

Practice Note for Managing Air Quality in
Air-conditioned Public Transport Facilities

Ferries

Environmental Protection Department
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ENVIRONMENTAL PROTECTION DEPARTMENT

PRACTICE NOTE FOR PROFESSIONAL PERSONS

Introduction

1. This Practice Note provides guidelines to practitioners and professional persons on the management of air quality in ferry facilities operated within Hong Kong by the franchised and licensed ferry companies.

2. The guidelines include the following:
 - (i) **Air Quality Guidelines** - controlling parameters and limits to indicate better air quality in ferry facilities;
 - (ii) **Company Framework and Responsibilities** - incorporation of company policies or service pledge to achieve better air quality in ferry facilities;
 - (iii) **Design Considerations** - factors that should be considered in the design of ferry facilities in order to achieve better air quality;
 - (iv) **Operational Practices** - good practices to be followed for the achievement of better air quality in ferry facilities; and
 - (v) **Monitoring, Inspection and Maintenance Requirements** - sampling and maintenance to be taken to achieve and maintain better air quality in ferry facilities.

3. **Scope and Definitions**
 - (i) This Practice Note provides guidelines for all air-conditioned and enclosed local ferry facilities, covering:
 - (a) ferry compartments for passengers; and
 - (b) passenger-waiting halls at ferry piers
 - (ii) “Ferry facilities” in this Practice Note means “air-conditioned and enclosed ferry facilities”.
 - (iii) Environmental control system refers to the air-conditioning and ventilation system which sustains the intended environmental quality inside the ferry facilities. All equipment and materials used in operation, maintenance and cleaning of the system are included.

Air Quality Guidelines

4. Given the large number and high density of people inside the ferry facilities, the quality of outdoor air taken into the ferry facilities for the purpose of diluting air pollutants in ferry facilities should be given due consideration. There are two major areas of concern in ferry facilities:
 - (i) adequacy of ventilation, i.e. supply and quality of outdoor air; and
 - (ii) infiltration of exhaust gases into ferry compartments due to short-circuiting.

5. Since it is difficult and resources intensive to effectively monitor the various air pollutants found inside ferry facilities, an effective way to monitor the air quality is to measure appropriate surrogate air quality indicator(s). The choice of surrogate indicator(s) depends on a number of factors:
 - (i) how representative they are of reflecting the actual air quality;
 - (ii) ease of measurement;
 - (iii) ease of interpretation of results;
 - (iv) possibility of real-time monitoring; and
 - (v) feasibility of incorporating measurements into a schedule of routine maintenance procedures.

6. Carbon dioxide (CO₂) is selected as a surrogate indicator because its concentration in an indoor environment is a good indicator of the effectiveness of ventilation system and the adequacy of ventilation. As regards the infiltration of exhaust gases into ferry compartments, the conditions of ferry bodies and components will be monitored during routine inspections by ferry operators as well as during the statutory vessel examination.

7. To allow flexibility for ferry operators and to encourage them to strive for better air quality, two-level air quality guidelines is established to serve as the benchmark for evaluating and assessing air quality in ferry facilities. The two-level air quality guidelines are as follows:
 - Level 1 - represents good air quality of a comfortable ferry facility at which there is no health concern identified.
 - Level 2 - represents the air quality of a ferry facility at which there is no health concern identified.

The numerical values of carbon dioxide for the two-level air quality guidelines are tabulated below:

Parameters	<u>Air Quality Guidelines</u> *	
	Level 1	Level 2
Carbon dioxide	2,500 ppm (4,500 mg/m ³)	3,500 ppm (6,300 mg/m ³)

* Expressed as trip average for ferry compartment for passengers, and hourly average for passenger-waiting hall at the pier

Company Framework and Responsibilities

8. Ferry operators should establish a framework and an action plan to demonstrate their commitment to achieve and maintain better air quality in their facilities, including but not limited to:
 - (i) put up a pledge to maintain better air quality in ferry facilities;
 - (ii) make known the pledge in (i) above to all employees of the company and the public;
 - (iii) set up procedures to take into account the pledge in (i) above in procurement, design, operation and maintenance of the ferry facilities;
 - (iv) take appropriate actions when the relevant air quality guidelines set out in Paragraph 7 above are exceeded;
 - (v) operate a complaint handling mechanism on air quality in ferry facilities and make it known to the public;
 - (vi) nominate air quality manager(s), either part time or full time, with authority and responsibility to maintain better air quality within ferry facilities, including the investigation, mitigation and logging of air quality complaints.

Design Considerations

9. The following design guidelines should be taken into consideration when new ferry facilities are built. Existing facilities not meeting the design guidelines should be upgraded or retrofitted to meet the guidelines where reasonably practicable.

(A) Air-conditioned and enclosed Ferry Compartment for Passengers

10. Design guidelines for air-conditioned and enclosed ferry compartment are:

- (i) Engine
 - (a) give priority to low pollution emission models which also satisfy the relevant requirements of the Marine Department when specifying the engine type to reduce the amount of pollutants that may infiltrate into compartments.
 - (b) locate the engine exhaust away from the outside air intake of the ventilation system to reduce the risk of short-circuiting of exhaust gases into the compartment.
- (ii) Compartment Body
 - (a) isolate the interior of the compartment body from the exhaust of its own engine.
 - (b) facilitate regular maintenance and cleaning works. Reduce niches that may accumulate dirt and micro-organisms.
 - (c) ventilate all parts of the compartment adequately by airflow induced by the ventilation system.
 - (d) select materials with minimum emission of pollutants for use inside the compartment, and seat coverings that resist soiling to avoid the growth of bacteria and fungi, etc.
- (iii) Ventilation System
 - (a) locate outside air inlet away from any pollution sources to avoid intake of air pollutants.
 - (b) install particulate filters making reference to the relevant ASHRAE standards.
 - (c) install fans of appropriate size, taken into account the expected operational resistance of the filters (prior to filter cleaning or disposal), to deliver the designed flow rate at all times.
 - (d) allow access for regular maintenance and cleansing.
 - (e) design and locate the air outlets and return air grilles so that air can be evenly distributed throughout the compartment for flushing all parts and yet avoiding excessive draughts on passengers.
 - (f) provide adequate outside air ventilation rate based on the licensed maximum passenger carrying capacity to meet with the relevant air quality guidelines in Paragraph 7 above.

(B) Air-conditioned and enclosed Passenger-Waiting Hall at Ferry Pier

11. Design guidelines for the air-conditioned and enclosed passenger-waiting hall are:

(i) Ventilation System

- (a) design the outdoor air supply flow rate and the ventilation rate based on the designed passenger transfer rate to meet the air quality guidelines set out in Paragraph 7 above.
- (b) install particulate filters at the outside air inlet and, if needed, at the recirculated path. Efficiency of the filters should follow the “General Specification for Air Conditioning, Refrigeration, Ventilation and Central Monitoring and Control System Installation” published by the Architectural Services Department or the relevant ASHRAE standards.
- (c) install fans of appropriate size, taken into account the expected final resistance of the filters (prior to filter cleaning or disposal), to deliver the designed flow rate at all times.
- (d) ensure that there will be no short-circuiting of foul air in the system and no reduction in outdoor and total supply air quantity due to by-pass away from intended air paths.
- (e) install duty fans for minimum outside air and for total supply air for air-conditioning purposes. Outside air fans sized for 100% supply air (free cooling fans), individual supply air fans, return air fans and exhaust air fans should be considered, as usually they provide better system performance and flexibility with air circulation and recirculation.
- (f) take into account the expected latent heat load in calculating the cooling capacity of the primary air units and air-handling units. Construct equipment with adequate numbers of rows of cooling coils for the required duty. Avoid condensation and cold spots by careful planning of the air distribution and the temperature set points. Reference shall be made to the relevant ASHRAE standards.
- (g) allow access for regular maintenance and cleansing of the ductwork and cooling coils, and cleansing and replacement of the particulate filters.
- (h) install a separate exhaust at kiosks if they are expected to emit excessive amount of air pollutant.
- (i) provide a dedicated air cleaner or exhaust connections for temporary renovation sites within the passenger-waiting hall to avoid dispersal of pollutants if significant amounts of pollutants are expected.

(ii) Plumbing and Drainage System

- (a) use durable materials for piping, valves and drains to avoid leakages and

odour.

- (b) provide drainage for underground water seepage and condensation to avoid accumulation of water.

- 12. In general, ferry operators should use environmentally friendly materials in all ferry facilities. If the use of materials that will emit harmful pollutants or odour is unavoidable, the pollutants should either be baked out before the materials are put into service, or the concentration of the pollutant should be controlled at an acceptable level by operating the environmental control system in an appropriate mode (details are in Annex A).

Operational Practices

- 13. Operate the environmental control system in an appropriate mode such that the relevant air quality guidelines in Paragraph 7 will be met.

Monitoring, Inspection and Maintenance Requirements

- 14. The compliance status of the level of carbon dioxide at all ferry facilities should be ascertained by a qualified indoor air quality monitoring practitioner or professional in the following frequencies:
 - (i) monitor the average concentration of carbon dioxide (according to the averaging period as specified in Paragraph 7) during normal operations at peak hours at least once a year.
 - (ii) check the ventilation rate or ventilation system in ferry facilities at least once a year.
 - (iii) In addition, during the annual compliance checking, the qualified indoor air quality monitoring practitioner or professional should review the cleansing records of the previous year and advise on the cleansing programme for the forthcoming year taking into account any relevant observations drawn from the previous cleansing records.
- 15. When the relevant air quality guidelines in Paragraph 7 above are exceeded, the air quality manager(s) should conduct investigations and recommend mitigation measures to ensure the compliance of the relevant guidelines.
- 16. The air quality manager(s) should develop a cleansing programme to remove dirt and rubbish, avoid water or damp materials, and remove stains, bacteria and mould growth, etc. The programme should cover, but not limited to, the following:

- (i) regular cleansing and replacement of air filters in ventilation systems of the ferry facilities;
- (ii) regular (or at such interval as recommended by manufacturers) cleansing of cooling coils, drain pans and those accessible air ducts in ferry facilities. Use a high suction power vacuum cleaner with HEPA filters or other equivalent equipment as determined by the air quality manager(s) in order to avoid dust being returned to the facilities;
- (iii) adequate purging of areas including air ducts and cooling coils that have undergone cleansing procedure of fumigation with outdoor air before the ferry facilities are returned to service;
- (iv) keeping cleansing records for individual ferry facilities; and
- (v) keeping records of the regular monitoring data of the air quality in ferry facilities as collected by the qualified indoor air quality monitoring practitioner or professional.

Enquiries

17. Please contact the Air Policy Group of the Environmental Protection Department (Telephone: 2594 6265, Facsimile: 2827 8040) for enquiries on managing air quality in ferry facilities.



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Harmful Pollutants

1. The air quality manager(s) should :
 - (i) ensure that environmentally friendly material is used in ferry facilities as much as possible;
 - (ii) be aware of any potential risk of harmful substances, including odour, emitted from any material if the use of such material is unavoidable;
 - (iii) obtain information such as the emission rate of air pollutants from the supplier and manufacturer of the material in (ii) above; and
 - (iv) dilute the harmful pollutants with adequate outdoor air by properly managing the environmental control system.

2. The air quality at any zone of a ferry facility is a function of the pollutants, ventilation rate and quality of the outside air. The concentration of a pollutant at steady state condition is given by:

$$C_{ss} = C_o + G/Q$$

where C_{ss} = concentration of a pollutant at steady state of an operating mode of the environmental control system

C_o = in-facility background concentration of that pollutant of the effective ventilation

G = generation rate of the pollutant at the zone of concern

Q = effective ventilation rate at the zone of concern.

C_o and G constitute the inventory of a pollutant. It can be determined by adopting appropriate measurement protocols to suit the characteristics of the zone and configuration of the environmental control system.

3. The “Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places” published by the Indoor Air Quality Management Group of the HKSAR Government in September 2003 and the “WHO guidelines for indoor air quality: selected pollutants” published by the World Health Organization (WHO) in 2010 provide guidelines for the most common pollutants in indoor air.