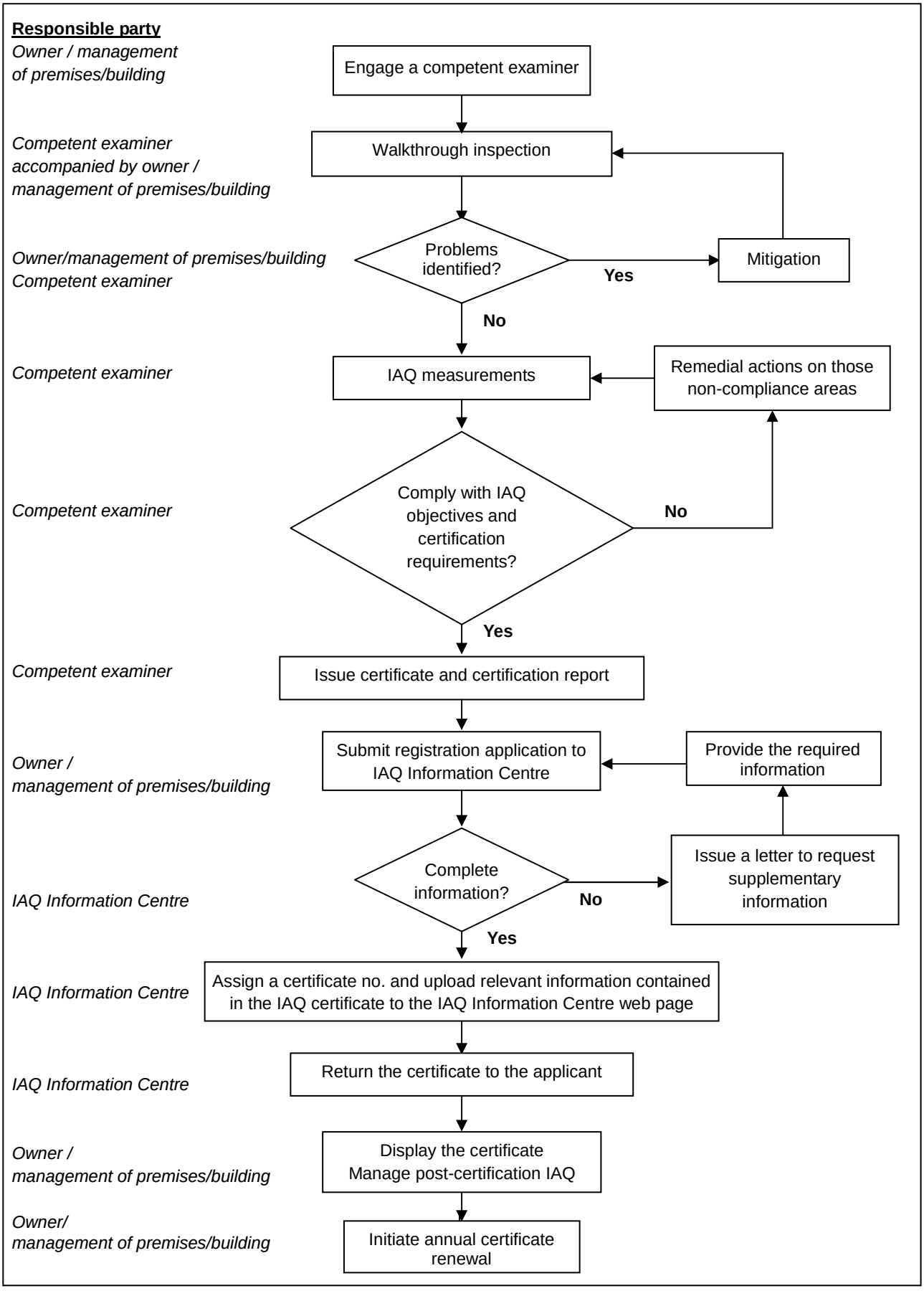
Legends:

a. WHO (1995), Updating & Revision of the *Indoor Air Quality Guidelines for Europe*
b. 1/300 of ACGIH TLV-TWA, ACGIH (1996), *ACGIH Threshold Limit Values for Chemical Substances in the Work Environment.*
c. A continuous exposure guideline value as recommended by WHO
d. The Royal Society, London (1983) "Risk level where very few would consider action necessary, unless clear causal risk with consumer products"
e. Labour Department (2002), *Code of Practice on Control of Air Impurities (Chemical Substances) in the Workplace*

Note: All conversion calculations are based on data from NIST Standard Reference Database 69 – March 2003 Release: *NIST Chemistry Webbook*.

ANNEX 1

FLOW CHART FOR APPLICATION PROCEDURE



ANNEX 2

CHECKLIST FOR WALKTHROUGH INSPECTION

General

Check whether there is any -

- Odour
- Dirty or unsanitary conditions (e.g. excessive dust)
- Visible fungal growth or mouldy odour (often associated with problem of excessive moisture)
- Staining or discolouration of building materials
- Sanitary conditions in equipment such as drain pans and cooling towers
- Inadequate ventilation
- Inadequate exhaust air flow
- Blocked vents
- Uneven temperature
- Overcrowding
- Poorly-maintained filters
- Personal air cleaners (e.g. ozone generators)
- Presence of hazardous substances
- Unsanitary mechanical room, or trash or stored chemicals in mechanical room

Specific

Thermal comfort

- Check for any evidence of high or low temperature. Are these due to occupant interference, such as installation of new equipment?
- Check for evidence of thermal gradients. The floor-to-ceiling differential should not exceed 3°C.
- Check for any obstruction of air circulation, such as partitions, taped diffusers, or blocked by files, papers, books, or cabinets.
- Ensure that thermostats are functioning, calibrated, correctly located, and not obstructed or enclosed.
- Is there any system intervention, such as blockage of the ventilation grilles?

Potential sources of contaminants

- Enquire about any recent change in the physical set-up and use of the space (e.g. open office space converted to closed offices, transformation of office space into a waiting room or computer room etc).

- Inspect the loading dock and car parks connected with the premises/building:
  - Are they properly ventilated?
  - Are stairways, elevator shafts, and ducts acting as pathways for automobile exhaust and diesel fumes?
  - Are carbon monoxide sensors (for ventilation control) and alarms installed in the garage calibrated and operating properly?
- Are stoves and other sources fitted with exhaust system?
- Is the building less than a year old, or has any area been renovated, redecorated or newly furnished within the past month?
- Are suitable cleaning products being employed? Is time of use optimum, so as to reduce exposure of occupants?
- Do any activities involve the use of large amounts of chemicals, especially highly volatile solvents? Is solvent odour present? Are soaked materials and solvents being disposed of properly?
- Have pesticides been improperly applied?
- Is the trash properly disposed of daily?
- Is extra ventilation or a separate ventilation system being used where there are localised sources? Is the ventilation system recirculating volatile organic compounds from a source throughout the building?
- Any there any mouldy, damp odour or evidence of a previous flood or water leak?
- Records should be examined for evidence of recent renovation, painting, installation of plywood or particleboard, replacement of carpets, and installation of new furniture.
- Are there dirt marks or white dust on diffusers, indicating particulates entering from the ventilation system?
- Is smoking only restricted to designated areas with independent ventilation system?
- Are carpets cleaned regularly?

MVAC system

- Is the amount of fresh air provided to the premises/building in line with the latest version of ASHRAE Standard 62?
- Are the electrostatic precipitators the approved type from Fire Services Department?
- Where is the fresh air intake duct located? Is it blocked up? Is it near the cooling tower? Is it at street level or near a car park (air intakes located below third-floor level can conduct fumes from vehicular traffic and parking garages)? Are heavy industries located nearby? Is there any construction work going on nearby?
- Are the fresh air controls and dampers functioning properly?
- Is the minimum fresh air damper opening set at approximately 15%?
- Are all air distribution dampers functioning properly and cleared of obstruction?
- Are filters installed and maintained properly (e.g. no bypassing, not overloading with dust)?
- Is the filtering system designed for primary filters rated between 10% and 30% dust-spot

efficiency, and for secondary filters rated between 40% and 85% dust-spot efficiency?

- Are the drain pans clean, properly drained, and without visible mould growth?
- Are the fan motors and belts working properly?
- Are diffusers and exhaust outlets close together, causing short-circuiting?
- Is the air-conditioning system turned off any time during the day?
- Is there a regular schedule for cleaning and maintenance of the MVAC system?
- Are all the components of the MVAC system regularly inspected for leaks or breaches, etc.?
- Do the cooling towers treated according to the "Code of Practice for Prevention of Legionnaires' Disease" published by Electrical and Mechanical Services Department?
- Are the mechanical rooms clean and free of contaminants (e.g. refuse or chemicals)?
- Are the exhaust fans operating properly?
- Are all air distribution paths unobstructed?

ANNEX 3

MEASUREMENT METHODOLOGIES FOR IAQ PARAMETERS

Below are measurement methodologies that should be used for determining the 12 IAQ parameters. To conduct a valid sampling programme, all equipments or methods adopted should have appropriate detection range and limit of detection to cover the respective IAQ objectives.

(a) Temperature, Relative Humidity, and Air Movement

Temperature, relative humidity, and air movement should be measured by electronic thermometers, psychrometer, and anemometers, respectively. These equipments should have readouts for the data logging.

For air movement measurements, the competent examiner should set up the monitor in such location as to receive the air current first.

(b) Carbon Dioxide and Carbon Monoxide

The level of carbon dioxide and carbon monoxide should be measured by a real-time monitor, such as a non-dispersive infrared (NDIR) analysers or electrochemical oxidation device.

(c) Radon

The level of radon should be measured by an electronic radon monitor which complies with the device performance test described in the US Environmental Protection Agency (USEPA) National Radon Proficiency Program Handbook (EPA 402-R-95-013, July 1996), or equivalent.

(d) Formaldehyde

The level of formaldehyde should be determined by active or passive sampling followed by analysis methods such as high performance liquid chromatography (HPLC) or colorimetry as below:

i) Active sampling and analysis by HPLC based on the USEPA TO-11A method, or

ii) Passive sampling and analysis by colorimetry based on the ASTM method D5014-94, or

iii) Passive sampling and analysis by HPLC based on the method with the following features:

- Analysis method: desorption of hydrazone and analysis via HPLC; and
- Lower detectable limit of less than 6 $\mu g/m^3$ (8-hour average).

Real-time measurement of formaldehyde can also be used.

(e) Nitrogen Dioxide

The level of nitrogen dioxide should be quantified by collecting air samples in a Tedlar bag with subsequent analysis by a chemiluminescence based NO_2 analyser that complied with USEPA designated methods in accordance with Title 40, Part 53 of the Code of Federal Regulations (40 CFR Part 53), or equivalent.

Alternatively, the level of nitrogen dioxide can be quantified by passive sampling using absorbent filter containing triethanolamine for nitrogen dioxide absorption and analysed by spectrophotometry at a wavelength of 545 nm*, or by real time portable analyzers.

* Reference should be made to the method developed by the Yokohama City Research Institute of Environmental Science, Japan

(f) Ozone

The level of ozone should be measured by real-time instruments, such as heated metal oxide semiconductors, electrochemical, UV photometric or chemiluminescence detectors.

(g) Respirable Suspended Particulates

The level of respirable suspended particulates should be determined by the following methods:

i) A gravimetric analysis method based on the IP-10A method of the USEPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air (EPA/600/4-90/010), or

ii) A real-time monitoring method with analyzers, such as optical scattering or piezoelectric monitors.

(h) Total Volatile Organic Compounds

For continuous 8-hour sampling, the analytical method with whole air sampling by passivated canisters or solid sorbents and followed by direct flame ionisation detection based on the USEPA compendium method TO-12 should be used.

For real-time monitoring, monitors such as a photo-ionisation detector (PID) or a flame ionisation detector (FID) could be used. However, the competent examiner should be cautious when using a real-time PID instrument as the readings could be interfered by the presence of other non-VOC compounds such as anesthetic or disinfecting gases. For calibration of the real-time monitors, isobutylene (2-methylpropene) should be used as the reference calibration gas.

As an alternative compliance of Good Class TVOC objective, the measurements of individual VOCs as listed in Table 2 could be conducted by passivated canister sampling or solid sorbent sampling followed by gas chromatography flame ionization detection (GC/FID) or gas chromatography mass spectrometric (GC/MS) analysis based on the USEPA's organic (TO) compendium procedures. For the compliance of Good Class TVOC objective with individual VOC measurements, please refer to paragraph 29 for details.

(i) Airborne Bacteria

The level of airborne bacteria should be quantified using samplers such as Andersen multi-hole impactor, Reuter Centrifugal Sampler (RCS), Surface Air System (SAS) bioaerosol sampler, or cyclone scribbler and reference should be made to the "Field Guide for the Determination of Biological Contaminants in Environmental Samples" published by the American Industrial Hygiene Association (AIHA) in 1996.

For office buildings, 5-minute integrated samples should be collected at four time-slots evenly distributed within the 8-hour sampling period at each sampling point. For public places, samples should be collected at four time-slots covering the worst case scenario such as periods of highest occupancy.

For analysis of airborne bacteria, tryptic soy agar plates (less than 1-month in age) should be used for culturing bacteria and the plates should be incubated at 30°C (± 1°C or better) for 48 hours in a microbiology laboratory prior to performing bacterial count. Colony counts should be done according to the specification of the manufacturer of the samplers. Standard aseptic techniques should be practiced throughout the whole process.

ANNEX 4

Certificate No.
證書編號 : _____

Indoor Air Quality Certificate
(Excellent Class)
室內空氣質素檢定證書《卓越級》

Valid period
有效日期 : _____ to 到 _____

I hereby certify that the indoor air quality of the following location(s) has fully complied with the Excellent Class of the Indoor Air Quality Objectives.
本人證明下列地點的室內空氣質素完全符合「卓越級」室內空氣質素指標。

Name of building
建築物名稱 : _____

Address
地址 : _____

_____

Certified location(s)
已檢定地點 : _____

_____

Competent Examiner
合資格檢驗師

Name
姓名 : _____

Organisation
所屬機構 : _____

Signature
簽署 : _____

Date of issue
簽發日期 : _____

Organisation Chop
機構印鑑

Indoor Air Quality Certification Scheme for Offices and Public Places
辦公室及公眾場所室內空氣質素檢定計劃

Indoor Air Quality Information Centre
室內空氣質素資訊中心

Hotline 熱線: 2788 6177
Webpage 網址: http://www.iaq.gov.hk/

Certificate No.
證書編號 : _____

Indoor Air Quality Certificate
(Good Class)
室內空氣質素檢定證書《良好級》

Valid period
有效日期 : _____ to 到 _____

I hereby certify that the indoor air quality of the following location(s) has fully complied with the Good Class of the Indoor Air Quality Objectives.
本人證明下列地點的室內空氣質素完全符合「良好級」室內空氣質素指標。

Name of building
建築物名稱 : _____

Address
地址 : _____

_____

Certified location(s)
已檢定地點 : _____

_____

Competent Examiner
合資格檢驗師

Name
姓名 : _____

Organisation
所屬機構 : _____

Signature
簽署 : _____

Date of issue
簽發日期 : _____

Organisation Chop
機構印鑑

Indoor Air Quality Certification Scheme for Offices and Public Places
辦公室及公眾場所室內空氣質素檢定計劃

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Webpage 網址: http://www.iaq.gov.hk/

ANNEX 5

CONTENTS OF IAQ CERTIFICATION REPORT

1. Competent examiners should include the following in the IAQ certification report for certification of the 12 parameters:

(a) an Executive Summary on the premises/building information and certification results, using the format prescribed in the Appendix;
(b) major IAQ problems identified during the walkthrough inspection and the remedial actions taken;
(c) a set of layout drawing for the premises/building with the sampling points indicated;
(d) results of IAQ measurements and compliance rate with respect to the relevant IAQ objectives for each of the IAQ parameters;
(e) names and details of laboratories employed for analysis of integrated chemical/biological samples;
(f) evidence for complying with "Sample Management" (paragraphs 22 – 24 of this Guide) and "Quality Control" (paragraphs 25 – 27 of this Guide); and
(g) advice to owners/management of the premises/building to manage post-certification IAQ.

2. For certificate renewal requiring the measurement of CO_2 and PM_{10} only, the following information should be included in the certification report:

(a) an Executive Summary on the premises/building information and certification results, using the format prescribed in the Appendix;
(b) major IAQ problems identified during the re-certification and the remedial actions taken;
(c) a set of layout drawing for the premises/building with the sampling points indicated;
(d) results of the CO_2 and PM_{10} measurements and compliance rate with respect to the relevant IAQ objectives for each of the IAQ parameters;
(e) evidence for complying with "Sample Management" (paragraphs 22 – 24 of this Guide) and "Quality Control" (paragraphs 25 – 27 of this Guide), and
(f) additional advice to owners/management of the premises/building to manage post-certification IAQ, if any.

EXECUTIVE SUMMARY OF THE CERTIFICATION REPORT

(1) Name of building : _____

(2) Full address : _____

_____

_____

(3) Total number of floors : _____

(4) Age of building : _____

(5) Assessment of whole building :

☐ Yes (Total floor area: _____ m^2)

☐ No. Please specify the certified location(s) and areas :

_____

_____

_____

_____

_____

(6) Name of owner or management of building/certified location(s) :

_____

(7) Contact person(s) : _____

(8) Telephone number : _____

(9) Fax number : _____

(10) E-mail address (if any) : _____

(11) Type of premises/building :

☐ Office building

☐ Cinema

☐ Restaurant

☐ Shopping mall

☐ Other : _____

(12) Type of ventilation system :

☐ Constant Air Volume (CAV)

☐ Variable Air Volume (VAV)

☐ Fan Coil Unit (FCU)

☐ Other: _____

(13) Presence of reheat system : ☐ Yes
☐ No
☐ Other: _____

(14) Presence of humidity control system : ☐ Yes
☐ No
☐ Other: _____

(15) Smoking policy : ☐ Permitted
☐ Not permitted
☐ Not permitted but no restriction to visitors / customers
☐ Restricted to smoking lounge/area
☐ Restricted to private office
☐ Other: _____

(16) For office buildings, do the following premises form part of the building?

Premises	**Existence**		**Have measurement been taken in these premises?**	
	Yes	No	Yes	No
Bank	☐	☐	☐	☐
Club house	☐	☐	☐	☐
Gymnasium / aerobics centre	☐	☐	☐	☐
Department store	☐	☐	☐	☐
Retail shop	☐	☐	☐	☐
School	☐	☐	☐	☐
Supermarket	☐	☐	☐	☐
Coffee Shop	☐	☐	☐	☐
Others (Please specify) : _____			☐	☐

(17) Date, time, and period of assessment :

_____

_____

(18) Individual IAQ parameters measurement results:

(For re-certification application requiring the measurement of CO_2 and PM_{10}, please provide the data on CO_2 and PM_{10} only.)

Parameter	No. of sample points collected	Highest concentration recorded[#]	Percentage of compliance
Room temperature		°C	%
Relative humidity		%	%
Air movement		m/s	%
Carbon dioxide (CO_2)		ppmv	%
Carbon monoxide (CO)		ppmv	%
Respirable suspended particulates (PM_{10})		$\mu g/m^3$	%
Nitrogen dioxide (NO_2)		ppbv / $\mu g/m^3$ †	%
Ozone (O_3)		ppbv / $\mu g/m^3$ †	%
Formaldehyde (HCHO)		ppbv / $\mu g/m^3$ †	%
Total volatile organic compound (TVOC)*		ppbv / $\mu g/m^3$ †	%
Radon (Rn)		Bq/m^3	%
Airborne bacteria		cfu/m^3	%

* *For alternative compliance check of the TVOC Objective for **Good** Class IAQ Certification with individual VOC measurement, please provide details by completing paragraph (19) below.*

† *Delete as appropriate.*

\# *For Excellent Class, please record the lowest and the highest readings observed for "Temperature" and "Relative Humidity" (e.g. 18.9℃ /26℃) to demonstrate compliance with the respective IAQ objectives.*

(19) Individual VOC measurement results (if applicable):

(For re-certification requiring the measurement of CO_2 and PM_{10} only, please leave this blank)

VOC Species	No. of sample points collected	Highest concentration recorded
Benzene		ppbv / $\mu g/m^3$ †
Carbon tetrachloride		ppbv / $\mu g/m^3$ †
Chloroform		ppbv / $\mu g/m^3$ †
1,2-Dichlorobenzene		ppbv / $\mu g/m^3$ †
1,4-Dichlorobenzene		ppbv / $\mu g/m^3$ †
Ethylbenzene		ppbv / $\mu g/m^3$ †
Tetrachloroethylene		ppbv / $\mu g/m^3$ †
Toluene		ppbv / $\mu g/m^3$ †
Trichloroethylene		ppbv / $\mu g/m^3$ †
Xylene (*o*-, *m*-, *p*-isomers)		ppbv / $\mu g/m^3$ †

† *Delete as appropriate.*

(20) Based on the assessment results, _____ Class of the IAQ Objectives is attained for the above building/location(s)*.

(21) An IAQ Certificate duly signed by me together with the full IAQ Certification Report are attached.

(22) I, the undersigned, confirm that the information provided above is true and correct to the best of my knowledge.

Name : _____

Engineering discipline : _____

RPE registration no.** : _____

Organisation : _____

Telephone no. : _____

Fax no. : _____

Email address (if any) : _____

Organisation Chop
機構印鑑

Signature : _____

Date : _____

* *Delete as appropriate.*

** *Please state "Not Applicable" if the competent examiner is a public officer appointed by Director of Electrical & Mechanical Services or Director of Architectural Services.*

ANNEX 6

APPLICATION FOR REGISTRATION OF IAQ CERTIFICATE UNDER THE IAQ CERTIFICATION SCHEME FOR OFFICES AND PUBLIC PLACES

I, the undersigned, would like to apply for registration of Indoor Air Quality (IAQ) Certificate under the IAQ Certification Scheme for Offices and Public Places for the following building/certified location(s) :

Name of building : _____

Full address : _____

_____

_____

Certified location(s)[#] : _____

[#] *Please state "the whole building" if the whole building is certified; if not, please specify the locations certified.*

2. This is (please tick as appropriate):

☐ the first-time application.

☐ the _____ time of renewal*.
The certificate number of the last submission is _____

* *Please fill in the number of times of renewal as appropriate.*

3. I confirm that I have engaged a competent examiner to carry out IAQ measurement in the above building/certified location(s), with the original copy of the IAQ Certificate and the duplicate copy of the Certification Report signed off by the competent examiner as attached.

4. I agree to disclose the information contained in the IAQ Certificate to the public in the IAQ Information Centre website and related publications.

5. After registration of the Certificate, please (tick as appropriate)

☐ send the Certificate to me by surface mail.

☐ notify me for collection of the Certificate at the IAQ Information Centre.

Name : _____

Company : _____

Position : _____

Telephone No : _____

Fax No : _____

Email address (if any) : _____

Signature : _____

Date : _____

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ANNEX 7

CHECKLIST FOR POST-CERTIFICATION MAINTENANCE FOR MVAC SYSTEM

I. Area Usage

- Any changes in the original usage of the places of which the MVAC system was designed for? For example, office use changed to shops or restaurants?
- Any change of number of occupants?

II. Maintenance Records

- MVAC equipment regularly maintained as recommended by the manufacturers?
- Any modification/replacement of MVAC equipment? New equipment capacity as per originally designed?
- Air ducting regularly cleaned as recommended?
- Air balancing regularly checked and maintained?

III. MVAC Equipment

(a) Chillers

- coils properly cleaned?
- any refrigerant and oil leakages?

(b) Cooling towers

- regularly cleaned and treated in accordance with Code of Practice for Prevention of Legionnaires' Disease (published by Electrical and Mechanical Services Department)?

(c) Fresh air intakes

- regularly cleaned?
- wire guard in place?
- any new possible pollution sources (e.g. exhausts, garbage collection and bus stops, etc.) located near the fresh air intakes?

(d) MVAC equipment room

- clean and dry?
- chemicals or refuse stored?
- drain points/pans blocked?

(e) Air filters

- securely fixed to the housing without any bypassing of unfiltered air?
- pre-filter and final filters properly installed?
- filter indicators / alarms properly installed and functioning?
- regularly cleaned and replaced?

(f) Cooling/Heating coils
- regularly cleaned?
- any rust?

(g) Drain pans
- outlet clogged?
- condensate easily drained?
- regularly cleaned?

(h) Automatic controls
- are all fans, AHUs, etc. programmed to start and stop as designed?
- all control relays function properly?
- fire dampers/volume control dampers set as per designed?
- damper actuators function and set properly?
- temperature and humidity sensors functioning properly?
- thermostats, humidistats, limit switches set and function properly?

(i) Fans
- fan blades clean?
- ductwork/inlet/outlet properly and securely connected?

(j) Fancoils
- thermostats properly set?
- filters regularly cleaned?
- drip pans properly installed, insulated and pitched?
- chilled water and condensate pipe work properly insulated?

(k) Ductwork
- properly sealed?
- regularly cleaned?
- access doors properly closed?
- insulation intact?

(l) Air grilles/diffusers
- properly sealed?
- smudge marks on air outlets?
- regularly cleaned?
- air plenums regularly cleaned?
- volume dampers/blades regularly cleaned and properly set as per design?

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Hong Kong Special Administrative Region Government
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