

## **CHAPTER 4**

**Environment Bureau  
Environmental Protection Department**

**Government initiatives to improve indoor air quality**

**Audit Commission  
Hong Kong  
31 March 2011**

*This audit review was carried out under a set of guidelines tabled in the Provisional Legislative Council by the Chairman of the Public Accounts Committee on 11 February 1998. The guidelines were agreed between the Public Accounts Committee and the Director of Audit and accepted by the Government of the Hong Kong Special Administrative Region.*

Report No. 56 of the Director of Audit contains 8 Chapters which are available on our website at <http://www.aud.gov.hk>.

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# GOVERNMENT INITIATIVES TO IMPROVE INDOOR AIR QUALITY

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## **PART 1: INTRODUCTION**

1.1 This PART describes the background to the audit and outlines the audit objectives and scope.

### **Background**

1.2 In Hong Kong, most people spend a majority of time at home, in office and other indoor environments. Research has found that many indoor air pollutants, including carbon dioxide, carbon monoxide, respirable suspended particulates (RSP) and formaldehyde, may cause headaches, dizziness, nausea, and nose, throat and skin irritation, as well as some serious illnesses, such as cancer (see Appendix A). These adverse health effects would increase medical costs, lower workforce's productivity and undermine people's quality of life. Therefore, good **indoor air quality (IAQ)** is essential for safeguarding people's health. A system of setting IAQ standards, implementing IAQ improvement measures, performing periodic assessments of IAQ against standards, and reporting and publishing of the assessment results will help improve IAQ and enhance public accountability.

1.3 The **Environment Bureau (ENB — Note 1)** and the **Environmental Protection Department (EPD)** are responsible for formulating and implementing environmental policies, including those on indoor and outdoor air quality.

### ***1995 Consultancy Study***

1.4 In November 1993, in a review of pollution in Hong Kong (Note 2), the ENB recognised the existence of potential health risks and problems associated with indoor air pollution. To address these issues, in 1995, the EPD commissioned a consultancy study (**1995 Consultancy Study**) on "Indoor Air Pollution in Offices and Public Places". The consultancy study was completed in September 1997.

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**Note 1:** *In July 2007, the ENB was formed to take up the policy on environmental matters. Before July 2007, the policy responsibility was taken up by the then Environment, Transport and Works Bureau (July 2002 to June 2007), the then Environment and Food Bureau (January 2000 to June 2002) and the then Planning, Environment and Lands Bureau (July 1997 to December 1999). For simplicity, all previous policy bureaux responsible for the policy on environmental matters are referred to as the ENB in this Report.*

**Note 2:** *This refers to the "Second Review of the 1989 White Paper on Pollution in Hong Kong".*

### *Setting up of IAQ Management Group in 1998*

1.5 To take forward the recommendations of the 1995 Consultancy Study, in September 1998, an inter-departmental **IAQ Management Group** was set up to coordinate actions on the control of IAQ. The Group was chaired by a Deputy Secretary of the then Planning, Environment and Lands Bureau, with members comprising representatives from various government bureaux and departments (B/Ds).

### *IAQ Management Programme*

1.6 In November 1999, based on the findings and recommendations of the 1995 Consultancy Study, the IAQ Management Group proposed the **IAQ Management Programme** for implementation. The objectives of the programme were to improve IAQ in buildings and public places, protect public health in the indoor environment and promote public awareness of the importance of IAQ. In June 2000, after public consultation, the Administration informed the Legislative Council (LegCo) Panel on Environmental Affairs (EA Panel) of the IAQ Management Programme, which comprised the following tasks:

- (a) launching a public education and publicity campaign to promote public awareness of IAQ;
- (b) setting up an IAQ information centre to disseminate pertinent information and reference materials relating to IAQ;
- (c) conducting a review of the legislative framework for the control of IAQ in parallel with the implementation of a voluntary IAQ certification scheme (see item (g) below);
- (d) adopting a set of IAQ objectives as a common benchmark for evaluating and assessing IAQ;
- (e) publishing a set of guidance notes for better management of IAQ in offices and public places;
- (f) publishing a set of professional practice notes on IAQ for public transport facilities; and
- (g) promulgating a voluntary IAQ certification scheme and inviting owners and management of premises, including government buildings, to participate in the scheme.

## Audit review

1.7 The Audit Commission (Audit) has recently conducted a review to examine the actions taken by the ENB, the EPD, the Electrical and Mechanical Services Department (EMSD) and the Architectural Services Department (ArchSD) in improving IAQ (Note 3). The review focuses on the following areas:

- (a) implementation of IAQ Management Programme (PART 2);
- (b) setting of IAQ Objectives (PART 3);
- (c) publishing of guidance notes and practice notes (PART 4);
- (d) administration of IAQ Certification Scheme (PART 5);
- (e) management of IAQ in government premises (PART 6); and
- (f) the way forward (PART 7).

1.8 Audit has found that there are areas where improvements can be made by the Administration in improving IAQ. Audit has made a number of recommendations to address the issues.

## General response from the Administration

1.9 The **Secretary for the Environment** and the **Director of Environmental Protection** generally agree with the findings of this Report. They have said that they will put forward the recommendations for consideration by the IAQ Management Group, and will follow up their implementation with the relevant B/Ds.

## Acknowledgement

1.10 Audit would like to acknowledge with gratitude the full cooperation of the staff of the ENB, the EPD, the EMSD, the ArchSD and the Government Property Agency (GPA) during the course of the audit review.

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**Note 3:** *Under the Smoking (Public Health) Ordinance (Cap. 371), smoking is prohibited in indoor workplaces and public places. This audit review does not cover issues relating to smoking controls which fall within the purview of the Tobacco Control Office of the Department of Health.*

## **PART 2: IMPLEMENTATION OF IAQ MANAGEMENT PROGRAMME**

2.1 This PART examines the EPD's launch of a public education and publicity campaign, setting up of an IAQ information centre and review of the legislative framework for the control of IAQ under the IAQ Management Programme (see para. 1.6(a) to (c)).

### **Public education and publicity campaign**

2.2 Since 2000, the EPD has organised various education and publicity activities on IAQ, such as advertisements and promotions in the mass media, seminars, and school visits to enhance public awareness of IAQ. The EPD has also issued the following publications on IAQ for public information and educational purposes:

- (a) 2 booklets, namely:
  - (i) Improve the Indoor Air Quality in Your Home; and
  - (ii) Improve the Indoor Air Quality in Your Building;
- (b) 12 information leaflets, including:
  - (i) Indoor Air Quality and You;
  - (ii) Environmental Tobacco Smoke and You; and
  - (iii) In-Vehicle Air Quality; and
- (c) 20 posters, including:
  - (i) Benefits of Good Indoor Air Quality;
  - (ii) Common Indoor Air Pollutants; and
  - (iii) Common Solutions to Indoor Air Quality Problems in Homes.

### **IAQ Information Centre**

2.3 In January 2001, the EPD set up the IAQ Information Centre in a building in Kowloon Tong and a cyber centre on the Internet (<http://www.iaq.gov.hk>). In April 2001, the EPD awarded a service contract (renewable on a yearly basis) to a service provider to



operate and maintain the IAQ Information Centre and the cyber centre, and to conduct seminars and school visits to promote IAQ improvement measures. The objectives of the IAQ Information Centre include promoting good IAQ, disseminating information and displaying IAQ-related products to the public. Its functions include:

- (a) making information on IAQ widely and easily accessible (including information on health effects, environmental impacts, pollution prevention methods and indoor environmental-friendly products);
- (b) providing technical advice to professionals on IAQ matters (including the provision of relevant reference materials), and a telephone hotline for enquiry;
- (c) processing applications for registration of IAQ certificates and maintaining a register of IAQ certificates issued; and
- (d) maintaining an Internet webpage for public access to information on the latest local and overseas IAQ development.

### **2006 Consultancy Study**

2.4 In November 2006, the EPD commissioned a consultancy study (**2006 Consultancy Study**) to review the IAQ Management Programme. The Study was scheduled for completion in November 2007. The objectives of the 2006 Consultancy Study included:

- (a) reviewing overseas practices and policies in IAQ management, as well as the corresponding local practices, policies and research findings by local academia;
- (b) identifying practices and policies in the places of study which might be applicable to Hong Kong;
- (c) reviewing the effectiveness of the IAQ Management Programme;
- (d) proposing areas for improvement or future development, including introducing regulatory controls;
- (e) reviewing if the IAQ Objectives were appropriate and proposing revisions or inclusion of new parameters (such as fungi) in the IAQ Objectives; and

- (f) reviewing if the present institutional set-up for managing the IAQ Management Programme was suitable and proposing a suitable IAQ management strategy for better management and development of the IAQ policy.

## Audit observations and recommendations

### *Promotion of public awareness of IAQ*

2.5 Table 1 shows the number of group and individual visits to the IAQ Information Centre from 2007 to 2010.

**Table 1**  
**Visits to IAQ Information Centre**  
**(2007 to 2010)**

Year	Group visit		No. of individual visitors
	No. of groups	No. of visitors	
2007	179	4,950	407
2008	117	3,575	176
2009	123	3,556	35
2010	116	3,609	84
<b>Total</b>	<b>535</b>	<b>15,690</b>	<b>702</b>

*Source: EPD records*

2.6 For group visits with advance bookings, there would be briefings and introductions by staff of the Centre. Audit examination revealed that about 90% of the group visitors came from the Mainland or other countries, and each group comprised on average 29 visitors (a total of 15,690 visitors in 535 groups from 2007 to 2010). Based on the information in Table 1, on average, **only about one group visited the Centre every two days and less than one individual visited the Centre a day** (Note 4). Audit considers that the number of visits to the Centre was low.

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**Note 4:** *During 2007 to 2010, the Centre was open on average for 247 days a year (closed on Saturdays, Sundays and public holidays).*

2.7 As revealed in a survey conducted as part of the 2006 Consultancy Study (see para. 2.4):

- (a) only 27% of respondents heard about the IAQ Management Programme;
- (b) only 13% of respondents heard about the IAQ Certification Scheme;
- (c) only 19% of respondents considered that the promotion of public awareness of IAQ was adequate; and
- (d) 81% of respondents preferred the mass media for obtaining information about improvement of IAQ.

2.8 In January 2011, the EPD informed Audit that raising public awareness of IAQ was essential to the IAQ Management Programme. It had, therefore, included the survey as a requirement in the 2006 Consultancy Study to help work out an appropriate plan to promote the IAQ Management Programme proactively.

2.9 Audit examination revealed that, from 2007 to 2010, the EPD had only organised advertisements on three occasions in newspapers, but none on television and radio. **Audit considers that the EPD needs to step up efforts to promote the public awareness of IAQ.**

#### *Efforts in public education*

2.10 The service contracts with the service provider (see para. 2.3) specified the numbers of seminars and school visits to be conducted in a year. Audit however noted that, from 2007-08 to 2009-10, the number of school visits actually conducted was significantly lower than the contract requirements (see Table 2). Audit could not find records showing the EPD's approval for the reduction in the number of school visits.

Table 2

**Seminars and school visits  
(2007-08 to 2010-11)**

Year	Seminar		School visit	
	Contract requirement (No.)	Actual (No.)	Contract requirement (No.)	Actual (No.)
2007-08	2	4	20	0
2008-09	2	0	50	25
2009-10	2	2	40	18
2010-11	2	2	22	42
<b>Total</b>	<b>8</b>	<b>8</b>	<b>132</b>	<b>85</b>

Source: EPD records

2.11 In January 2011, the EPD informed Audit that:

- (a) effective use of the IAQ Information Centre facilities was one of the means to increase public awareness of IAQ; and
- (b) each year, the IAQ Information Centre sent letters to primary and secondary schools inviting them to apply for IAQ presentations at their schools.

2.12 **Audit considers that the EPD needs to step up efforts in IAQ public education and closely monitor the delivery of services by the service provider of the IAQ Information Centre in accordance with contract requirements. The EPD also needs to liaise with the Education Bureau with a view to promoting student awareness of IAQ through conducting more IAQ presentations at schools.**

*Meetings of IAQ Management Group*

2.13 The IAQ Management Group was set up in 1998 to coordinate actions on the control of IAQ (see para. 1.5). Its terms of reference included:

- (a) coordinating all activities within the Government relating to the area of IAQ (including delineation of responsibilities for handling and referral of complaint cases) and monitoring the progress and effectiveness of these activities;
- (b) studying and recommending detailed implementation of the most suitable legislative/control framework;
- (c) carrying out necessary consultation, and making subsequent amendments if any, on the Code of Practice on IAQ, and overseeing its implementation;
- (d) reviewing the IAQ standards on a regular basis and advising on changes to the appropriate authority;
- (e) incorporating existing “grey areas” (such as public places, transport facilities, schools and hospitals) into its management, and ascertaining a minimum standard of IAQ in these premises; and
- (f) educating and promoting the awareness of the public on how to control and reduce exposure to common indoor air pollutants.

2.14 Audit noted that, since its establishment in September 1998 and up to December 2010, the IAQ Management Group had only held eight meetings, with the last meeting held in June 2003. In October 2010 and January 2011, the EPD informed Audit that:

- (a) at the last meeting in June 2003, the IAQ Management Group agreed that future meetings would be held on a need basis, and that individual B/Ds would consider and take action on regulating IAQ in premises under their purview;
- (b) no IAQ Management Group meetings had been held since June 2003 as there were no major updates on the IAQ Management Programme;

- (c) the Group had tried to resolve issues relevant to the work of the IAQ Management Group by circulation. For example, in 2006, during the development of the quality assurance programme which would require all IAQ reports and certificates to be issued and signed by the IAQ certificate issuing bodies (CIBs — Note 5) under the IAQ Certification Scheme (see PART 5), the EPD consulted members of the Management Group in writing before the programme was implemented;
- (d) it was more cost-effective to hold meetings on a need basis than on a regular basis; and
- (e) the IAQ Management Group would meet again to discuss the findings and recommendations of the 2006 Consultancy Study (Note 6), which could lead to enhancement of the IAQ Management Programme.

2.15 From 2003 to 2010, there were changes in the policy portfolios and responsibilities of the related B/Ds. For example, subsequent to the re-organisation in July 2007, the ENB was formed to take up the policy on environmental matters (see Note 1 to para. 1.3). In January 2011, the EPD informed Audit that in future:

- (a) the IAQ Management Group would be chaired by a Deputy Director of Environmental Protection;
- (b) the membership of the IAQ Management Group would include representatives from three bureaux (namely the ENB, the Food and Health Bureau and the Education Bureau) and 11 departments (namely, the EPD, the ArchSD, the Customs & Excise Department, the Buildings Department, the EMSD, the Fire Services Department, the Department of Health, the Labour Department, the Food and Environmental Hygiene Department, the Housing Department and the GPA); and
- (c) consideration would be given to inviting other relevant B/Ds to join the IAQ Management Group.

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**Note 5:** *As of February 2011, there were five CIBs in the private sector which were accredited to carry out IAQ assessments and issue certificates under the IAQ Certification Scheme (see para. 5.3).*

**Note 6:** *The IAQ Management Group held a meeting in March 2011 to examine a draft executive summary (containing findings and recommendations) of the 2006 Consultancy Study (see para. 7.5).*

2.16 **Audit considers it unsatisfactory that the IAQ Management Group did not hold any meetings from July 2003 to December 2010 (see para. 2.14), notwithstanding that the IAQ Management Programme was under implementation during the period. The EPD needs to arrange regular Management Group meetings for examining important IAQ issues and discharging the Group's responsibilities.**

*Mechanisms for handling complaints*

2.17 According to the 1995 Consultancy Study (see para. 1.4), one useful indicator to monitor the progress on improvement in IAQ was the collection of complaint information on IAQ in offices and public places. The study recommended that the IAQ Management Group should set up a proper system to collect and collate such information. This task was subsequently included in the IAQ Management Group's terms of reference (see para. 2.13(a)).

2.18 In January 2011, the EPD informed Audit that it had taken up the leading role in handling IAQ complaints received by its Pollution Complaint Hotline and by the Government's centralised "1823" Hotline, and had forwarded the complaints to the responsible B/Ds for action, where necessary.

2.19 Audit however noted that the EPD had not established mechanisms for collecting and collating complaint information from other government departments on IAQ. **Audit considers that the EPD needs to establish mechanisms for collecting, collating and publishing IAQ complaint information. These measures would enhance public accountability and provide useful information for IAQ policy formulation.**

*Provision of performance indicators*

2.20 Air policy is a major policy area of the EPD, covering both IAQ and outdoor air quality. In its Controlling Officer's Reports (CORs), the EPD provided performance targets and levels of achievement on outdoor air quality. Examples of the performance targets included:

- (a) there should not be a day in a year where the air pollution index exceeded 100; and
- (b) the annual average air pollution index should be 50 or less.

2.21 Audit however noted that the EPD had not set performance targets on IAQ. At its three meetings held in 1998, although the IAQ Management Group discussed setting performance indicators for IAQ, it did not make any conclusions. **Audit considers that the EPD needs to develop IAQ performance indicators and publish the levels of achievement in the CORs.**

#### *Management of 2006 Consultancy Study*

2.22 The 2006 Consultancy Study commenced in November 2006 and was scheduled for completion in November 2007 (see para. 2.4). However, up to December 2010, the Study had not yet been finalised.

2.23 In March 2011, the EPD informed Audit that:

- (a) having noted after the commencement of the 2006 Consultancy Study that the World Health Organisation (WHO) would publish guidelines on IAQ, which were relevant to fulfilling the key objective of reviewing the IAQ Objectives of the Study, the EPD had asked the consultant to take account of WHO guidelines that were about to be released; and
- (b) with the benefit of WHO guidelines for biological and chemical pollutants issued in July 2009 and December 2010 respectively, the consultant had submitted its Study report to the EPD in January 2011.

2.24 As the 2006 Consultancy Study would lead to improvements in IAQ policies and management practices, the EPD needed to expedite action to finalise the Study.

#### *Time frame for review of legislative framework*

2.25 A review of the legislative framework for the control of IAQ was one of the tasks under the IAQ Management Programme. However, up to February 2011, the EPD had not yet set a time frame for the review. **Audit considers that the EPD needs to set a time frame on the issue, as the IAQ Management Programme was launched as early as June 2000.**



*Audit recommendations*

2.26 **Audit has recommended that the Director of Environmental Protection should, in collaboration with the Secretary for the Environment:**

*Promotion of public awareness of IAQ*

- (a) **step up efforts to promote the public awareness of IAQ;**

*Efforts in public education*

- (b) **step up efforts in IAQ public education;**
- (c) **closely monitor the delivery of services by the service provider of the IAQ Information Centre in accordance with contract requirements;**
- (d) **liaise with the Secretary for Education to step up efforts to promote IAQ awareness at schools;**

*Meetings of IAQ Management Group*

- (e) **arrange regular meetings of the IAQ Management Group for examining important IAQ issues and discharging the Group's responsibilities;**

*Mechanisms for handling complaints*

- (f) **establish mechanisms to collect, collate and publish public complaint information on IAQ;**

*Provision of performance indicators*

- (g) **develop IAQ performance indicators and publish the levels of achievement in the EPD's CORs;**

*Management of 2006 Consultancy Study*

- (h) **expedite action to finalise the 2006 Consultancy Study; and**

*Time frame for review of legislative framework*

- (i) **set a time frame for conducting a review of the legislative framework for the control of IAQ.**

## **Response from the Administration**

2.27 The **Secretary for the Environment** and the **Director of Environmental Protection** agree with the audit recommendations. They have said that:

### *Efforts in public education*

- (a) the school visit programme commenced in 2007. In the first few years, despite that the service provider had extended invitations to many schools for IAQ presentations, the responses of schools to the offers were rather lukewarm. As the number of schools that were willing to take up the offers of IAQ presentations was beyond the service provider's control, the ENB and the EPD did not consider it appropriate to take the service provider as not fulfilling his contractual responsibilities even though the numbers of school visits were below the targets. Notwithstanding this, the EPD would require the service provider to make up the shortfall in school visits without additional government cost in the new service contract;
- (b) the EPD will organise more advertisements in the mass media subject to availability of funding and resources. The IAQ Information Centre will also continue to send letters to all primary and secondary schools to offer presentations on the IAQ Management Programme at these schools and provide such presentations as far as possible;

### *Provision of performance indicators*

- (c) the IAQ Management Programme is one of the many on-going programmes of the EPD. To help evaluate the implementation of the IAQ Management Programme, the EPD would look into the feasibility of specifying new performance targets for the Programme in the CORs;

### *Management of 2006 Consultancy Study*

- (d) the Consultancy Study has recently been completed. At a meeting on 7 March 2011, the IAQ Management Group considered and discussed the draft executive summary of the Study report (see para. 7.5); and

### *Time frame for review of legislative framework*

- (e) the need for introducing a legislative framework for the control of IAQ forms part of the 2006 Consultancy Study. The ENB and the EPD will address the matter in considering the findings and recommendations of the Study.

## **PART 3: SETTING OF IAQ OBJECTIVES**

3.1 This PART examines the setting of IAQ Objectives under the IAQ Management Programme (see para. 1.6(d)).

### **Setting of IAQ Objectives by the EPD**

3.2 In 2003, the EPD established the IAQ Objectives for Office Buildings and Public Places (**IAQ Objectives** — see Table 3). The IAQ Objectives, comprising 12 parameters, are to be used for evaluating and assessing IAQ in offices and public places served by mechanical ventilation and air-conditioning (MVAC) systems for human comfort. Two classes of achievement are provided under the IAQ Objectives, namely:

- (a) ***Excellent Class:*** representing an excellent level of IAQ that a high-class and comfortable building should have; and
- (b) ***Good Class:*** representing the level of IAQ that provides protection to the public at large including the young and the aged.

**Table 3**  
**IAQ Objectives**

Item	Parameter	Unit	Level (Note)	
			Excellent Class	Good Class
1	Room temperature	°C	20 to <25.5	<25.5
2	Relative humidity	%	40 to <70	<70
3	Air movement	Metres/second	<0.2	<0.3
4	Carbon dioxide	Parts-per-million (ppm)	<800	<1,000
5	Carbon monoxide	Microgram per cubic metre ( $\mu\text{g}/\text{m}^3$ )	<2,000	<10,000
6	RSP	$\mu\text{g}/\text{m}^3$	<20	<180
7	Nitrogen dioxide	$\mu\text{g}/\text{m}^3$	<40	<150
8	Ozone	$\mu\text{g}/\text{m}^3$	<50	<120
9	Formaldehyde	$\mu\text{g}/\text{m}^3$	<30	<100
10	Total volatile organic compounds	$\mu\text{g}/\text{m}^3$	<200	<600
11	Radon	Becquerel/ $\text{m}^3$	<150	<200
12	Airborne bacteria	Colony-forming-units/ $\text{m}^3$	<500	<1,000

Source: EPD records

Note: The measurements would be taken on an eight-hour average basis.

- 3.3 According to the EPD, the IAQ Objectives:
- (a) were prepared with reference to international health-based air quality standards and modified good practices to suit local circumstances. Continuous achievement of the objectives should protect the majority of the community from ill health and discomfort arising from working in or visiting public places and office buildings; and
  - (b) are intended to minimise ill health, promote the comfort and well-being of all building occupants, and protect a diverse population (including the young and the aged).

### **Audit observations and recommendations**

#### *Acceptable levels of IAQ Objectives*

3.4 As shown in Table 3, each of the parameters was regarded as having met the Excellent or Good Class of the IAQ Objectives if its measured value was “**less than**” the specified level. For example, for room temperature, a measurement below 25.5°C was regarded as meeting the Good Class (see Item 1 in Table 3). Similarly, for carbon dioxide, a concentration of “less than 1,000 ppm” was regarded as meeting the Good Class (see Item 4 in Table 3). Audit examination however revealed that the CIBs, in their IAQ assessments, had treated a measured value which was “**equal to or less than**” the specified level as having met the Excellent or Good Class. This practice was at variance with the requirements under the IAQ Objectives published by the EPD (see Table 3).

3.5 **Audit considers that the EPD needs to review the practice adopted by the CIBs and, if necessary, make appropriate adjustments to the acceptable levels of IAQ Objectives.**

#### *Review of sampling-point compliance rate*

3.6 In its guidance notes, the EPD has set out the minimum number of sampling points for different ranges of floor areas served by MVAC systems for IAQ assessments. Details are shown in Table 4.

Table 4

## Minimum number of sampling points

Total floor area served by MVAC system (Square metres)	Minimum number of sampling points (Note 1) (No.)
< 3,000	1 – 6 (Note 2)
3,000 to < 5,000	8
5,000 to < 10,000	12
10,000 to < 15,000	15
15,000 to < 20,000	18
20,000 to < 30,000	21
≥ 30,000	≥ 25 (Note 3)

Source: EPD records

Note 1: Depending on the type and nature of a building, additional sampling points should be taken where necessary.

Note 2: One sampling point should be selected for every 500 square metres of floor area.

Note 3: One sampling point should be selected for every 1,200 square metres of floor area.

3.7 The EPD has also provided the following guidelines regarding the assessment and evaluation of IAQ Objectives:

- (a) at least 80% of the sampling points for each of the parameters should comply with the relevant IAQ Objectives;
- (b) for each of the parameters on room temperature, relative humidity and air movement (see Items 1 to 3 in Table 3 in para. 3.2), none of the measured values of the sampling points should exceed 10% of the relevant IAQ Objectives, or fall outside 10% of the upper or lower limit of a range; and

- (c) for each of the chemical and biological parameters (see Items 4 to 12 in Table 3), none of the measured values of the sampling points should exceed 50% of the relevant IAQ Objectives.

3.8 According to EPD guidelines, save the requirements in paragraph 3.7(b) and (c), only 80% or more of the sampling points are required to meet the IAQ requirements. Audit noted that, at the time of developing the IAQ Objectives in 2000, the sampling-point compliance rate was set at 95%. In November 2001, after conducting IAQ surveys in government buildings and taking account of the dynamic nature of IAQ in an indoor environment, the EPD revised the compliance rate from 95% to 80%.

3.9 **About ten years have elapsed since the revision of the compliance rate from 95% to 80%. In order to make enhancement to IAQ, there are merits for the EPD to conduct a review of the sampling-point compliance rate, taking account of the international practices (Note 7).**

#### *Updating of IAQ Objectives*

3.10 The IAQ Objectives were set and promulgated in September 2003. Audit noted that the Objectives had not been revised since then. From 2006 to 2010, the WHO issued three documents on IAQ, namely:

- (a) “Development of WHO Guidelines for Indoor Air Quality” (October 2006) which contained recommendations for development of IAQ guidelines;
- (b) “WHO Guidelines for Indoor Air Quality — Dampness and Mould” (July 2009) which included guidelines for the protection of public health from health risks due to dampness, associated growth of mould (a kind of fungi) and contamination of indoor spaces; and
- (c) “WHO Guidelines for Indoor Air Quality: Selected Pollutants” (December 2010) which contained information and advice on the protection of public health from risks due to a number of chemicals commonly found in indoor air.

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**Note 7:** *The environmental protection agencies of some overseas countries (e.g. the United States, Australia and Germany) have not mentioned on their websites about the adoption of any sampling-point compliance rates in their IAQ assessments.*

3.11 Audit notes that airborne fungi are a common biological contaminant in the indoor environment, particularly under the hot and humid conditions in Hong Kong. In September 2003, in promulgating guidance notes on IAQ Objectives (see para. 4.2), the EPD indicated that airborne fungi would in future be included in the IAQ Objectives. However, up to February 2011, this proposal had not been implemented. In this connection, the WHO has provided guidelines on dampness and mould which relate to fungi (see para. 3.10(b)). **In Audit's view, the EPD needs to take action to include airborne fungi in the IAQ Objectives. The EPD also needs to conduct periodic reviews of the IAQ Objectives taking account of WHO guidelines, and revise the Objectives, where necessary.**

*Audit recommendations*

3.12 **Audit has recommended that the Director of Environmental Protection should, in collaboration with the Secretary for the Environment:**

*Acceptable levels of IAQ Objectives*

- (a) **conduct a review of the acceptable levels of IAQ Objectives and make appropriate adjustments, where necessary;**

*Review of sampling-point compliance rate*

- (b) **conduct a review of the sampling-point compliance rate requirement for meeting the IAQ Objectives, taking account of the international practices;**

*Updating of IAQ Objectives*

- (c) **take action to include airborne fungi in the IAQ Objectives; and**
- (d) **conduct periodic reviews of the IAQ Objectives taking account of WHO guidelines, and revise the Objectives, where necessary.**

**Response from the Administration**

3.13 The **Secretary for the Environment** and the **Director of Environmental Protection** agree with the audit recommendations. They have said that:

*Acceptable levels of IAQ Objectives*

- (a) the EPD will review the acceptable levels of IAQ Objectives with reference to international practices;



*Review of sampling-point compliance rate*

- (b) the EPD would examine the international practices on IAQ compliance criteria and invite the IAQ Management Group to review the compliance rate in the light of the findings; and

*Updating of IAQ Objectives*

- (c) the EPD has required the 2006 Consultancy Study to make reference to WHO guidelines in reviewing the need for including airborne fungi in the IAQ Objectives. The review findings will form part of the recommendations of the Study for consideration by the IAQ Management Group (see para. 7.5(g)).

## **PART 4: PUBLISHING OF GUIDANCE NOTES AND PRACTICE NOTES**

4.1 This PART examines the EPD's publishing of guidance notes for offices and public places, and practice notes for public transport facilities on IAQ.

### **Guidance notes for offices and public places**

4.2 In September 2003, the EPD issued the Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places (**Guidance Notes**), which was one of the tasks of the IAQ Management Programme (see para. 1.6(e)). The objectives of the Guidance Notes are to provide background information of IAQ Objectives, and practical guidelines to users for:

- (a) formulating IAQ policies;
- (b) designing buildings and building services for acceptable IAQ;
- (c) setting operation and maintenance procedures; and
- (d) mitigating IAQ problems.

4.3 The Guidance Notes:

- (a) apply to all buildings or totally enclosed areas served by MVAC systems for human comfort, including office buildings, shopping malls, hotels, restaurants, theatres and cinemas;
- (b) are written primarily for building owners, building tenants (who have installed their own ventilation systems) and building management; and
- (c) are not legally binding (i.e. compliance with the IAQ Objectives and the Notes is voluntary).

## Practice notes for public transport facilities

4.4 In November 2003, the EPD issued two sets of practice notes for managing air quality in air-conditioned public transport facilities, one for buses and the other for railways (**Practice Notes** — see para. 1.6(f)). The two sets of Practice Notes provide guidelines covering areas of monitoring of air quality; pertinent company framework and responsibilities; and design considerations, operational practices, inspection and maintenance of pertinent facilities.

4.5 The Practice Notes adopt carbon dioxide concentration, temperature and relative humidity as IAQ indicators. For carbon dioxide concentration, the Practice Notes provide two levels of achievement, namely:

- (a) **Level 1** for good air quality of a comfortable transport facility, at which there is no health concern identified. The maximum carbon dioxide concentration for this level is set at 2,500 ppm (hourly average); and
- (b) **Level 2** for the air quality of a transport facility, at which there is no health concern identified. The maximum carbon dioxide concentration for this level is set at 3,500 ppm (hourly average).

4.6 In addition to carbon dioxide concentration, the Practice Notes stipulate that:

- (a) the recommended temperature ranges from 20°C to 28°C; and
- (b) the recommended relative humidity ranges from 40% to 70%.

4.7 According to the Practice Notes, bus and railway operators should monitor **at least once a year** the one-hour average concentration of carbon dioxide during normal operation at peak hours for:

- (a) all train and bus stations; and
- (b) at least 10% of the bus and train fleet of each model of bus or train.

## Audit observations and recommendations

### *Adoption of Guidance Notes for offices and public places*

4.8 Adoption of the IAQ Objectives and compliance with the Guidance Notes will help improve the IAQ in offices and public places, which will contribute to better health of users in these premises. Audit however noted that:

- (a) compliance with the Guidance Notes by owners, tenants and building management was **voluntary**; and
- (b) the EPD had **not** set up mechanisms to:
  - (i) monitor the extent of adoption and compliance with the Guidance Notes;
  - (ii) consult owners, tenants and building management who had not adopted the Guidance Notes to ascertain their reasons for not doing so; and
  - (iii) consult owners, tenants and building management who had adopted the Guidance Notes to ascertain any difficulties in complying with the requirements, with a view to providing necessary assistance or improving the Guidance Notes.

4.9 In January 2011, the EPD informed Audit that:

- (a) in preparing the Guidance Notes, it had consulted the trade and the public to ensure that the Notes were useful and practicable; and
- (b) up to January 2011, it had not received any adverse comments on the Guidance Notes.

**In Audit's view, the EPD needs to set up pertinent mechanisms for improvement.**

*Publishing of guidelines for other indoor environments*

4.10 The Guidance Notes and the IAQ Objectives only cover office buildings and some public places that are served by MVAC systems for human comfort (see para. 4.3(a)). Audit research found that some countries (e.g. Canada and the United States) had extended their IAQ programmes to cover schools. **Audit considers that good IAQ at child care centres, kindergartens and schools is essential for safeguarding the health of the young population. There are merits for the EPD to consider publishing guidance notes for these premises.**

*Compliance with Practice Notes for public transport facilities*

4.11 As early as November 2003, the EPD issued Practice Notes for managing air quality in air-conditioned buses and railway facilities (see para. 4.4). Audit examination however revealed that the EPD had not:

- (a) set up a mechanism to regularly monitor the bus and railway operators' compliance with the Practice Notes; and
- (b) requested the bus and railway operators to provide periodic returns on the extent of compliance with the Practice Notes.

4.12 In December 2010, Audit research on the websites of the local public bus and railway operators revealed that none of the operators provided information about the extent of their compliance with the Practice Notes. Only one bus operator mentioned that it had improved the design of the ventilation system of its vehicles for better IAQ.

4.13 **In Audit's view, in order to improve the IAQ of public transport facilities, the EPD needs to consider taking measures to encourage the public bus and railway operators to adopt the Practice Notes for compliance, and publish on their websites the extent of compliance for public information. The EPD also needs to consider publishing IAQ practice notes for other public transport facilities. To provide incentives for adoption of the Practice Notes, there are merits for the EPD to consider:**

- (a) **giving commendations to public transport operators for adopting the Practice Notes; and**
- (b) **publishing on EPD website the public transport operators' extent of compliance with the Practice Notes.**

*Publishing of practice note for ferries*

4.14 In 2003, the EPD commenced preparing a practice note for ferries and consulted the trade. It was mentioned in the Guidance Notes issued in September 2003 (see para. 4.2) that the practice note for ferries was being finalised. However, up to December 2010, the practice note for ferries had not been issued.

4.15 In January 2011, the EPD informed Audit that:

- (a) it had decided not to prepare an IAQ practice note for ferries because, in 2006, the Marine Department issued the Code of Practice on Safety Standards for Classes I, II, and III Vessels under the Merchant Shipping (Local Vessels) Ordinance (Cap. 548); and
- (b) the Code set out standards of safety and protection for passengers and crew on board local ferries and other vessels. The standards had covered, among others, the requirements for ventilation. As such, the Code had already served the purpose of a practice note for maintaining the IAQ of air-conditioned ferries at a good level.

4.16 Audit however notes that, apart from ventilation requirements, the practice notes for public transport facilities also cover other areas, such as monitoring of air quality, and pertinent company framework and responsibilities (see para. 4.4). Therefore, the Code of Practice issued by the Marine Department does not fully serve the purpose of the practice note for ferries. **Audit considers that the EPD needs to expedite action on publishing the practice note for ferries.**

*Audit recommendations*

4.17 **Audit has recommended that the Director of Environmental Protection should, in collaboration with the Secretary for the Environment:**

*Adoption of Guidance Notes for offices and public places*

- (a) **for the Guidance Notes for offices and public places, set up mechanisms to:**
  - (i) **monitor the extent of adoption of, and compliance with, the Guidance Notes;**

- (ii) **consult owners, tenants and building management who have not adopted the Guidance Notes to ascertain their reasons for not doing so; and**
- (iii) **consult owners, tenants and building management who have adopted the Guidance Notes to ascertain any difficulties in complying with the requirements, with a view to providing necessary assistance or improving the Guidance Notes;**

*Publishing of guidelines for other indoor environments*

- (b) **consider publishing IAQ guidance notes for child care centres, kindergartens and schools;**

*Compliance with Practice Notes for public transport facilities*

- (c) **consider taking measures to encourage public bus and railway operators to:**
  - (i) **comply with the Practice Notes for public transport facilities; and**
  - (ii) **publish on their websites the extent of compliance with the Practice Notes for public information;**
- (d) **consider giving commendations to public transport operators for adopting the Practice Notes;**
- (e) **consider publishing on EPD website the public transport operators' extent of compliance with the Practice Notes;**
- (f) **consider publishing IAQ practice notes for other public transport facilities; and**

*Publishing of practice note for ferries*

- (g) **expedite action on publishing the practice note for ferries.**

## **Response from the Administration**

4.18 The **Secretary for the Environment** and the **Director of Environmental Protection** agree with the audit recommendations. They have said that:

***Adoption of Guidance Notes for offices and public places***

- (a) the EPD would continue monitoring closely the latest development and will revise the Guidance Notes as appropriate. In the coming IAQ Management Group meetings, it would seek B/Ds' feedback and meet with the trade for the development of updated or additional guidelines;

***Publishing of guidelines for other indoor environments***

- (b) a review on extending the coverage of the IAQ Management Programme has been included in the 2006 Consultancy Study, and its recommendations will be considered by the IAQ Management Group for implementation. The EPD would assess the technical and other implications of the recommendation in paragraph 4.17(b) with the EMSD and the Education Bureau;

***Compliance with Practice Notes for public transport facilities***

- (c) the EPD would liaise with the Transport and Housing Bureau, the Transport Department, and the public bus and railway operators on the feasibility of implementing the recommendations in paragraph 4.17(c) to (f); and

***Publishing of practice note for ferries***

- (d) the EPD would liaise with the Transport and Housing Bureau, the Transport Department, the Marine Department and the trade to review the need for publishing the practice note for ferries.



## **PART 5: ADMINISTRATION OF IAQ CERTIFICATION SCHEME**

5.1 This PART examines the EPD's administration of the IAQ Certification Scheme for Offices and Public Places (**IAQ Certification Scheme** — see para. 1.6(g)).

### **IAQ Certification Scheme**

5.2 In September 2003, the EPD launched the voluntary IAQ Certification Scheme. The Scheme was intended for enclosed offices and public places (Note 8) served by MVAC systems. In the same month, the EPD issued "A Guide on Indoor Air Quality Certification Scheme for Offices and Public Places" (**Certification Guide**), which provided details on the compliance criteria, sampling methodology and measurement protocols. The objectives of the Scheme were to:

- (a) recognise good IAQ management practices; and
- (b) provide incentives for owners of premises/buildings or property management companies to pursue the best level of IAQ.

### ***IAQ certificates***

5.3 The owner or management of an office or a public place intending to join the IAQ Certification Scheme needs to employ at his/its own cost an accredited CIB to conduct an assessment against the IAQ Objectives to ascertain whether the building or premises (Note 9) meet the criteria for the Excellent Class or Good Class (see para. 3.2). Based on the assessment results, where appropriate, the CIB would issue a certificate (valid for 12 months) to the owner or management of the office or public place for display at a prominent place of the premises for public information. The owner or management needs to employ a CIB to conduct the following assessments for issue or renewal of the IAQ certificate in a five-year cycle:

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**Note 8:** *Examples of public places include cinemas, shopping malls, restaurants, sports venues, club houses, libraries, town halls and community centres.*

**Note 9:** *Under the IAQ Certification Scheme, a building refers to a whole building, whereas premises form part of a building, such as a unit or a floor.*

- (a) for the first year of a five-year cycle, an assessment of all the 12 parameters of the IAQ Objectives (see Table 3 in para. 3.2); and
- (b) for each of the subsequent four years, an assessment of only two parameters (namely carbon dioxide and RSP).

*Information maintained by the EPD and the issue of IAQ labels*

5.4 After issue of a certificate by a CIB, the owner or management of an office or a public place should apply for registration of the certificate with the IAQ Information Centre by submitting an application together with the required information, including IAQ certificate details, company name, address, type of building or premises (e.g. office, restaurant or shopping mall). The Centre will allocate a registration number to the office or public place and upload the pertinent information (certificate number, name of building, address, certificate period and certificate class) onto the Centre website. Upon completion of registration, the EPD will issue IAQ labels of the appropriate class (see Figure 1) to the office or public place for posting at prominent places for public information.

**Figure 1**

**IAQ labels**



Source: EPD records

## Audit observations and recommendations

### *Effectiveness of IAQ Certification Scheme*

5.5 The IAQ Certification Scheme was launched in September 2003. Table 5 shows the numbers of offices and public places participating in the Scheme, and of the related Excellent and Good Class IAQ certificates, as at the end of each year since 2003.

**Table 5**

**Offices and public places participating in the IAQ Certification Scheme  
(2003 to 2010)**

As at 31 December of the year	Type of premises			Certificate class		
	Office Building  (a) (No.)	Public Place  (b) (No.)	Total  (c) = (a) + (b) (No.)	Excellent  (d) (No.)	Good  (e) (No.)	Total  (f) = (d) + (e) (No.)
2003	26	1	27	2	25	27
2004	60	21	81	10	71	81
2005	61	69	130	11	119	130
2006	74	96	170	27	143	170
2007	171	92	263	42	221	263
2008	263	152	415	61	354	415
2009	312	211	523	99	424	523
2010	319	240	559	124	435	559

Source: EPD records

Remarks: Each year, some offices or public places did not renew their IAQ certificates upon expiry. They are regarded as withdrawing from the Scheme and are not included in the year-end numbers. On the other hand, some new offices or public places joined the Scheme during the year and are included in the year-end numbers.

5.6 Table 5 shows that, although the number of offices and public places participating in the Scheme increased from 27 in 2003 to 559 in 2010, the participation rates were still very low, given the large number of offices and public places in Hong Kong.

5.7 In January 2007, in response to a question raised by a LegCo Member, the ENB informed LegCo that it did not have statistics on the total number of offices and public places in Hong Kong, nevertheless, premises voluntarily participating in the IAQ Certification Scheme accounted for only a relatively small proportion of the large number of offices and public places in the territory.

**5.8 In Audit's view, the low participation rate in the IAQ Certification Scheme is unsatisfactory. The EPD needs to conduct a review to ascertain the reasons for the low participation rate. The EPD also needs to explore effective measures to help improve IAQ in offices and public places.**

*Withdrawal from the Scheme*

5.9 Audit examination revealed that, from 2003 to 2010, a total of 245 certificates had not been renewed upon expiry. Details are shown in Table 6.

**Table 6**  
**Number of certificates not renewed upon expiry**  
**(2003 to 2010)**

Year	Government premises (No.)	Private premises (No.)	Total (No.)
2003 (From September)	0	0	0
2004	8	0	8
2005	2	3	5
2006	2	10	12
2007	6	5	11
2008	24	32	56
2009	54	43	97
2010	25	31	56
<b>Total</b>	<b>121</b>	<b>124</b>	<b>245</b>

*Source: EPD records*

5.10 Audit examination also revealed that, as of October 2010, the IAQ Information Centre did not:

- (a) send letters to IAQ certificate holders to remind them to renew their certificates before expiry; and
- (b) make enquiries and document the reasons for certificate holders not renewing their certificates upon expiry.

5.11 Audit considers that the EPD needs to take measures to encourage participants to renew IAQ certificates before expiry, such as sending renewal reminders and making enquiries to ascertain their reasons for not renewing the certificates with a view to providing necessary assistance as far as possible.

*Confirmation of no major changes to MVAC systems*

5.12 Under the IAQ Certification Scheme, from the second to the fifth year of a five-year cycle, only 2 of the 12 parameters of the IAQ Objectives are required to be assessed for renewal of certificates (see para. 5.3(b)). Nevertheless, under the following circumstances, all the 12 parameters are required to be assessed for renewal of certificates:

- (a) when there is a change to the use of the premises which may adversely affect the IAQ; or
- (b) when there is a major alteration or change to the operation or maintenance of the MVAC system.

5.13 **Audit examination of a sample of 10 certification reports (which only assessed two IAQ parameters) for renewal of certificates revealed that 8 reports had not confirmed that the circumstances in paragraph 5.12(a) and (b) were not applicable. Audit considers that the EPD needs to tighten controls in this area.**

*Assessment periods*

5.14 According to the IAQ Certification Guide:

- (a) IAQ measurements should be conducted on a continuous eight-hour basis to obtain the average value of each IAQ parameter; and
- (b) where it is not practicable to conduct a continuous eight-hour measurement, a surrogate measurement based on the average of half-hour measurements conducted at four time slots is acceptable. As a guideline, for office buildings, the four time slots should be evenly distributed over the business hours. **For public places, the four time slots should cover the worst-case scenario (such as periods of highest occupancy).**

5.15 Audit examination of a sample of 25 IAQ reports (15 for offices and 10 for public places) compiled by CIBs under the Scheme revealed that:

- (a) the measurements of all the 25 cases were conducted on the half-hour time slot basis;
- (b) for the 15 cases involving office buildings, the time slots selected for measurement were evenly distributed over the office business hours; and

- (c) for the 10 cases involving public places (Note 10), the selected time slots only covered weekdays but not weekends and public holidays, which were periods of high occupancy.

5.16 In Audit's view, it is likely that the IAQ at public places during weekends and public holidays may not be as good as that during weekdays. The EPD needs to require CIBs to conduct IAQ assessments covering periods of high occupancy, in accordance with the Certification Guide (see para. 5.14(b)).

*Audit recommendations*

5.17 Regarding the implementation of the IAQ Certification Scheme, Audit has recommended that the Director of Environmental Protection should:

*Effectiveness of IAQ Certification Scheme*

- (a) conduct a review to ascertain the reasons for the low participation rate of the Scheme;
- (b) explore effective measures to help improve IAQ in offices and public places;

*Withdrawal from the Scheme*

- (c) take measures to encourage participants to renew their IAQ certificates before expiry;

*Confirmation of no major changes to MVAC systems*

- (d) request CIBs to confirm in the certification reports which only assess two IAQ parameters that:
  - (i) there is no change to the use of the premises which may adversely affect the IAQ; and
  - (ii) there is no major alteration or change to the operation or maintenance of the MVAC system; and

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**Note 10:** The 10 public places included 5 sports centres, 2 clubhouses, 2 libraries and 1 theatre.

*Assessment periods*

- (e) require CIBs to conduct IAQ assessments covering periods of high occupancy of public places.

**Response from the Administration**

5.18 The **Secretary for the Environment** and the **Director of Environmental Protection** agree with the audit recommendations. They have said that:

*Effectiveness of IAQ Certification Scheme*

- (a) to attract more premises to join the IAQ Certification Scheme, the EPD will enhance publicity by bringing public attention to the Scheme and the IAQ certified premises. In this connection, it has requested the IAQ Information Centre to launch an IAQ label design competition with a view to replacing the present labels with more attractive ones;
- (b) subject to the availability of resources, the EPD will organise advertisements and promotions on IAQ using the new IAQ labels in the mass media as appropriate. It would consider conducting a survey with property developers and management companies to ascertain their reasons for the low participation in the Scheme;

*Withdrawal from the Scheme*

- (c) since November 2010, the EPD has issued reminders to scheme participants, and will take follow-up actions with a view to retaining participants who intend to withdraw from the Scheme;

*Confirmation of no major changes to MVAC systems*

- (d) in February 2011, CIBs were requested to confirm in their certification reports (which only assessed two IAQ parameters) for renewal cases that there was no change to the use of the premises which might adversely affect the IAQ, and that there was no major alteration or change to the operation or maintenance of the MVAC system; and

*Assessment periods*

- (e) in February 2011, the EPD reminded CIBs that they should conduct IAQ assessments covering periods of high occupancy in accordance with the Certification Guide.



## **PART 6: MANAGEMENT OF IAQ IN GOVERNMENT PREMISES**

6.1 This PART examines the management of IAQ in government premises by B/Ds (see para. 1.6(g)).

### **Government premises joining IAQ Certification Scheme**

6.2 In January 2000, the Administration informed the LegCo EA Panel that it would take the lead in implementing the IAQ Certification Scheme and selected government premises would join the Scheme when it was launched.

#### *ArchSD internal instruction*

6.3 In October 2003, subsequent to the launch of the IAQ Certification Scheme, the ArchSD issued an internal instruction (Note 11) on “Indoor Air Quality in Air-conditioning Design”. According to the instruction:

- (a) for projects involving buildings served by MVAC systems, the design of the systems should aim to achieve the Excellent Class of the IAQ Objectives; and
- (b) in case of difficulties which might render the cost to achieve the Excellent Class of the IAQ Objectives being prohibitive or not practicable, the Good Class should then be considered as a minimum.

6.4 In October 2003, August 2007 and March 2008, the ENB and the EPD issued memoranda to B/Ds inviting them to join the IAQ Certification Scheme. The EPD also organised IAQ seminars to explain to B/Ds the costs and benefits of participating in the Scheme and the ways to achieve better IAQ.

#### *Joint circular on Green Government Buildings*

6.5 In April 2009, the Development Bureau (DEVB) and the ENB issued a joint circular on “Green Government Buildings” (**Joint Circular**), setting out a green performance framework for new and existing government buildings. According to the Circular:

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**Note 11:** *In May 2009, this instruction was superseded by a new one, but the requirement for attaining the Excellent Class of the IAQ Objectives in new government projects remained unchanged.*

- (a) all new government buildings should aim to achieve the Excellent Class of the IAQ Objectives (Note 12);
- (b) all existing government buildings with a construction floor area of more than 10,000 square metres should aim to achieve the Good Class of the IAQ Objectives wherever possible; and
- (c) **to keep track of the implementation of the initiatives, regular updates would be sought from B/Ds on the progress made.**

*ENB to take the lead on IAQ matters*

6.6 In March 2011, the DEVB informed Audit that it had agreed with the ENB that the ENB would take the lead in matters relating to IAQ as promulgated under the Joint Circular, and in following up the audit recommendations in this PART.

**Audit observations and recommendations**

*IAQ in government premises*

6.7 From May 2000 to April 2001, the EMSD carried out an IAQ survey on 72 government premises installed with MVAC systems, which accounted for about 10% of such government premises (Note 13) at that time. The survey found that, of the 72 premises, 70 (97%) met the Good Class of the IAQ Objectives, and 2 (3%) failed to meet the Good Class requirements. In June 2000, the Administration informed the LegCo EA Panel that, subject to a review of the IAQ survey in that year, another survey would be conducted on the remaining 90% of government premises installed with MVAC systems, and these premises would be certified in compliance with the Excellent or Good Class of the IAQ Objectives, where appropriate. In the event, the IAQ survey was not conducted.

6.8 According to the Joint Circular, regular updates would be sought from B/Ds on the progress made on government buildings in achieving the Excellent Class or Good

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**Note 12:** *The Joint Circular stipulated that total additional costs for green measures (including IAQ improvement) would be capped at 2% of the total project cost, unless full justifications were provided by the relevant B/Ds.*

**Note 13:** *Government premises included office buildings, community centres, indoor games halls, museums and police stations.*

Class of the IAQ Objectives (see para. 6.5(c)). Audit however noted that, up to February 2011, no updates had been sought from B/Ds. In Audit's view, the ENB needs to issue guidelines to request B/Ds to conduct periodic surveys to ascertain the IAQ levels in their premises. Based on the results, B/Ds should consider taking appropriate follow-up actions in premises with IAQ not meeting the applicable level as promulgated in the Joint Circular. For public accountability, B/Ds should also publish, as far as possible, on their websites the IAQ levels in their premises.

### *Government premises joining the IAQ Certification Scheme*

6.9 As of December 2010, the Electrical and Mechanical Services Trading Fund (EMSTF — Note 14) was maintaining the building services systems of about 750 government premises served by MVAC systems. However, of these 750 premises, only 136 (18%) participated in the IAQ Certification Scheme. **In Audit's view, this low participation rate was unsatisfactory. B/Ds need to take the lead in participating in the IAQ Certification Scheme to demonstrate to the public the Administration's commitment to the Scheme. In this connection, the EPD needs to conduct a review to ascertain the reasons for the low participation rates, and explore effective measures to facilitate B/Ds to arrange for their premises to participate in the Scheme. The ENB also needs to request B/Ds to improve the participation rates.**

### *B/Ds' withdrawal from the Scheme*

6.10 Audit also noted that, from 2004 to 2010, 121 IAQ certificates for government premises had not been renewed upon expiry (see Table 6 in para. 5.9). In January 2011, the EPD informed Audit that, since November 2010, the IAQ Information Centre had been sending renewal reminders to the IAQ certificate holders. **Audit considers that the ENB needs to take measures to request B/Ds to renew the IAQ certificates of their premises as far as possible.**

### *IAQ certification work in maintenance service agreements*

6.11 Audit selected four government departments with the largest numbers of premises (including the GPA) for examination of their service agreements with the EMSTF for maintenance of MVAC systems of their premises.

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**Note 14:** *The EMSTF was established in August 1996 under the EMSD for providing services to government departments and public bodies on the operation and maintenance of their building services systems.*

6.12 Audit noted that the GPA's service agreement with the EMSTF for maintenance of MVAC systems included IAQ certification work, while the agreements of the other three government departments with the EMSTF did not include such work (Note 15). Audit noted that all the 39 premises served by MVAC systems managed by the GPA had participated in the IAQ Certification Scheme, while the other three departments had much lower participation rates (below 50%).

**6.13 In Audit's view, the ENB needs to request B/Ds to include IAQ certification work, as far as possible, in their service agreements with maintenance agents (e.g. the EMSTF) for maintaining MVAC systems.**

#### *Funding arrangements for joining the Scheme*

6.14 In 2005-06, it was agreed between the EMSD and the Financial Services and the Treasury Bureau that the EMSD would contribute some of the retained earnings of the EMSTF for energy-saving retrofit, renewable energy and IAQ improvement projects over five years (from 2006-07 to 2010-11). During the period, about \$76 million of EMSTF contribution was spent on implementing IAQ improvement projects. The objective was to facilitate selected government departments to participate in the IAQ Certification Scheme. The scope of works included improvement works for MVAC systems (e.g. air duct cleaning, installation of disinfection devices and replacement of air filters), IAQ measurement, and venue certification for joining the IAQ Certification Scheme.

6.15 As at 31 December 2010, of the total 179 premises included in the IAQ improvement works programme, 132 (74%) had their IAQ improvement works completed. Of these 132 premises, 124 (94%) had joined the IAQ Certification Scheme. The EMSD programme for implementing IAQ improvement projects would be completed by March 2011.

6.16 Audit however noted that about 570 government premises served by MVAC systems were not covered by the EMSD programme. **Audit considers that the ENB needs to request B/Ds to explore funding arrangements for carrying out IAQ improvement works to the MVAC systems of government premises not covered by the EMSD programme, with a view to facilitating all government premises with MVAC systems to meet the IAQ Objectives and join the IAQ Certification Scheme.**

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**Note 15:** *The service agreements only included the conduct of periodic IAQ surveys on selected IAQ parameters.*

*Government buildings meeting the Excellent Class*

6.17 As laid down in ArchSD instruction of October 2003 (see para. 6.3), for projects involving buildings served by MVAC systems, the design of the MVAC systems should aim to achieve the Excellent Class of the IAQ Objectives. The ICAC Building was completed in April 2007 and has been occupied since August 2007. According to the ArchSD's design requirements as indicated in the design report for the ICAC Building, the design of the MVAC system aimed at achieving the Excellent Class of the IAQ Objectives. In September 2008, the ArchSD conducted IAQ assessments of the building and found that it met the Excellent Class requirements. Nevertheless, the ICAC Building did not join the IAQ Certification Scheme.

6.18 The EMSTF was employed as the maintenance agent for the building services systems of the ICAC Building, including IAQ certification service for the building. In March 2010, the EMSTF's assessments found that the ICAC Building only met the Good Class of the IAQ Objectives, with four parameters (namely RSP, total volatile organic compounds, nitrogen dioxide and airborne bacteria) failing to meet the Excellent Class levels.

6.19 **Audit considers that the EMSD, in coordination with the ArchSD and the Independent Commission Against Corruption (ICAC), needs to ascertain the reasons why the ICAC Building did not meet the Excellent Class of the IAQ Objectives after three years of occupation, and propose appropriate measures for improvement.**

*Audit recommendations*

6.20 **Audit has recommended that the Secretary for the Environment should issue guidelines to request B/Ds to:**

*IAQ in government premises*

- (a) **conduct periodic surveys to ascertain the IAQ in their premises;**
- (b) **consider appropriate follow-up actions in their premises with IAQ not meeting the applicable level as promulgated in the Joint Circular;**
- (c) **publish, as far as possible, on their websites the IAQ of their premises with reference to the IAQ Objectives;**

*Government premises joining the IAQ Certification Scheme*

- (d) arrange for their premises to join the IAQ Certification Scheme as far as possible;

*B/Ds' withdrawal from the Scheme*

- (e) renew the IAQ certificates of their premises as far as possible;

*IAQ certification work in maintenance service agreements*

- (f) include IAQ certification work, as far as possible, in service agreements for maintaining MVAC systems; and

*Funding arrangements for joining the Scheme*

- (g) explore funding arrangements for carrying out improvement works to the MVAC systems of their premises not covered by the EMSD programme, with a view to facilitating these premises to meet the IAQ Objectives and join the IAQ Certification Scheme.

6.21 **Audit has recommended that the Director of Environmental Protection should:**

*Government premises joining the IAQ Certification Scheme*

- (a) conduct a review to ascertain the reasons for the low participation of B/Ds' premises in the IAQ Certification Scheme; and
- (b) explore measures to facilitate B/Ds to arrange for their premises to join the IAQ Certification Scheme.

6.22 **Audit has recommended that the Director of Electrical and Mechanical Services should, in collaboration with the Director of Architectural Services and the Commissioner, Independent Commission Against Corruption, ascertain the reasons why the ICAC Building did not meet the Excellent Class of the IAQ Objectives after three years of occupation, and propose appropriate measures for improvement.**

## **Response from the Administration**

6.23 The **Secretary for the Environment** and the **Director of Environmental Protection** agree with the audit recommendations in paragraphs 6.20 and 6.21.

6.24 The **Secretary for Development** has said that the DEVB would continue to provide necessary input and support for the implementation of the audit recommendations in paragraph 6.20.

6.25 The **Director of Electrical and Mechanical Services** agrees with the audit recommendation in paragraph 6.22. He has said that the EMSD will collaborate with the ArchSD and the ICAC to ascertain the reasons why the ICAC Building did not meet the Excellent Class of the IAQ Objectives, and propose appropriate measures for improvement.

6.26 The **Director of Architectural Services** has said that the ArchSD will provide technical support to the EMSD and the ICAC in ascertaining the reasons why the ICAC Building did not meet the Excellent Class of the IAQ Objectives.

6.27 The **Commissioner, Independent Commission Against Corruption** agrees with the audit recommendation in paragraph 6.22.

## **PART 7: THE WAY FORWARD**

7.1 This PART examines the way forward to make sustained IAQ improvements.

### **The way forward**

7.2 As revealed in PARTs 2 to 6, there was room for improvement in various areas in the implementation of the IAQ Management Programme.

7.3 Audit noted that, at an IAQ Management Group meeting in December 1998 on the implementation of the IAQ Management Programme, a member suggested that there was a need to determine:

- (a) the time for commencing the Programme and the time frame for its implementation; and
- (b) the major milestones and performance indicators to evaluate the achievements of the Programme.

7.4 In a paper submitted to the LegCo EA Panel in June 2000, the Administration included a schedule for the implementation of the IAQ Management Programme. However, the paper did not include major milestones and performance indicators. In November 2005, the EPD informed the EA Panel of the progress of implementing the IAQ Management Programme, and the work on developing the Programme further.

7.5 The 2006 Consultancy Study included reviewing the effectiveness of the IAQ Management Programme and proposing an IAQ management strategy for better management and development of the future IAQ policy. At the meeting in March 2011, the IAQ Management Group examined the draft executive summary of the Consultancy Study report (see para. 2.27(d)). As stated in the draft executive summary, among others, the consultant recommended:

- (a) expanding the scope of the IAQ Information Centre as a leading IAQ centre;
- (b) strengthening the promotion of low-emission indoor products and materials;



- (c) promoting positive IAQ management practices and providing incentives to attract more participation in the IAQ Certification Scheme;
- (d) extending the existing IAQ programmes progressively to cover other premises, such as schools and elderly homes;
- (e) taking a more proactive and leading approach to promoting IAQ by making IAQ certification in all government premises a key policy and setting a target to complete the certification in phases;
- (f) removing comfort factors from IAQ Objectives for, among other things, energy conservation and saving;
- (g) incorporating airborne fungi as one of the parameters in the IAQ Objectives;
- (h) revising the IAQ Objectives in the light of the newly published WHO guidelines on IAQ;
- (i) revisiting the IAQ measurement protocol and updating it according to the advancement in pollutant monitoring technologies;
- (j) strengthening the existing legislative provisions on ventilation requirements; and
- (k) conducting regular IAQ surveys to gauge the effectiveness of the IAQ programmes.

7.6 In Audit's view, based on the findings of the 2006 Consultancy Study and taking account of the audit observations and recommendations in this Report, the ENB and the EPD need to consider compiling an updated IAQ Management Programme with milestones for implementation and with key performance indicators for monitoring and evaluation.

### **Audit recommendations**

7.7 **Audit has recommended that the Secretary for the Environment should, in collaboration with the Director of Environmental Protection:**

- (a) **consider compiling an updated IAQ Management Programme, taking account of the findings of the 2006 Consultancy Study and the audit observations and recommendations in this Report;**

- (b) **set timetables and milestones for implementation of the various tasks under the updated IAQ Management Programme, and develop key performance indicators for monitoring and evaluation; and**
- (c) **set up an effective mechanism to monitor the implementation of the updated IAQ Management Programme and report the progress, where appropriate, to the LegCo EA Panel.**

### **Response from the Administration**

7.8 The **Secretary for the Environment** and the **Director of Environmental Protection** agree with the audit recommendations.

**Common indoor air pollutants**

<b>Pollutant</b>	<b>Source</b>	<b>Potential health effect</b>
Carbon dioxide	Smoking and combustion sources, e.g. cooking stoves	Headaches, dizziness and nausea at high concentration
Carbon monoxide	Combustion sources, smoking, and outdoor sources, e.g. vehicle emissions	Headaches, decreased alertness, flu-like symptoms, nausea, fatigue, rapid breathing, chest pain, confusion, impaired judgement and death at high concentration
RSP	Smoking, combustion sources, photocopying machines, and outdoor sources	Allergic reactions, e.g. dry eyes, nose, throat and skin irritation, coughing, sneezing, and respiratory difficulties
Nitrogen dioxide	Combustion sources, smoking, and outdoor sources	Eye and respiratory irritation
Ozone	Photocopying machines, printers, and air purifiers with high-voltage discharge components	Tingling sensation in the nose, dry and sore throat, tearing, burning, stinging and pain in the eyes
Formaldehyde	Smoking, pressed-wood products, urea-formaldehyde foam insulation products, adhesives, paints, and furniture	Eye and respiratory irritation, lung tissue damage if inhaled in high concentration
Volatile organic compounds	Cleaning agents, disinfectants, paints and solvents, printing inks, furniture and furnishings, and smoking	Some organic compounds from these sources are carcinogenic
Radon	Granite used in building materials	Lung cancer
Microbials (e.g. bacteria and fungi)	Microbial proliferation under suitable conditions, e.g. high humidity	Toxic, pathogenic or allergic reactions

Source: EPD records

**Acronyms and abbreviations**

ArchSD	Architectural Services Department
Audit	Audit Commission
B/Ds	Government bureaux and departments
CIB	Certificate issuing body
CORs	Controlling Officer's Reports
DEVB	Development Bureau
EA Panel	Panel on Environmental Affairs
EMSD	Electrical and Mechanical Services Department
EMSTF	Electrical and Mechanical Services Trading Fund
ENB	Environment Bureau
EPD	Environmental Protection Department
GPA	Government Property Agency
IAQ	Indoor air quality
ICAC	Independent Commission Against Corruption
LegCo	Legislative Council
MVAC	Mechanical ventilation and air-conditioning
ppm	Parts-per-million
RSP	Respirable suspended particulates
WHO	World Health Organisation
$\mu\text{g}/\text{m}^3$	Microgram per cubic metre