

**ENVIRONMENTAL PROTECTION DEPARTMENT
PRACTICE NOTE FOR PROFESSIONAL PERSONS**

Control of Air Pollution in Car Parks

Introduction

This Practice Note provides guidance on the control of air pollution in car parks including :

- (i) air quality guidelines required for the protection of public health; and
- (ii) factors that should be considered in the design and operation of car parks in order to achieve the required air quality.

Air Quality Guidelines

2. Carbon monoxide and nitrogen dioxide are the most relevant air pollutants inside car parks in Hong Kong. As a generalization, petrol engine vehicles (mainly cars) are the source of most but not all carbon monoxide in car parks and diesel engine vehicles are the source of most but not all nitrogen dioxide. Carbon monoxide blocks the absorption of oxygen by the blood and this can lead to dizziness, unconsciousness, or death depending on the concentration. Nitrogen dioxide affects the lungs and can cause breathing difficulties, prompts asthma attacks and causes long term damage to the lungs. To provide adequate protection of the public health, the air quality inside car parks should be kept within the following concentration limits :

Air Pollutants	Averaging Time	Maximum Concentration	
		Microgrammes Per Cubic Metre ($\mu\text{g}/\text{m}^3$)	Parts Per Million (ppm)
(a) Carbon monoxide (CO)	5 minutes	115,000	100
(b) Nitrogen dioxide (NO ₂)	5 minutes	1,800	1

All limits are expressed as at reference conditions of 298 K and 101.325 kPa.

Design Considerations

3. Car park ventilation systems should be designed to ensure that the car park air quality guidelines, set out in paragraph 2 above, are met under all circumstances. For most cases, the NO₂ concentration in a car park is within the guideline limit as long as the CO guideline is satisfied. For car parks used by a high proportion of goods and other diesel-fuelled vehicles, NO₂ concentration becomes a more important consideration.

4. To meet the air quality guidelines stated in paragraph 2, good ventilation is of paramount importance. The ventilation provided must be able to provide sufficient dilution of the CO and NO₂ emitted from vehicles during peak hours as well as under the worst foreseeable operating conditions, such as queuing of vehicles within the car park. Other factors to be considered in designing ventilation systems for car parks are listed below :

- (i) The supply and exhaust openings for the ventilation system should be distributed to ensure :
 - (a) even dilution and removal of air pollutants from all parts of the car park; and
 - (b) no possibility of any obstruction to the airflow due to debris and the like.

Particular attention should be paid to ensure the fresh air intakes and exhaust outlets will be free from blockage, short circuiting, interaction with other systems and down wash due to winds.

- (ii) Sufficient standby units should be provided to meet the air quality guidelines during maintenance periods or in the event of the break down of the normal units.
- (iii) Separate fresh air supply should be provided to areas that are occupied regularly such as lift lobbies, pay booths and car cleaning services bay. For the main car park area, care should be taken to ensure that fresh air is under positive pressure and is supplied without contamination of the vitiated air of the car park or the ventilation exhaust.
- (iv) Exhaust air should be discharged to the atmosphere in such a manner and at such a location as not to cause a nuisance to occupants in the building or of neighbouring buildings, or to the public.

5. The layout of the car park should help minimize the emissions from vehicles. A few possible measures are illustrated below :

- (i) Ramps and bends which may give rise to unnecessary congestion should be minimized;
- (ii) Exit routes should, whenever possible, be at a location with little road traffic;
- (iii) Additional entrance and/or exit for vehicles should be provided, wherever practicable, if :
 - (a) the anticipated vehicle movement rate is high;
 - (b) the car park has in total more than 500 parking spaces; or
 - (c) queuing inside the car park is anticipated.

Monitoring and Control

6. To ensure the air quality guidelines can always be met, the levels of CO in a car park should be monitored continuously and the measurement results linked up automatically through a tamper-proof device with the control of the ventilation system. A sample monitoring and control scheme is attached for reference at Appendix.

Enquiries

7. Officers in the Air Services Group of the Environmental Protection Department are glad to answer any enquiries concerning the control of air pollution in car parks. Enquiries can be addressed to the Senior Environmental Protection Officer, Air Services Group, Environmental Protection Department (Telephone: 2594 6265, Facsimile: 2827 8040).

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Issued June 1996
Ref. : EP 81/C2/28 Annex I

A Sample Monitoring and Control Scheme

- i) The monitoring system should be operated continuously with the performance specifications compatible to those mentioned in the Method IP-3 (Determination of Carbon Monoxide or Carbon Dioxide in Indoor Air) of the United States Environmental Protection Agency's Compendium of Methods for the Determination of Air Pollutants in Indoor Air (EPA/600/4-90/010) and should measure the concentration with an accuracy of 10% in the range between 11,500 $\mu\text{g}/\text{m}^3$ and 138,000 $\mu\text{g}/\text{m}^3$. If the car park does not open 24 hours per day, the system should be automatically activated at such time that it can accurately analyze and properly react to the first sample analyzed immediately after the car park is open to receive entering cars.

- ii) The monitoring system should include devices to detect and signal fault conditions, including erroneous response, non-response to CO concentration, or loss of power to the system. During any of these faulty conditions, the system should automatically activate an alarm at a suitable location and set the ventilation system(s) for the corresponding zone/level to operate at full capacity until the faulty condition is rectified.

- iii) When the monitoring system detects a change in CO concentration to fall within different set concentration ranges listed below, and such condition has been sustained at the same sampling point for 4 minutes continuously, the system should immediately vary the ventilation rate to exceed the value calculated in accordance with the following criteria :

CO Concentration Range (microgrammes per cubic <u>metre</u>)	<u>Mode of Operation</u>
(a) 90,000 or more	Operate at full ventilation rate;
(b) Between 55,000 and 90,000	Operate at a rate not less than determined by the following equation :

$$VR = MR + [(X - 55,000) / 35,000] \times (FR - MR)$$

where :

VR = ventilation rate

MR = minimum ventilation rate
as defined in (c) below

FR = design air flow rate

X = the highest CO concentration
(microgrammes per cubic metre)
sustained for 4 minutes in the zone/level
under consideration

- (c) 55,000 or less Operate at the minimum ventilation rate of 25% of the FR for each zone/level (required only when that zone/level is open).
- iv) The sampling points for each zone/level should, whenever practicable, be evenly distributed spatially so that no part of the car park is more than 25 metres horizontally from a sampling point for CO monitoring. In addition, at least one sampling point should be provided at each of the entrance(s) and exit(s) of car park.
- v) The sampling points for CO monitoring should, whenever practicable, be :
- (a) between 0.9 metres and 1.8 metres above floor surface at positions which will allow samples to be fully representative of the local atmosphere;
 - (b) at least 0.1 metres clear of walls, columns and other vertical or near vertical surfaces, and not in a position significantly influenced by either supply air or car exhaust emissions; and
 - (c) closer to exhaust inlets than supply air outlets, and wherever possible, situated such that the distance from exhaust openings is 3/10 of the distance between supply air and exhaust openings.

- vi) All CO analyzers should be checked for zero and span with standard gases of known CO concentration and calibrated and certified by a competent environmental laboratory in accordance with the manufacturers' recommendations.
- vii) The car park management should ensure free flow of vehicles inside the car park at all times. Procedures should be established to ensure no vehicle will be allowed to enter the car park once it is full or when the air quality guidelines have been exceeded. A display should be provided at the entrance of the car park to inform the users whether the air quality inside is acceptable.
- viii) Effective control of air pollution requires proper supervision on the maintenance and operation of the ventilation systems and the CO monitoring system. Good preventive maintenance should be employed.
- ix) Staff should be properly trained on their duties relating to control of air pollution.
- x) The car park management should keep log of monitoring results.

Addendum to the ProPECC Practice Note PN 2/96
(valid from 22 November 2005)

Original	Amendments
<p data-bbox="236 398 395 432">Paragraph 7</p> <p data-bbox="236 448 772 907">“Officers in the Air Services Group of the Environmental Protection Department are glad to answer any enquiries concerning the control of air pollution in car parks. Enquiries can be addressed to the Senior Environmental Protection Officer, Air Services Group, Environmental Protection Department (Telephone: 2594 6265, Facsimile: 2827 8040).”</p> <p data-bbox="236 972 711 1193">Contact address was: Environment Protection Department 28/F Southorn Centre 130 Hennessy Road Wan Chai</p>	<p data-bbox="799 448 1326 672">“Enquires on the Practice Note can be made to the Air Science Group of the Environmental Protection Department (Telephone: 2594 6421, Facsimile: 2827 8040, email: enquiry@epd.gov.hk).”</p> <p data-bbox="799 972 1297 1245">Contact address is: Air Science Group Environmental Protection Department 33/F, Revenue Tower 5 Gloucester Road Wan Chai, Hong Kong</p>