



Environmental Permit No. EP- 544/2017

Kai Tak Sports Park – Investigation

Environmental Team Leader Certification

Reference Document /Plan

Document/Plan to be Certified:	Air Quality Management Plan (Rev.6)
Date of Report:	May 2022
Date received by ETL:	27 May 2022

Reference EP Condition

Environmental Permit Condition:	2.16
<p>The Permit Holder shall, no later than one month before the commencement of construction of the Project or otherwise approved by the Director, submit three hard copies and one electronic copy of Air Quality Management Plan (the AQMP) Part 1 and AQMP Part 2 to the Director for approval. The AQMP Part 1 shall include details, implementation programme, maintenance and management schedules of the required air quality mitigation measures for the Project. The AQMP Part 2 shall include details on the application and implementation of the best practicable means (BPM) for enhancing air quality for the venue users of the Kai Tak Sports Park.</p>	

ETL Certification

<p>I hereby certify that the above reference plan complies with the above referenced condition of EP-544/2017.</p>	
	
Mr Sunny Chan Environmental Team Leader	Date: 30 May 2022



Environmental Permit No. EP-544/2017

Kai Tak Sports Park - Investigation

Independent Environmental Checker Verification

Reference Document/Plan

Document/Plan to be Certified / Verified:	Air Quality Management Plan
Date of Report:	May 2022 (Rev. 6)
Date received by IEC:	30 May 2022

Reference EP Condition

Environmental Permit Condition:	2.16
The Permit Holder shall, no later than one month before the commencement of construction of the Project or otherwise approved by the Director, submit three hard copies and one electronic copy of Air Quality Management Plan (the AQMP) Part 1 and AQMP Part 2 to the Director for approval. The AQMP Part 1 shall include details, implementation programme, maintenance and management schedules of the required air quality mitigation measures for the Project. The AQMP Part 2 shall include details on the application and implementation of the best practicable means (BPM) for enhancing air quality for the venue users of the Kai Tak Sports Park.	

IEC Verification

I hereby verify that the above referenced document /plan complies with the above referenced condition of EP-544/2017.	
	
Ms Mandy To	Date: 30 May 2022
Independent Environmental Checker	

Our ref: 0500384_IEC Verification Cert_KTSP_AQMP_20220530.docx

COMMENTS FROM RELATED DEPARTMENTS/PARTIES

	Comments	Responses
	<p>From: EPD, Matthew H. H. TANG Ref : () in EP 2/K19/O/28 Pt. 9 Date: 3 November 2021</p>	
	<p>I refer to your letter dated 14 September 2021 submitting a revised Air Quality Management Plan (AQMP) for Kai Tak Sports Park under Condition 2.16 of the captioned Environmental Permit.</p> <p>Please find enclosed in Annex 1 our comments on the AQMP submission for you to follow up.</p>	
	General	
1.	<p>For best practicable means using de-NO_x paint and filter, etc. for enhancing air quality, please supplement section(s) in the AQMP to describe the recurrent management and maintenance arrangements during operation of the Project, for instance, how to check the intact condition and satisfactory functioning of the applied de-NO_x paint and filter, how frequent/what condition(s) will be de-NO_x paint be re-applied and filter be replaced, how will new/better de-NO_x paint and filter be adopted in case of technological breakthrough in these products, etc.</p>	<p>Section 3.4 added for the inspection to be taken during operation phase.</p>
	Section 3.2: Use of De-NO_x Paints	
2.	<p>Table 3.1 and R-t-C Item 4 – Application of De-NO_x Paint to the underside surface of the podium deck connection above Shing Kai Road is noted. As commented before, please note that there is a linear relationship between UV intensity and photocatalytic activity for the photocatalytic materials of the De-NO_x Paint. The working efficiency of the De-NO_x Paint applied at the proposed underside may be in doubt. Please provide supplementary</p>	<p>The underside of the Main Plaza deck is confirmed to be not under direct sunlight and rely on indirect UV reflecting from Road level only.</p> <p>This is the only extensive area where de-NO_x paint can be potentially applied as confirmed by the design team.</p>

	Comments	Responses
	information to demonstrate that De-NOx Paint is workable at the proposed underside surface considering the anticipated NOx removal performance and required maintenance.	
3.	According to Section 3.2 of the AQMP, the building facades are primarily glazing and therefore not appropriate for application of De-NOx Paint. Also, as indicated in the R-t-C Item 1, there is no suitable location to implement De-NOx Paint inside the venues. Please note that De-NOx Paint can substitute traditional paint. With the view to enhancing the best air quality for the venue users, please consider to substitute the traditional paint by the De-NOx Paint for the painting works for the surface within the NO2 exceedance zone as far as practicable. Furthermore, please confirm if there will be no external surface of the venues which require painting.	The internal side of the venues are not exposed to UV and thus adoption of de-NOx paint to be ineffective. Further reviewing the external surface of the precinct, it is further considered that the external face interfacing CKR to be a potential area for paint application. Refer to Section 3.2 for detail description to the area.
4.	Noting that there will be liaison with the De-NOx Paint manufacturer for the maintenance requirements and the method for determining the reduction performance of the paint, please be reminded to provide the information once it is available. The information may form part of the updated AQMP Part 2 under EP Condition 2.18.	Noted
	Section 3.3: Use of Devices to Actively Filter Air Pollutant	
5.	According to the R-t-C Item 8, NAMI filters are provided at inlets to Primary Air Handling Units (PAUs) and designated Air Handling Units (AHUs). Accordingly, please revise Section 3.3 as follows: “...In addition, PAUs and AHUs serving the main stadium will be provided with NAMI PCO Nano Reactor...”	Section 3.3 is updated with the filter application strategy further clarified

Kai Tak Sports Park Ltd

Kai Tak Sports Park

Air Quality Management Plan
(Rev 6)

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 266006-70

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ARUP

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1 Introduction

1.1 Background

- 1.1.1** The Environmental Permit No. EP-544/2017 (the Environmental Permit) for the approved Environmental Impact Assessment (EIA) Report for Kai Tak Multi-purpose Sports Complex (AEIAR-204/2017) was granted on 8 September 2017. The Sports Complex is now known as Kai Tak Sports Park (KTSP). After the granting of the Environmental Permit, the Government decided to dispose the site for hotel and office through land sale by tender for development by a private developer. The Project under the Environmental Permit is therefore comprises the KTSP and the hotel and office development. The location of the Project is given in Figure 1 of the Environmental Permit.
- 1.1.2** Home Affairs Bureau, as the Permit Holder of Environmental Permit, has required the developer of the hotel and office development to submit an Air Quality Management Plan (AQMP) under land lease requirement to ensure the implementation of the air quality mitigation measures recommended in the EIA Report and the relevant air quality requirements would be complied with.
- 1.1.3** As stipulated in the Condition 2.16 of the Environmental Permit, the Permit Holder shall, no later than one month before the commencement of construction of the Project or otherwise approved by the Director of Environmental Protection (DEP), deposit with the DEP with three hard copies and one electronic copy of AQMP Part 1 and AQMP Part 2 to the DEP for approval. The AQMP Part 1 shall include details, implementation programme, maintenance and management schedules of the required air quality mitigation measures for the Project. The AQMP Part 2 shall include details on the application and implementation of the best practicable means (BPM) for enhancing air quality for the venue users of the KTSP.
- 1.1.4** In addition, as stipulated in Conditions 2.17 and 2.18 of the Environmental Permit, if there are any change(s) to the AQMP, the Permit Holder shall, no later than one month before implementation of

such change(s), deposit with the DEP three hard copies and one electronic copy of an update to the AQMP Part 1 and AQMP Part 2.

1.1.5 For the KTSP, the Design-Build-Operate Contract was awarded to the Kai Tak Sports Park Ltd. (KTSPL) and Hip Hing Engineering Company Ltd. (HHE), is nominated first tier subcontractor responsible for carrying out construction works for KTSP as well as associated environmental impact mitigation measures.

1.2 Purpose of the AQMP

1.2.1 This AQMP is prepared to comply with Conditions 2.16 to 2.18 of the Environmental Permit. The Part 1 of AQMP contains details, implementation programme, maintenance and management schedules of the required air quality mitigation measures for the KTSP. Whereas, the Part 2 of AQMP includes details on the application and implementation of the BPM for enhancing air quality for the venue users of KTSP. The AQMP for the hotel and office development is included in **Appendix A**.

2 Part 1 - Air Quality Mitigation Measures

2.1 Construction Phase

2.1.1 The following air quality mitigation measures and good site practices for construction phase have been considered in **Table 2.1** as follows.

Table 2.1: Construction phase air quality mitigation measures and good site practice

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
	<ul style="list-style-type: none"> Compile with relevant dust control measures stipulated in the APCO (Construction Dust) Regulation 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
	<ul style="list-style-type: none"> Implement Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation to minimize the emissions from non-road mobile machinery 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required
A1	<ul style="list-style-type: none"> Good housekeeping to minimize dust generation e.g by properly handling and storing dusty materials 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required
<i>Controls for Exposed Surface and Haul Roads</i>					
	<ul style="list-style-type: none"> Adopt good practices and ensure that all haul routes are paved, even if routes are temporary 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required
A18	<ul style="list-style-type: none"> All on-site unpaved roads should be compacted and kept free of loose materials as possible 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A17	<ul style="list-style-type: none"> Every main haul road should either be: <ol style="list-style-type: none"> 1.) paved with concrete and kept clear of dusty materials, or 2.) sprayed or watered to maintain the entire road surface wet 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required
A30	<ul style="list-style-type: none"> Regular watering once per hour on haul roads with an equivalent intensity of not less than 1.3L/m³ to achieve 91.7% dust removal efficiency shall be carried out and regular inspection and necessary repairing/re-surfacing is required to ensure the integrity of the haul roads 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required
	<ul style="list-style-type: none"> Earthworks shall be temporarily covered if possible 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A25	<ul style="list-style-type: none"> A hoarding of not less than 2.4 m high from ground level along the site boundary shall be provided as a wind barrier 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required
A26	<ul style="list-style-type: none"> Scaffolding shall be erected around the perimeter of a building under construction. Effective dust screens, sheeting or netting shall be provided to enclose the scaffolding from the ground floor level of the building. 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A27	<ul style="list-style-type: none"> Exposed earth should be properly treated by compaction, turfing, hydro-seeding, vegetation planting, or sealing with latex, vinyl, bitumen, shortcrete or other suitable surface stabilizer within six months after the last construction activity on the construction site or part of the construction site where the exposed earth lies 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required
A20	<ul style="list-style-type: none"> The vehicle washing and the road between washing area and site exit should be paved with concrete, bituminous or other hardcores 	HHE	Q2/2019 – Q1/2023	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
<i>Controls for Stockpiles ^[3]</i>					
A11	<ul style="list-style-type: none"> Any stockpile of dusty materials shall be entirely covered by impervious sheeting or sprayed with water to maintain the entire surface wet, and then removed, backfilled or reinstated where practicable within 24 hours of the excavation or unloading 	HHE	Q2/2019 – Q1/2021	HHE, KTSPL	As required
A5	<ul style="list-style-type: none"> Dusty materials (e.g. debris) should be wetted by misting / water-spraying before any loading, unloading, transfer or transport operation 	HHE	Q2/2019 – Q1/2021	HHE, KTSPL	As required
A10	<ul style="list-style-type: none"> The stockpile should not be extended beyond the pedestrian barriers, fencing or traffic cones 	HHE	Q2/2019 – Q1/2021	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
	<ul style="list-style-type: none"> Fences of similar height and size to the stockpile shall be erected to act as wind barriers 	HHE	Q2/2019 – Q1/2021	HHE, KTSPL	As required
A12	<ul style="list-style-type: none"> Dusty materials remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads 	HHE	Q2/2019 – Q1/2021	HHE, KTSPL	As required
<i>Control for Vehicles and Machines</i>					
A19	<ul style="list-style-type: none"> Effective vehicle cleaning and specific wheel-washing facilities including a high-pressure water jet shall be provided at every discernible or designated vehicle exit point 	HHE	Q2/2019 – Q2/2023	HHE, KTSPL	As required
	<ul style="list-style-type: none"> Vehicles carrying dusty materials shall be securely covered before leaving the site 	HHE	Q2/2019 – Q2/2023	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A15	<ul style="list-style-type: none"> Speed of trunks within the site should be limited to 10kph 	HHE	Q2/2019 – Q2/2023	HHE, KTSPL	As required
A16	<ul style="list-style-type: none"> Haulage and delivery vehicles shall be confined to designated roads Adopt best practicable means of reducing vehicle and machine emissions 	HHE	Q2/2019 – Q2/2023	HHE, KTSPL	As required
A23	<ul style="list-style-type: none"> All plant equipment should be provided with regular maintenance 	HHE	Q2/2019 – Q2/2023	HHE, KTSPL	As required
A24	<ul style="list-style-type: none"> Throttle down or switch off unused machines or machine in intermittent use 	HHE	Q2/2019 – Q2/2023	HHE, KTSPL	As required
A13	<ul style="list-style-type: none"> Properly fitted side and tail boards are necessary for any vehicle with open load area 	HHE	Q2/2019 – Q2/2023	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A21	<ul style="list-style-type: none"> The portion of any road leading only to construction site that is within 30m of a vehicle entrance or exit should be kept clear of dusty materials 	HHE	Q2/2019 – Q2/2023	HHE, KTSPL	As required
<i>Controls for Dusty Activities ^[4]</i>					
A9	<ul style="list-style-type: none"> Excavation area should be minimized as far as practicable 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required
	<ul style="list-style-type: none"> Regular water spraying once per hour shall be conducted on any area where demolition work, excavation or earthwork activities are carried out 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A8	<ul style="list-style-type: none"> Any area that involves demolition activities should be sprayed with water or a dust suppression chemical immediately after the activities to maintain the entire surface wet 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required
	<ul style="list-style-type: none"> All dusty activities should be damped down, especially during dry weather 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A14	<ul style="list-style-type: none"> While transporting materials that potentially create dust (e.g. debris), materials should not be loaded higher than side and tail boards, and should be fully covered by tarpaulin or similar materials which extent at least 300 mm over the edges of the side and tail boards to prevent leakage 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required
	<ul style="list-style-type: none"> Dropping heights shall be minimized to control the fall of materials 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required
A6	<ul style="list-style-type: none"> Any skip hoist for material transport should be fully enclosed by impervious sheeting 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A7	<ul style="list-style-type: none"> Surfaces where any pneumatic or power-driven drilling, cutting, polishing or other mechanical breaking operation takes place should be sprayed with water or a dust suppression chemical continuously; and 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required
A22	<ul style="list-style-type: none"> Dusty materials on every vehicles body and wheels should be removed in washing area before leaving the site 	HHE	Q2/2019 – Q2/2022	HHE, KTSPL	As required
<i>Cement Storage ^[5]</i>					
A2	<ul style="list-style-type: none"> Cement should be properly stored in shelters with 3 sides and the top covered by impervious materials if the stack exceeds 20 bags 	HHE	Q4/2020 – Q4/2022	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A4	<ul style="list-style-type: none"> Loading, unloading, transfer, handling or storage of bulk cement should be carried out in a totally enclosed system or facility, and any vent or exhaust should be fitted with an effective fabric filter or equivalent air pollution control system 	HHE	Q4/2020 – Q4/2022	HHE, KTSPL	As required
A3	<ul style="list-style-type: none"> Cement delivered in bulk should be stored in a close silo fitted with an audible high level alarm which is interlocked with the material filling line and no overfilling is allowed 	HHE	Q3/2019 – Q4/2020	HHE, KTSPL	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
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Environmental Monitoring and Audit

A28	<ul style="list-style-type: none"> Environmental monitoring and auditing including air quality monitoring throughout the construction period shall be carried out in accordance with EP and the EM&A manual. 	Environmental Team	Q2/2019 – Q2/2023	Independent Environmental Checker	As required
A29	<ul style="list-style-type: none"> Regular site inspection (e.g. weekly site inspection) will be carried out to audit the implementation of the mitigation measures. 	Environmental Team/ Independent Environmental Checker	Q2/2019 – Q2/2023	Environmental Team/ Independent Environmental Checker	As required

^[1] Construction works will be carried out between 2019 and 2023. Afterward testing and commissioning (T&C) will be in Q2/2023-Q4/2023.

^[2] Exact maintenance and management schedule will be confirmed in the implementation stage. Once the schedule is confirmed, it would be submitted to the DEP for review and incorporated in this AQMP for approval.

^[3] Outdoor stockpile work for construction and demolition activities such as excavation, utility works, etc. would be completed in Q1/2021.

^[4] Dusty construction activities of superstructure, haul road, etc would be completed in Q2/2022.

^[5] Cement Storage for foundation and superstructures would be completed in Q4/2020 and Q4/2022 respectively.

2.2 Operational Phase

2.2.1 The following air quality mitigation measures and good site practices for operational phase have been considered: in **Table 2.2** as follows.

Table 2.2: Operational phase air quality mitigation measures and good site practice.

EM&A Log no.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A31	<ul style="list-style-type: none"> Locate air intake point of hotel outside the exceedance zone of air pollutant NO₂ (at least 5m above ground). 	Hotel Designer	Design (Q4/ 2019 – Q3/2023)	Hotel Operator	As required
A32	<ul style="list-style-type: none"> Adopt the lower limits of parking provisions for retail area, office and hotel in the HKPSG as far as practicable to discourage use of cars. The car parking for coaches, goods vehicles and working /services / emergency vehicles should be less than 300. ^[3] 	HAB	Planning and Design Stage	N/A	N/A

EM&A Log no.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
<i>Promotion of Electric Vehicles</i>					
A33	<ul style="list-style-type: none"> Provision of electrical vehicle (EV) charging facilities in at least one-third of the car parking spaces for private cars. Provision of EV charging enabling facilities in all car parking spaces provided for private cars ^[4] 	HHE	Design (Q2/2019 – Q1/2023)	Operator	As required
A34	<ul style="list-style-type: none"> The entry of heavy goods vehicles should avoid peak hours, weekdays from 7 am to 10 am and from 4 pm to 7 pm, except for major events (i.e. more than 20,000 persons). 	Operator	Operation	Operator	As required
A35	<ul style="list-style-type: none"> Give priority to EV to use the car parking spaces as far as practicable ^[5] 	Operator	Operation	Operator	As required

EM&A Log no.	Mitigation Measures	Implementation Agent	Implementation Programme ^[1]	Maintenance and Management Parties	Maintenance and Management Schedule ^[2]
A36	<ul style="list-style-type: none"> Electric vehicles (EV) should be used under normal operation for vehicles such as electric saloon cars/coaches, if the operator provides transport services for the staff and/or guest 	Operator	Operation	Operator	As required

[1] Design works will be carried out between 2019 and 2023. Afterward T&C will be in Q2/2023-Q4/2023.

[2] Exact maintenance and management schedule will be confirmed in the implementation stage. Once the schedule is confirmed, it would be submitted to the DEP for review and incorporated in this AQMP for approval.

[3] For the KTSP as specified under the KTSP Contract and in the hotel and office development as required under the land lease, the total number of car parking spaces for coaches, goods vehicles & working/services/emergency vehicles, and the total number of car parking spaces are 280 and 999 respectively, which are less than 300 and 1000 for the corresponding car parking spaces stated in section 3.8.45 of the EIA Report.

[4] Refer to **Appendix B** for the “Specification for EV Charging Facilities and Payment System” under KTSP Contract (Contract No. HAB/KTSP/01) LED display will be provided at the main entrance and upload the car parking data on the internet system in real-time and free for public access. All car parking information and EV charging facilities information shall also be shared with the smart parking mobile app and the my Kowloon East apps, which is being developed by the Energizing Kowloon East Office, Development Bureau, the HKSAR Government

[5] The following procedures will be adopted to give priority to EV.

- To provide the carpark guidelines and direction sign to control the EV parking to give priority to EV to use the car parking spaces.
- Divide electric vehicles and general vehicles with different color boundaries
- Post a notice to the drivers that the general vehicles do not allow to enter the EV parking space without permission, otherwise the management office has the right to make a fixed penalty fine.
- The operator will develop a booking system called Smart Stadium Platform for the parking spaces for private cars. EV owners can have the privilege to book car parking spaces earlier than other non-EV owners. The car parking information sharing system will be provided and free for public access for obtaining real-time parking availability data of car parks and information of EV charging facilities.
- Hotel operator planned to provide two electric chargers for 2 electric vehicles and other types of electric vehicles are not required.

3 Part 2 - Best Practicable Means for Enhancing Air Quality

According to the Conditions of Approval under Section 8(3) of the EIAO for the Kai Tak Multi-purpose Sports Complex, the application and implementation of the best practicable means have been explored. These include:

- large scale planting;
- use of de-NO_x paints; and
- devices to actively filter air pollutants.

3.1 Large Scale Planting

Large scale planting has been proposed in the KTSP to enhance the air quality. Greening and planting will be offered at roadsides, roofs, walkways, ramps and decks within the site wherever applicable. Vertical greening will also be considered at the external facades to further raise the coverage of greenery. In conjunction with the landscaping and greening works to enhance the visual amenity, the Landscape Design Team of the KTSP will determine the most suitable locations for planting during the detailed design stage. The planting locations will be detailed in Landscape and Visual Mitigation Plan.

3.2 Use of De-NO_x Paints

Research on studies of De-NO_x paint was conducted. There were two local papers^[1,2] prepared by the Chinese University of Hong Kong for the Environmental Protection Department that provide a good reference for benchmarking. According to the papers, effective locations for application of De-NO_x paint are located in the immediate vicinity of roadside.

Review of the site provisions have been conducted and two potential locations were identified. The first location is at the site boundary of KTSP and the emerging section of the CKR tunnel. At this location, there is a boundary steel fence separating the two sites. **Figure 3.1a & 3.1b** illustrates the location. While the side wall interfacing with CKR is mainly allocated for exhaust louvre of KTSP service zone, there is around 400m² of the wall surface where De-NO_x paint can be applied. The second location is along Shing Kai Road where the North and South Precincts of the KTSP site is divided. Along the road sections dividing up the North and South sites of KTSP, the building facades are primarily glazing and therefore not appropriate for application of De-NO_x paint. While there is a concrete soffit for the

^[1] Ambient Air Treatment by Titanium Dioxide (TiO₂) Based Photocatalyst in Hong Kong (Tender Ref. AS 00-467) Technical Report, Department of Chemistry, The Chinese University of Hong Kong, Feb 2002

^[2] Deactivation and Regeneration of Environmentally Exposed Titanium Dioxide (TiO₂) Based Products Testing Report, Department of Chemistry, The Chinese University of Hong Kong, Jun 2003

main plaza deck, it is not an area exposed to direct sunlight and considered not to be an effective area for the De-NO_x chemical action which operates under the sunlight. **Figure 3.2a, Figure 3.2b and 3.3** illustrate the location and give the location layout respectively.

Figure 3.1a: Image of site location adjoining CKR tunnel

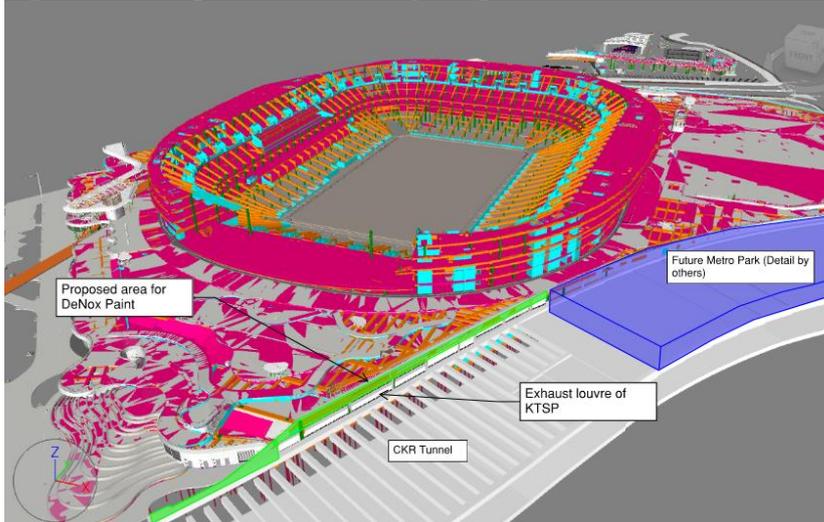


Figure 3.1b: Close up view showing interfacing wall layout (Exhaust Louvre not shown for simplicity)

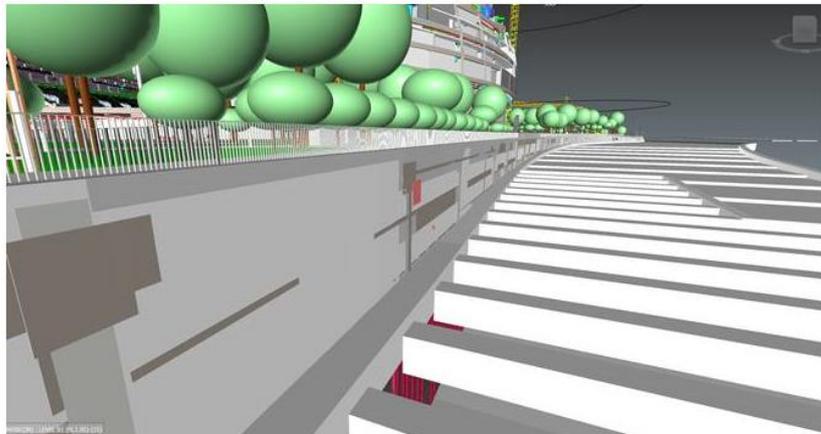


Figure 3.2a: Image of site location near the podium deck connection along Shing Kai Road



Figure 3.2b: Image of site location directly under the podium deck connection along Shing Kai Road

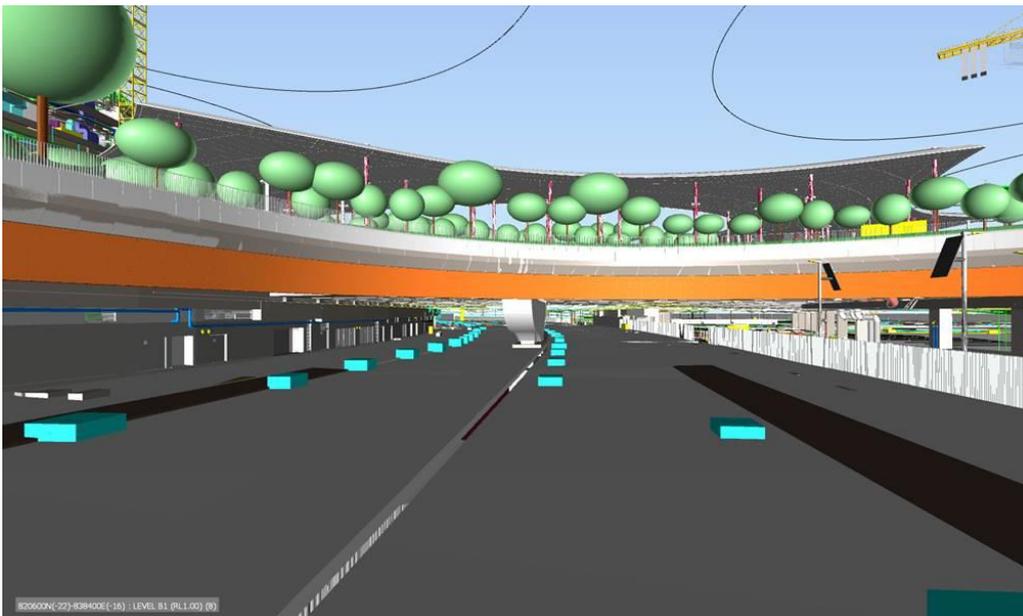
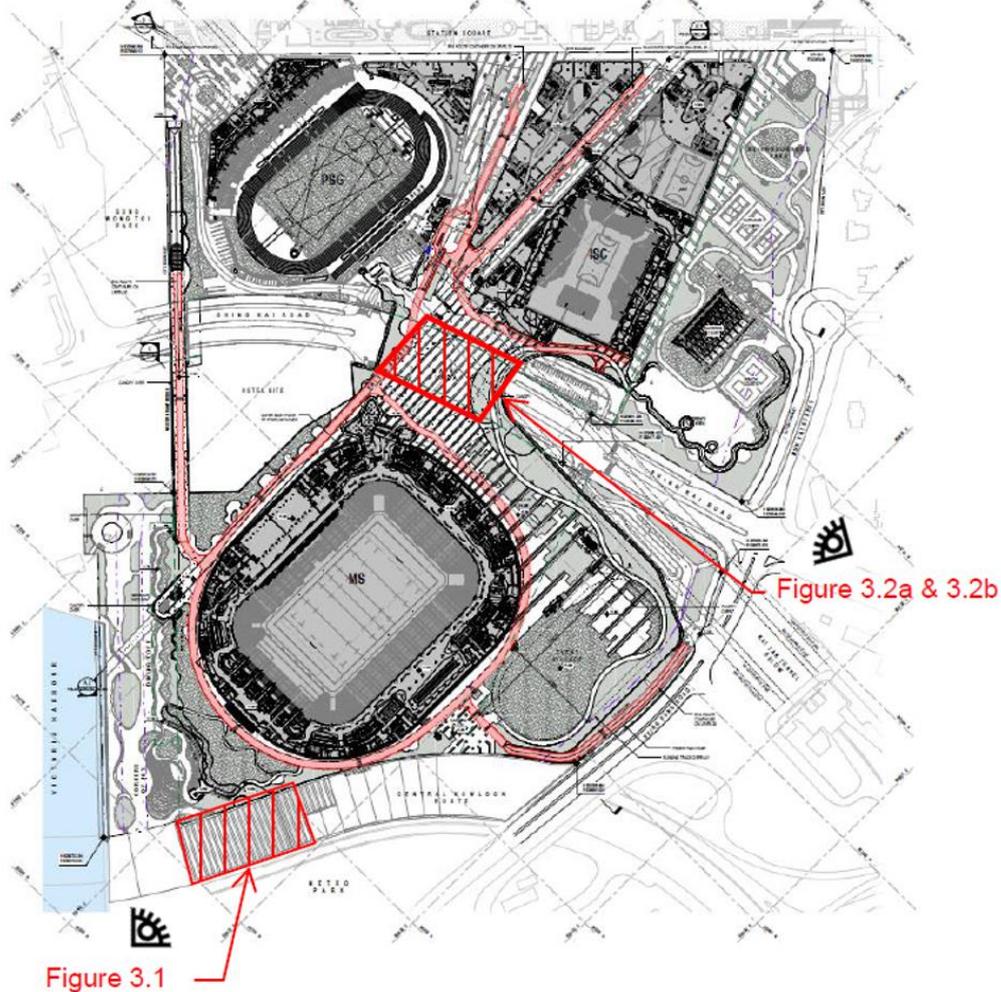


Figure 3.3: KTSP Site plan showing podium deck structure above Shing Kai Road



In sourcing for the De-NO_x paint products, the ER specification attached in **Appendix C** is referred. The implementation details of de-NO_x paint are summarized in **Table 3.1** and it is intended the method to determine the efficiency of the product will be liaised with the selected de-NO_x paint manufacturer to be appointed and implemented in the operational stage. Tentative programme for de-NO_x paint application and performance test monitoring is in 3rd Quarter of 2022.

Table 3.1: Implementation details of de-NO_x paint

Paint	Sol-silicate photocatalytic exterior paint Photocatalytic interior mineral paint
Location	On the external side wall facing CKR
Dimension	All external face area facing CKR outside the Metro park extent
Paint Specification	Refer to Appendix C
Air Pollutants of Concern	NO ₂
Maintenance and Management Schedule	According to manufacturer's maintenance requirements
Target Beneficiaries	Athletes and patrons

Expected Benefits	To be determined by laboratory and on site, if appropriate
NOx Reduction Performance	Primarily through laboratory testing. On site testing may be considered according to manufacturer's recommendations. In general, it is envisaged that air samples at L2 near CKR interface will be taken to check if any observed removal efficiency can be established.

3.3 Use of Devices to Actively Filter Air Pollutants

According to the EIA, pollution sources giving rise to the localised air quality concerns are related to the vehicular traffic. Various means have been incorporated in the MVAC design for filtering air pollutants from outdoor to indoor venues of the Main Stadium, Indoor Sports Centre and Public Sports Ground. These include PAU (Primary Air Handling Units) and AHU (Air Handling Units) for extraction of outdoor fresh air and circulation of indoor air mixed with outdoor fresh air into the indoor venues. PAUs and AHUs are equipped with MERV 13 bag filters.

In addition, AHUs serving Main Arena, Ancillary Sports Hall and Multi-purpose rooms at Indoor Sports Centre, Multi-purpose rooms at Public Sports Ground, and Main Stadium will be provided with NAMI PCO Nano Reactor. PAUs with FA intake at annually NO₂ exceeding zone, serving Main Stadium and Dining cove, will be provided with NAMI PCO Nano Reactor. Stand-alone air purifying unit (with built-in NAMI PCO Nano reactor) will be provided in lavatories located at Dining Cove. NAMI PCO Nano Reactor has a rated NO₂ reduction performance of 90%. **Appendix D** provides the PowerPoint summary information of the product.

These filtering devices as part of the MVAC system design will further enhance the air quality for the venue users, in particular athletes, in response to the comments made by the Advisory Council on the Environment during the application for approval of EIA report for Kai Tak Multipurpose Sports Complex.

3.4 Operation Phase

Recurrent management and maintenance to the above devices are important to keep these devices in proper functioning. Inspection as per recommendation by the De-NOx plant, or the design life for the filters/NAMI PCO Nano reactors to be carried out and replace if necessary.

4 Conclusion

According to Condition 2.16 of the Environmental Permit, this AQMP comprises two parts, viz. Part 1 on details, implementation programme, maintenance and management schedules of the required air quality mitigation measures for the KTSP and Part 2 on details of the application and implementation of the BPM for

enhancing air quality for the venue users of KTSP. In addition, the AQMP for the hotel and office development is included in **Appendix A**.

Appendix A

Air Quality **Management Plan for** **Hotel and Office** **Development**

**Proposed Hotel and Permitted
Office and Commercial
Development at New Kowloon
Inland Lot No. 6607, Shing Kai
Road, Kai Tak, Kowloon**

Air Quality Management Plan

REP-001-03

Oct 2020

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271916-00

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ARUP

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Figure A

Figure B

1 Introduction

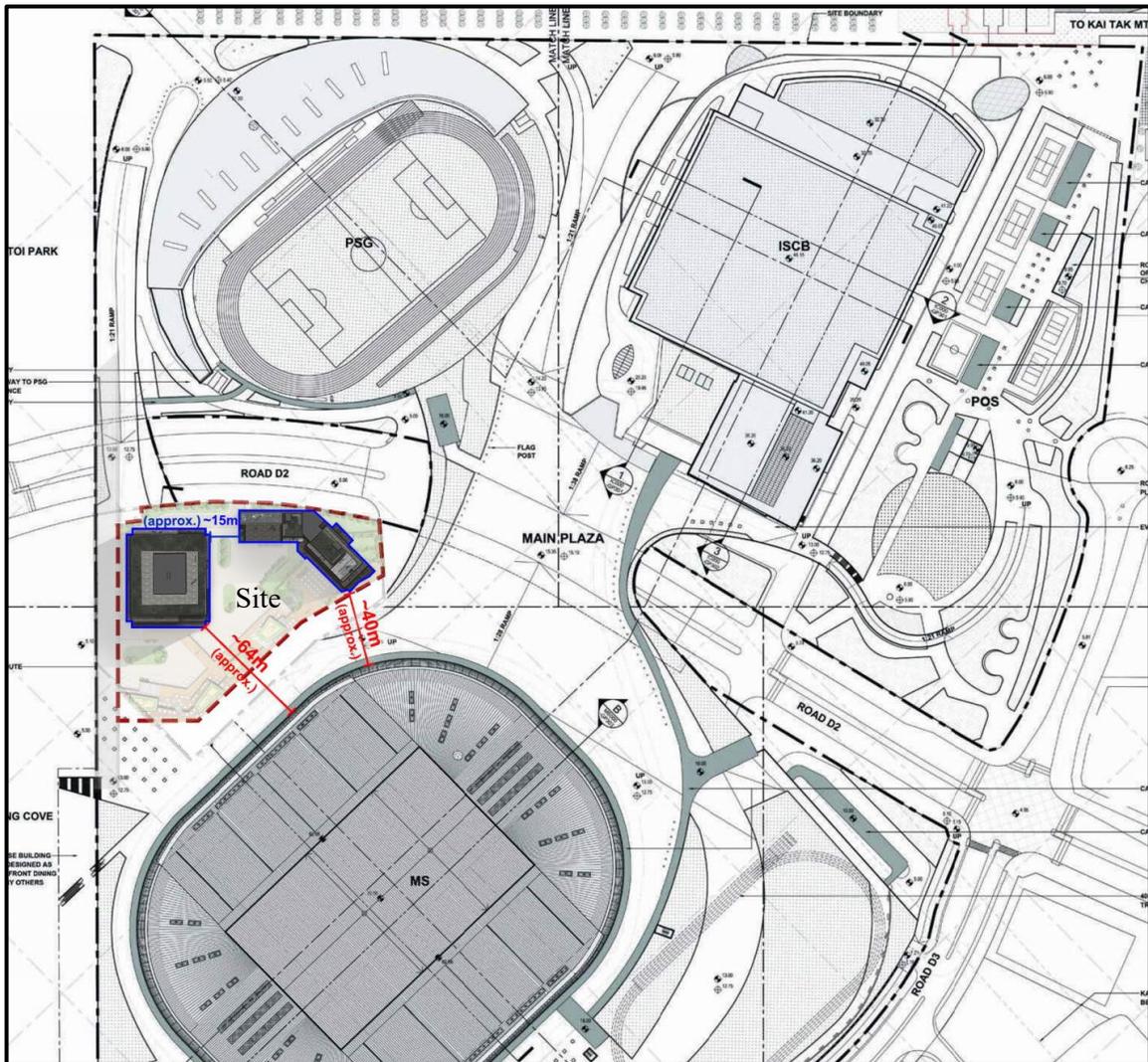
1.1 Background

- 1.1.1.1** The Proposed Development is located in the former North Apron Area of Kai Tak and zoned “Other Specified Uses” annotated “Stadium” (“OU(Stadium)”) on the Approved Kai Tak Outline Zoning Plan No. S/K22/6 (the OZP). An approved S16 application (No. A/K22/17) covering the “OU(Stadium)” zone (including the Application Site which is for hotel, office and commercial developments) for minor relaxation of building height restriction for the proposed Main Stadium of the Kai Tak Sports Park (KTSP), proposed hotel and eating place and permitted office and commercial uses in KTSP was approved by the Board in March 2017.
- 1.1.1.2** Subsequently, the Application Site, approved for hotel, office and commercial developments as part of the KTSP, was put on tender for sale in June 2019 and the Applicant (Sanon Limited) was awarded the tender on the Application Site.
- 1.1.1.3** According to the lease conditions for New Kowloon Inland Lot No. 6607, Air Quality Management Plan (AQMP) shall be prepared and submitted to Home and Affair Bureau (HAB) for approval.
- 1.1.1.4** Arup was commissioned to conduct an AQMP to support the development.

1.2 Purpose of the AQMP

- 1.2.1.1** The purpose of the AQMP is prepared to comply with Condition (36) of the lease condition. The AQMP contains details, implementation programme, maintenance and management schedules of air quality mitigation measures in accordance with the approved Environmental Impact Assessment (EIA) Report No. AEIAR-204/2017 for Kai Tak Multi-purpose Sports Complex (now known as Kai Tak Sports Park) and the Environmental Permit (EP) No. EP-544/2017 for Kai Tak Sports Park.

Figure 2.1b Location of the Application Site inside KTSP.



2.2 Proposed Development

2.2.1.1 The Proposed Development consists of two building blocks: the hotel block and office block. The planning parameters are summarized in the **Table 2.2**. **Figure 2.2a** and **Figure 2.2b** show the tentative Master Layout Plan (MLP) and the 3D view of the Proposed Development respectively. The indicative detailed plans of the Proposed Development are shown in the **Figure A**.

Table 2.2 Indicative planning parameters of the Proposed Development

Planning Parameters	Proposed Development
Total Gross Floor Area <ul style="list-style-type: none"> • Hotel • Office and/or Commercial 	About 32,000 m ² About 15,415 m ² About 16,585 m ²
Maximum Site Coverage <ul style="list-style-type: none"> • Below 15m above ground level • Above 15m above ground level 	Not more than 65% <ul style="list-style-type: none"> • 65% • 37%
No. of Storeys ⁽¹⁾ <ul style="list-style-type: none"> • Hotel • Office 	Not more than 14 storeys <ul style="list-style-type: none"> • 14 storeys • 11 storeys
Maximum Building Height ⁽²⁾ <ul style="list-style-type: none"> • Hotel • Office 	Not more than 60.15mPD <ul style="list-style-type: none"> • 60.15mPD • 57mPD
No. of Rooms (for hotel)	Not more than 440

Remarks:

- (1) Excludes 1 storey of basement car park
- (2) Up to the main roof structure level
- (3) The above planning parameters are subjective to the final approval by the Town Planning Board.

Figure 2.2a Master Layout Plan (MLP) of the Proposed Development

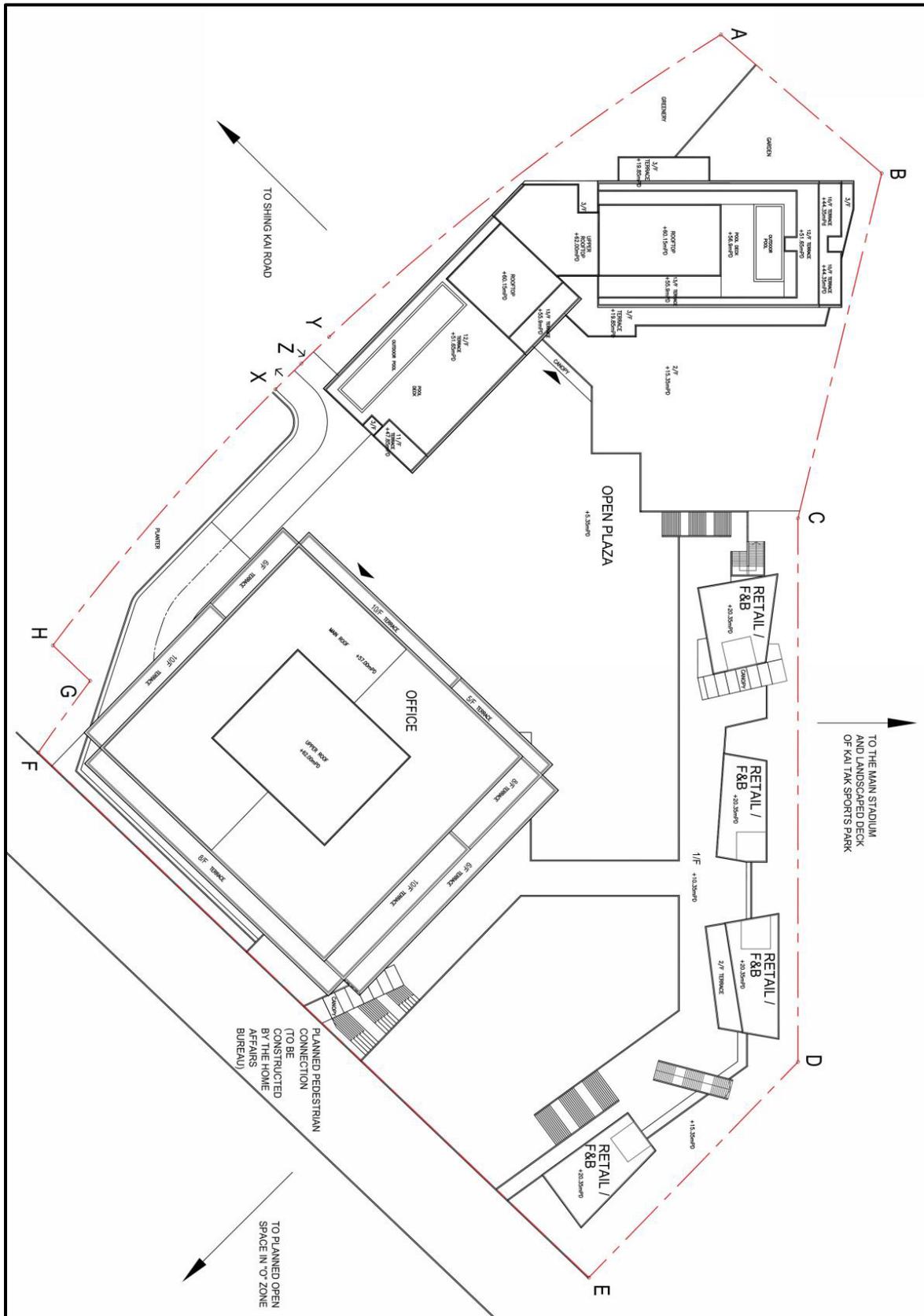


Figure 2.2b 3D View of the Proposed Development.



3 Air Quality Mitigation Measures

3.1 Construction Phase

3.1.1.1 The following air quality mitigation measures and good site practices for construction phase would be considered:

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
	<ul style="list-style-type: none"> Compile with relevant dust control measures stipulated in the APCO (Construction Dust) Regulation 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
	<ul style="list-style-type: none"> Implement Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation to minimize the emissions from non-road mobile machinery 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A1	<ul style="list-style-type: none"> Good housekeeping to minimize dust generation e.g. by properly handling and storing dusty materials 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
<i>Controls for Exposed Surface and Haul Roads</i>					
	<ul style="list-style-type: none"> Adopt good practices and ensure that all haul routes are paved, even if routes are temporary 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A18	<ul style="list-style-type: none"> All on-site unpaved roads should be compacted and kept free of loose materials as possible 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
A17	<ul style="list-style-type: none"> Every main haul road should either be: <ol style="list-style-type: none"> 1.) paved with concrete and kept clear of dusty materials, or 2.) sprayed or watered to maintain the entire road surface wet 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A30	<ul style="list-style-type: none"> Regular watering once per hour on haul roads with an equivalent intensity of not less than 1.3L/m³ to achieve 91.7% dust removal efficiency shall be carried out and regular inspection and necessary repairing/re-surfacing is required to ensure the integrity of the haul roads Earthworks shall be temporarily covered if possible 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A25	<ul style="list-style-type: none"> A hoarding of not less than 2.4 m high from ground level along the site boundary, except for a site entrance or exit. shall be provided as a wind barrier 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A26	<ul style="list-style-type: none"> Scaffolding shall be erected around the perimeter of a building under construction. Effective dust screens, sheeting or netting shall be provided to enclose the scaffolding from the ground floor level of the building 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
A27	<ul style="list-style-type: none"> Exposed earth should be properly treated by compaction or sealing with latex, vinyl, bitumen, shortcrete or other suitable surface stabiliser within six months after the last construction activity on the construction site or part of the construction site where the exposed earth lies 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A20	<ul style="list-style-type: none"> The vehicle washing and the road between washing area and site exit should be paved with concrete, bituminous or other hardcores 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
<i>Controls for Stockpiles</i>					
A11	<ul style="list-style-type: none"> Any stockpile of dusty materials shall be entirely covered by impervious sheeting or sprayed with water to maintain the entire surface wet, and then removed, backfilled or reinstated where practicable within 24 hours of the excavation or unloading 	Contractor	Foundation (Q2/2020-Q4/2021)	Contractor	As required
A5	<ul style="list-style-type: none"> Dusty materials (e.g. debris) should be wetted by misting / water-spraying before any loading, unloading, transfer or transport operation 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
A10	<ul style="list-style-type: none"> The stockpile should not be extended beyond the pedestrian barriers, fencing or traffic cones 	Contractor	Foundation (Q2/2020-Q4/2021)	Contractor	As required
	<ul style="list-style-type: none"> Fences of similar height and size to the stockpile shall be erected to act as wind barriers 	Contractor	Foundation (Q2/2020-Q4/2021)	Contractor	As required
A12	<ul style="list-style-type: none"> Dusty materials remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads 	Contractor	Foundation (Q2/2020-Q4/2021)	Contractor	As required
<i>Control for Vehicles and Machines</i>					
A19	<ul style="list-style-type: none"> Effective vehicle cleaning and specific wheel-washing facilities including a high-pressure water jet shall be provided at every discernible or designated vehicle exit point 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
	<ul style="list-style-type: none"> Vehicles carrying dusty materials shall be securely covered before leaving the site 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A15	<ul style="list-style-type: none"> Speed of trunks within the site should be limited to 10kph 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A16	<ul style="list-style-type: none"> Haulage and delivery vehicles shall be confined to designated roads 	Contractor	Foundation to OP	Contractor	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
			(Q2/2020-Q3/2023)		
	<ul style="list-style-type: none"> Adopt best practicable means of reducing vehicle and machine emissions 	Contractor	Foundation to OP	Contractor	As required
			(Q2/2020-Q3/2023)		
A23	<ul style="list-style-type: none"> All plant equipment should be provided with regular maintenance 	Contractor	Foundation to OP	Contractor	As required
			(Q2/2020-Q3/2023)		
A24	<ul style="list-style-type: none"> Throttle down or switch off unused machines or machine in intermittent use 	Contractor	Foundation to OP	Contractor	As required
			(Q2/2020-Q3/2023)		
A13	<ul style="list-style-type: none"> Properly fitted side and tail boards are necessary for any vehicle with open load area 	Contractor	Foundation to OP	Contractor	As required
			(Q2/2020-Q3/2023)		
A21	<ul style="list-style-type: none"> The portion of any road leading only to construction site that is within 30m of a vehicle entrance or exit should be kept clear of dusty materials 	Contractor	Foundation to OP	Contractor	As required
			(Q2/2020-Q3/2023)		
<i>Controls for Dusty Activities</i>					
A9	<ul style="list-style-type: none"> Excavation area should be minimized as far as practicable 	Contractor	Foundation	Contractor	As required
			(Q2/2020-Q4/2021)		

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
	<ul style="list-style-type: none"> Regular water spraying once per hour shall be conducted on any area where excavation or earthwork activities are carried out 	Contractor	Foundation (Q2/2020-Q4/2021)	Contractor	As required
A8	<ul style="list-style-type: none"> Any area that involves demolition activities should be sprayed with water or a dust suppression chemical immediately after the activities to maintain the entire surface wet 	Contractor	Foundation (Q2/2020-Q4/2021)	Contractor	As required
	<ul style="list-style-type: none"> All dusty activities should be damped down, especially during dry weather 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A14	<ul style="list-style-type: none"> While transporting materials that potentially create dust (e.g. debris), materials should not be loaded higher than side and tail boards, and should be fully covered by tarpaulin or similar materials which extent at least 300 mm over the edges of the side and tail boards to prevent leakage 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
	<ul style="list-style-type: none"> Dropping heights shall be minimized to control the fall of materials 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
A6	<ul style="list-style-type: none"> Any skip hoist for material transport should be fully enclosed by impervious sheeting 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A7	<ul style="list-style-type: none"> Surfaces where any pneumatic or power-driven drilling, cutting, polishing or other mechanical breaking operation takes place should be sprayed with water or a dust suppression chemical continuously; and 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A22	<ul style="list-style-type: none"> Dusty materials on every vehicles body and wheels should be removed in washing area before leaving the site 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required

Cement Storage

A2	<ul style="list-style-type: none"> Cement should be properly stored in shelters with 3 sides and the top covered by impervious materials if the stack exceeds 20 bags 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
A4	<ul style="list-style-type: none"> Loading, unloading, transfer, handling or storage of bulk cement should be carried out in a totally enclosed system or facility, and any vent or exhaust should be fitted with an effective fabric filter or equivalent air pollution control system 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required

EM&A Log No.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
A3	<ul style="list-style-type: none"> Cement delivered in bulk should be stored in a close silo fitted with an audible high level alarm which is interlocked with the material filling line and no overfilling is allowed 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required
<i>Environmental Monitoring and Audit</i>					
A29	<ul style="list-style-type: none"> Regular site inspection (e.g. weekly site inspection) will be carried out to audit the implementation of the mitigation measures 	Contractor	Foundation to OP (Q2/2020-Q3/2023)	Contractor	As required

Note:

[1] Mitigation Measures EM&A Log 28 in EIA report on “Carry out air quality monitoring throughout the construction period” is not relevant as air quality monitoring will be conducted in the main KTSP project.

3.2 Operational Phase

3.2.1.1 The following air quality mitigation measures and good site practices for operational phase have been considered:

EM&A Log no.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
A31	<ul style="list-style-type: none"> Locate air intake point of hotel outside the exceedance zone of air pollutant NO₂ (at least 5m above ground). Please refer to Figure B. 	Designer	Design (Q4/ 2019 – Q3/2023)	Operator	As required

Promotion of Electric Vehicles

A32	<ul style="list-style-type: none"> Adopt the lower limits of parking provisions for retail area, office and hotel in the HKPSG as far as practicable to discourage use of cars. The car parking for coaches, goods vehicles and working/services/emergency vehicles should be less than 300 (for whole KTSP)¹. 	Operator	start from 6 months after OP (Q1/ 2024)	Operator	As required
A33	<ul style="list-style-type: none"> Provision of electrical vehicle (EV) charging facilities in at least one-third of the car parking spaces for private cars. Provision of EV charging enabling facilities in all car parking spaces provided for private cars² 	Operator	start from 6 months after OP (Q1/ 2024)	Operator	As required

¹ The carpark number for Proposed Hotel and Permitted Office and Commercial Development at New Kowloon Inland Lot No. 6607 is:

Hotel Portion		Office Portion	
Private Cars	13 Nos	Private Cars	105 Nos
Loading / Unloading (Light Good)	2 Nos	Loading / Unloading (Light Good)	8 Nos
Loading / Unloading (Heavy Good)	1 No	Loading / Unloading (Heavy Good)	7 Nos
Taxi Lay-By	3 Nos.	Taxi Lay-By	1 No.
Coaches Lay-By	2 Nos.		

² According to Conditions of Approval Annex 1 (4), adequate power supply and space shall be provided for the establishment of electric vehicle charging facilities should be allowed to facilitate the use of electric vehicles. The EC charging facilities will comply with the EMSD requirement in “Technical Guidelines on Charging Facilities for Electric Vehicles, EMSD, 2015” and “Technical Guidelines for Electric Vehicle (EV) Charging-

EM&A Log no.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
	<ul style="list-style-type: none"> The car parking information sharing system shall be provided and free for public access for obtaining real-time parking availability data of car parks and information of EV charging facilities.³ 	Operator	start from 6 months after OP (Q1/ 2024)	Operator	As required
A34	The entry of heavy goods vehicles should avoid peak hours, weekdays from 7 am to 10 am and from 4 pm to 7 pm, except for major events (i.e. more than 20,000 persons).	Operator	start from 6 months after OP (Q1/ 2024)	Operator	As required
A35	<ul style="list-style-type: none"> Give priority to EV to use the car parking spaces as far as practicable⁴ 	Operator	start from 6 months after OP	Operator	As required

enabling for Car Parks of New Building Developments, EMSD, 2011”. In the development, one electric vehicle (EV) medium charger shall be provided and installed in at least one third of the car parking spaces. The mode of charging shall be “mode 3”. The standard requirement for EV medium charger are shown as below:

- The proposed power rating of the on-board charger of an EV medium charger shall be 7kW (32A, 1-phase, 220V).
The dedicated EV supply equipment (EVSE) and a charging cable assembly shall be employed. The control pilot cable of the charging cable assembly allows communication between the EVSE and the on-board charger of an EV to perform functions including verification of connection with the EV, continuous checking of protective earth conductor integrity, energization and de-energization of the supply, and selection of charging rate.
- Dedicated charging plug, socket and coupler are required for EV medium charging.
- Selection of EVSE shall depend on the charging protocol of the EV.
- The type of socket outlet or vehicle connector required shall be dedicated socket outlets conforming to IEC 62196, type 2 vehicle connector.

³ To provide the LED display at the main entrance and upload the car parking data on the internet system in real-time to free for public access.

⁴ There will be one third of the parking spaces equipped with medium chargers. The hotel operator and the property manager will grant priority to the Electric Vehicles (EV) drivers in the parking queue to use these parking spaces. The following control measures will be undertaken:

- To provide the carpark guidelines and direction sign to control the EV parking to give priority to EV to use the car parking spaces.
- Divide electric vehicles and general vehicles with different color boundaries
- Post a notice to the drivers that the general vehicles does not allow to enter the EV parking space without permission, otherwise the management office has the right to make a fixed penalty fine.

EM&A Log no.	Mitigation Measures	Implementation Agent	Implementation Programme	Maintenance and Management Parties	Maintenance and Management Schedule
A36	<ul style="list-style-type: none"> Electric vehicles (EV) should be used under normal operation for vehicles such as electric saloon cars/coaches, if the operator provides transport services for the staff and/or guest ⁵ 	Operator	(Q1/ 2024) start from 6 months after OP (Q1/ 2024)	Operator	As required

⁵ The hotel operator will use electric vehicles if limo service is operated by the hotel for transportation of staff and guests of the hotel. Besides, Hotel operator planned to provide two electric chargers for 2 electric vehicles and other types of electric vehicles are not required.

4 Conclusion

- 4.1.1.1** This Air Quality Management Plan summarizes the details, implementation programme, maintenance and management schedules of the required air quality mitigation measures for the Project for the construction and operational phases.

Figure A

Figure A.1 Indicative Block Plan

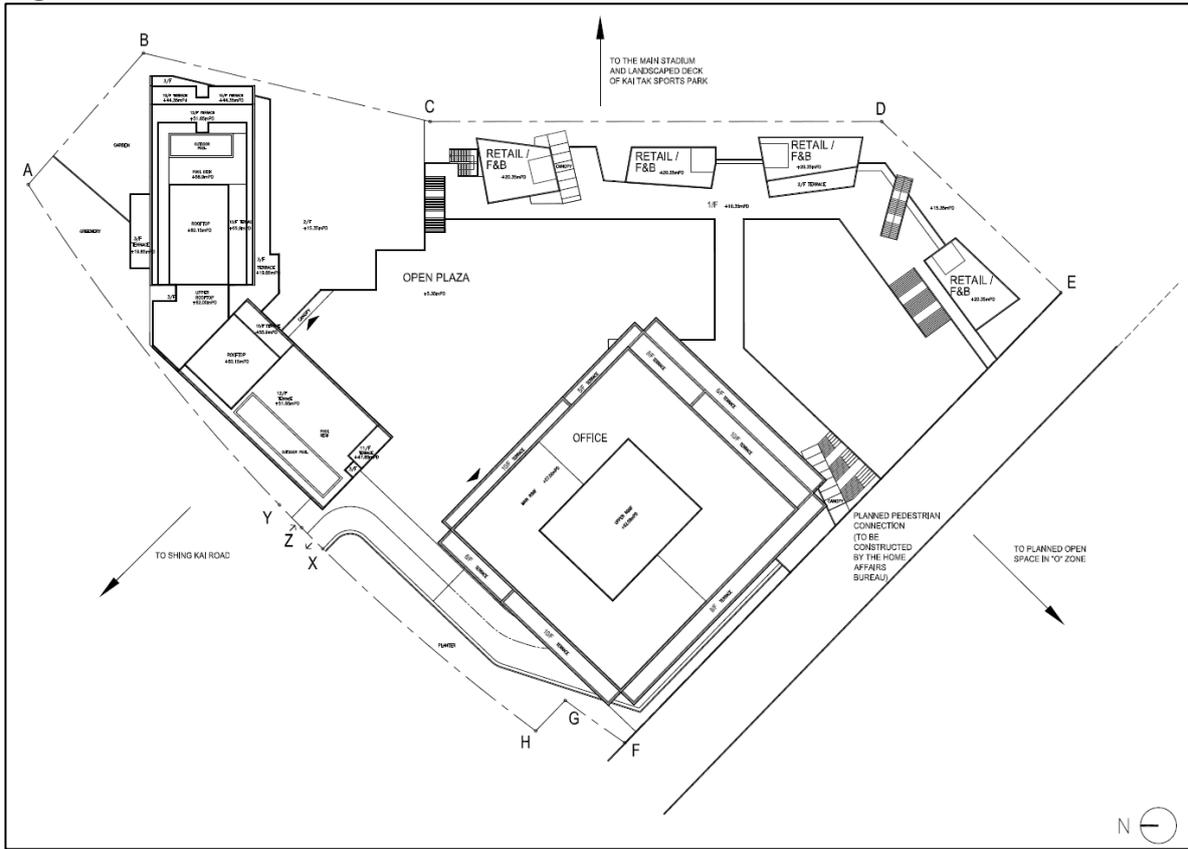


Figure A.2 Indicative Basement Plan

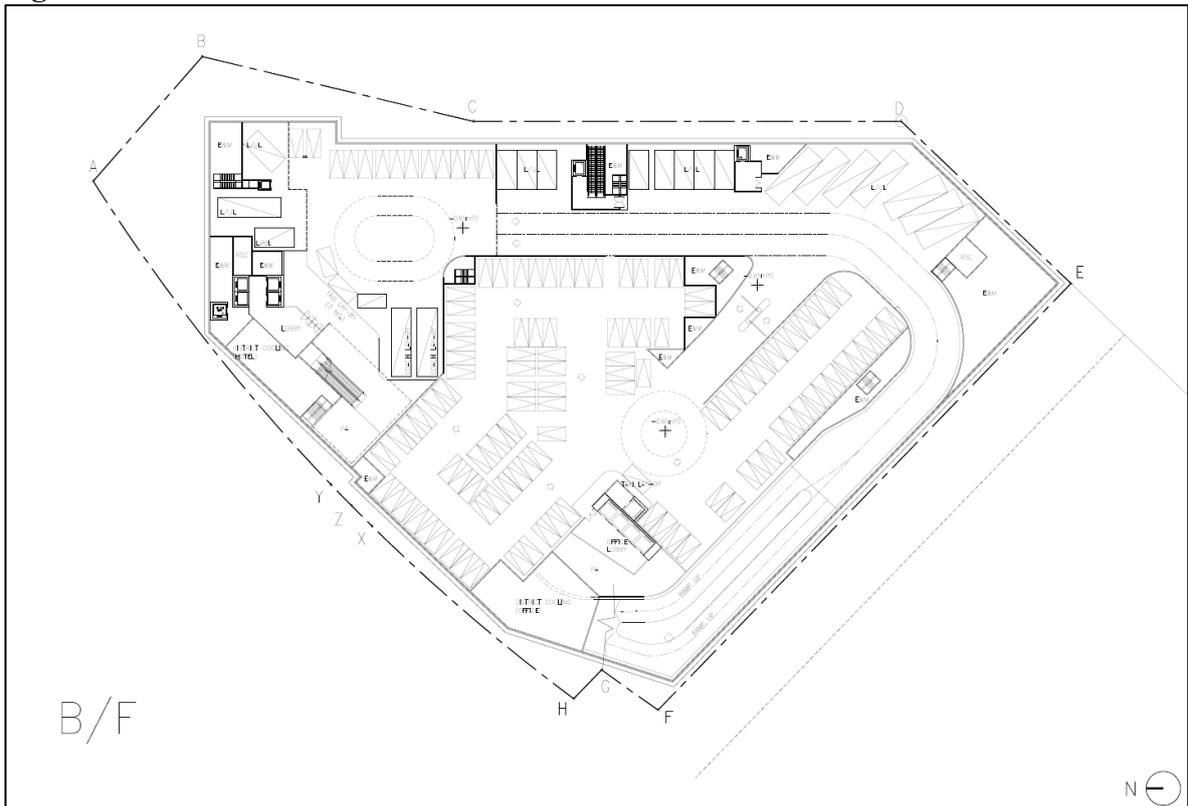


Figure A.3 Indicative G/F Plan

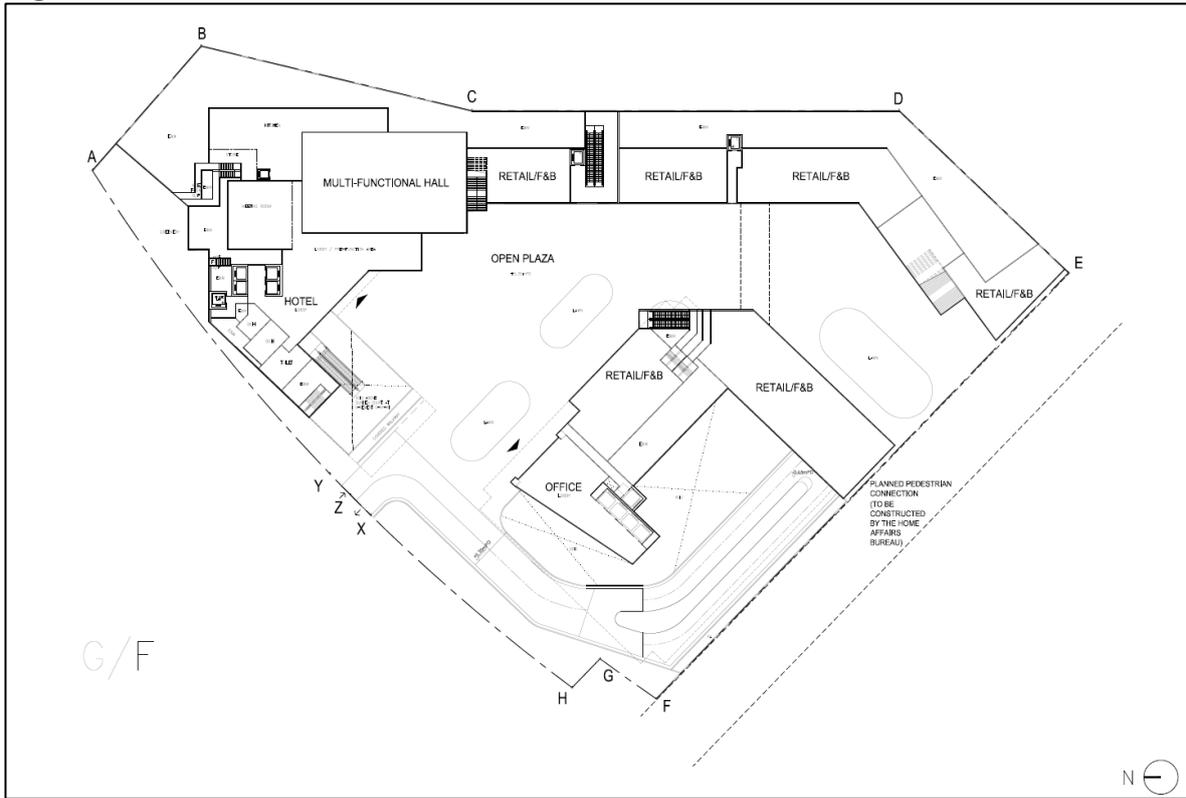


Figure A.4 Indicative 1/F Plan

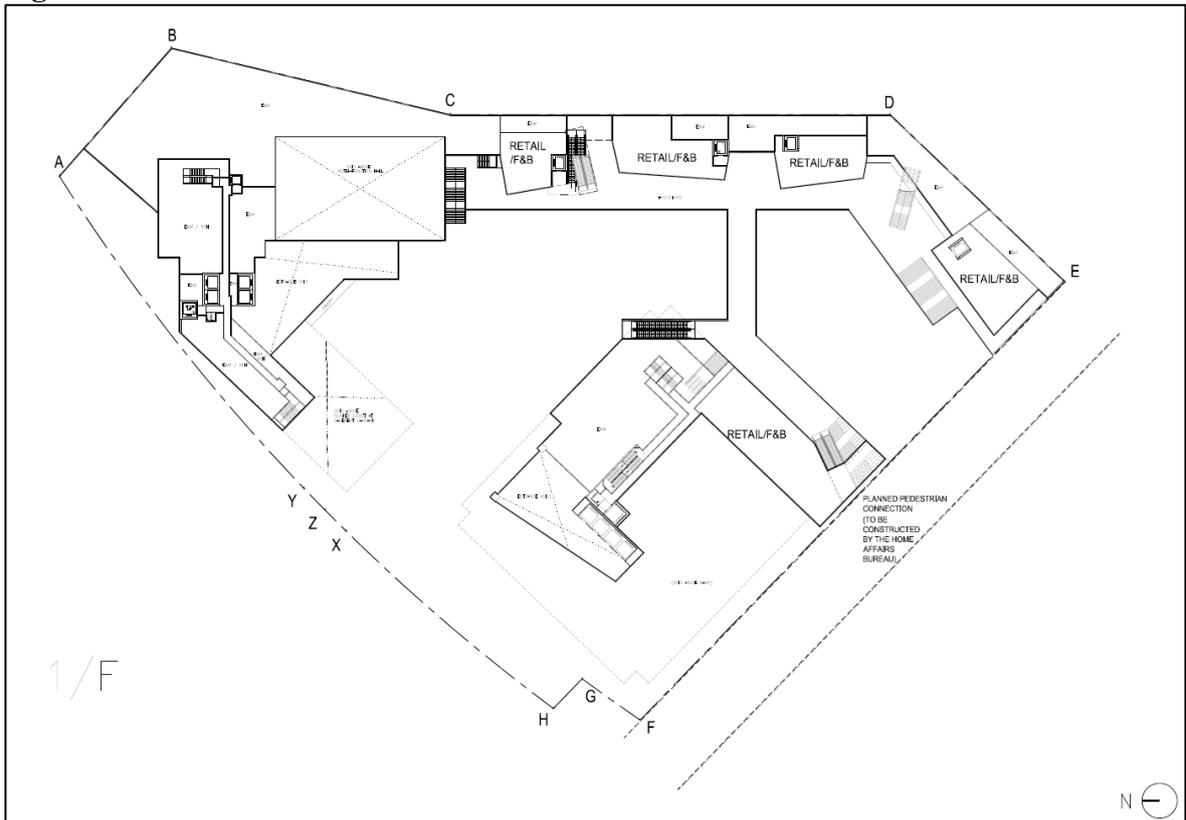


Figure A.5 Indicative 2/F Plan

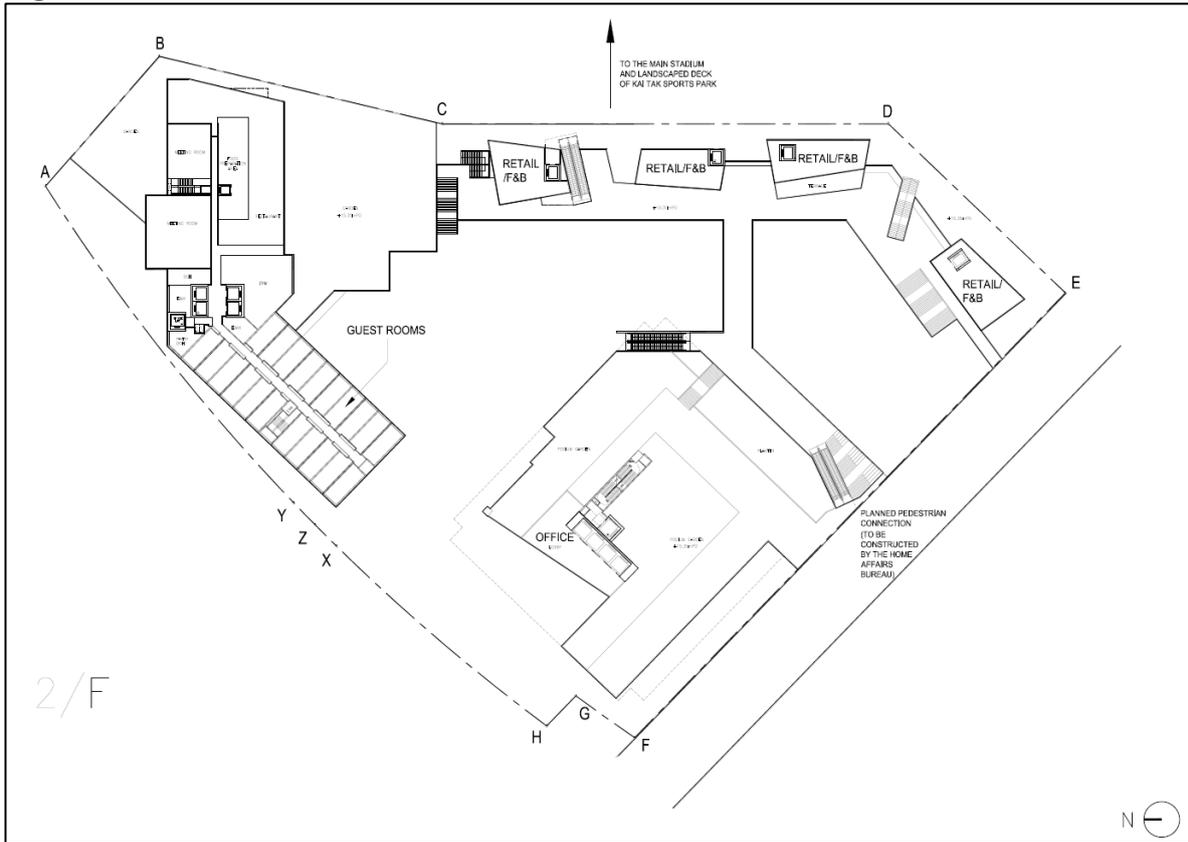


Figure A.6 Indicative Typical Plan (Hotel and Office)

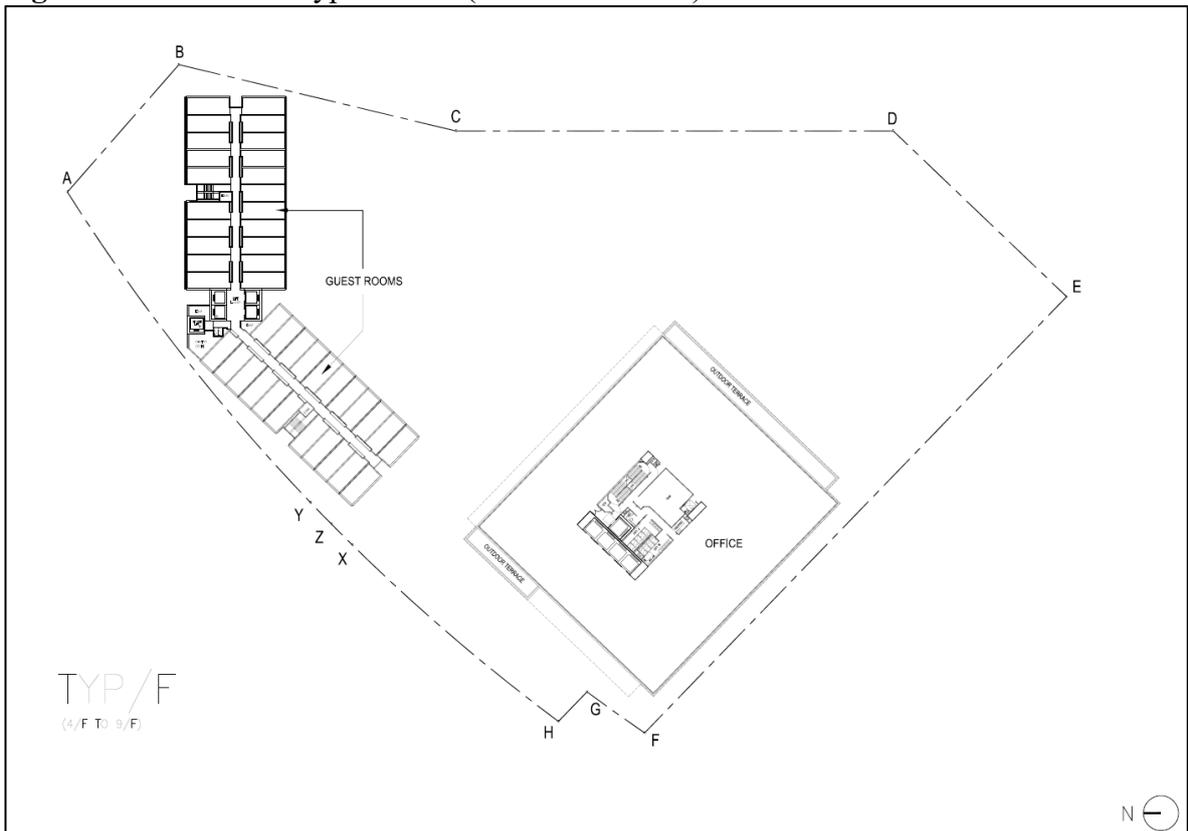


Figure A.7 Indicative Section Plan

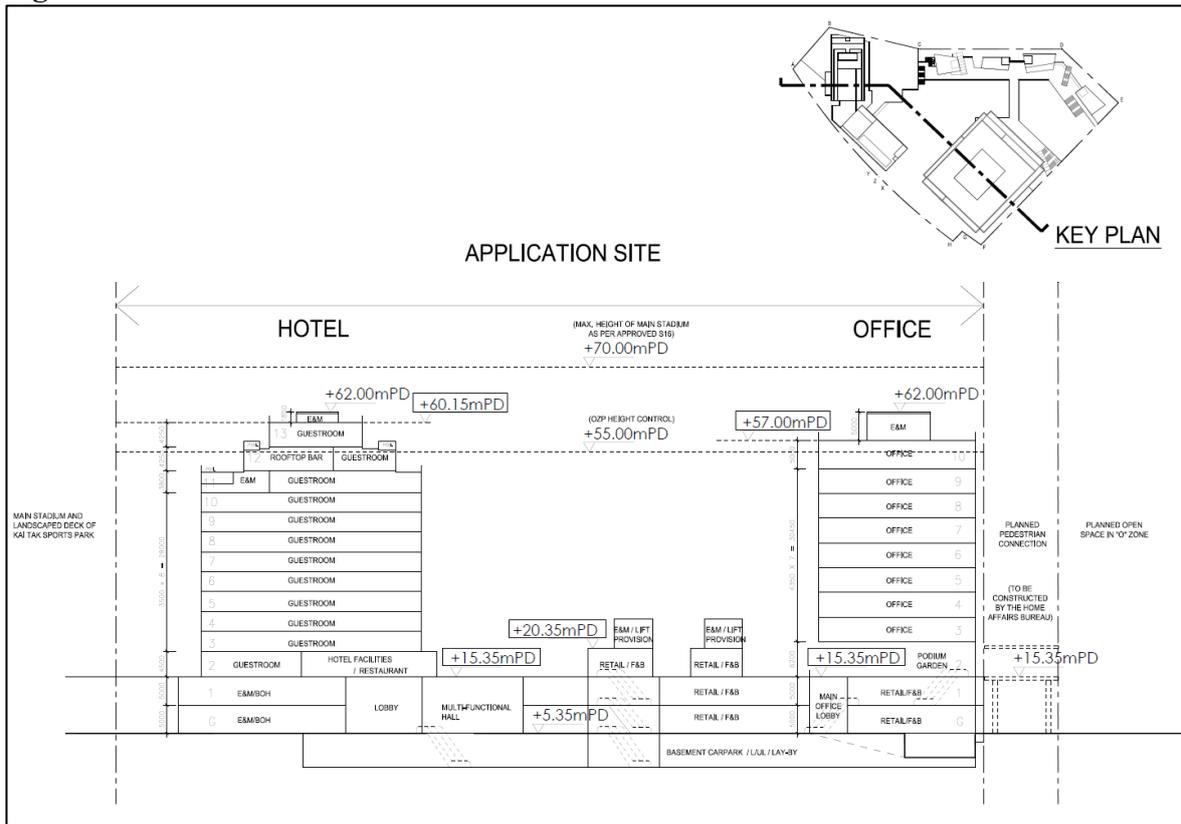
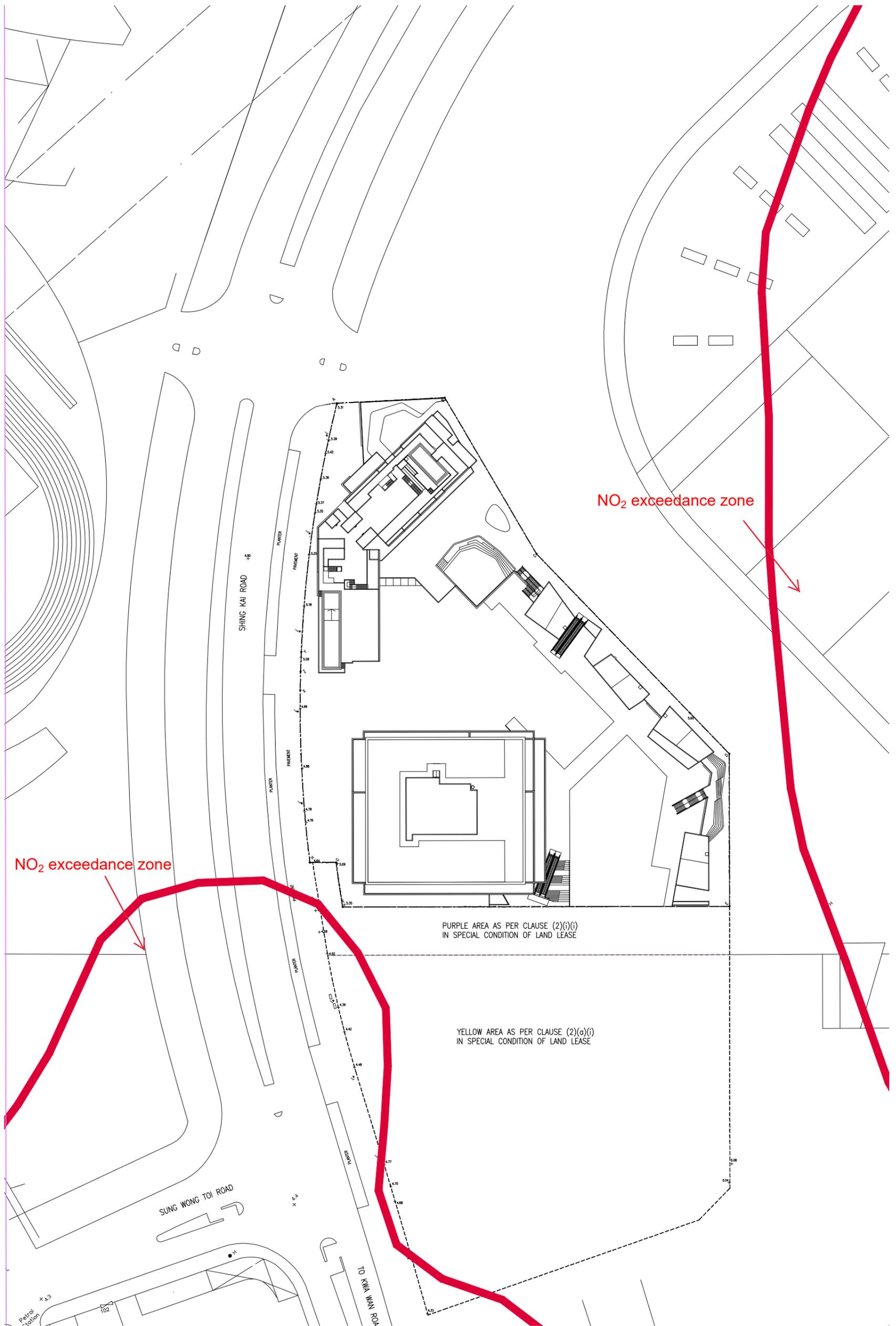


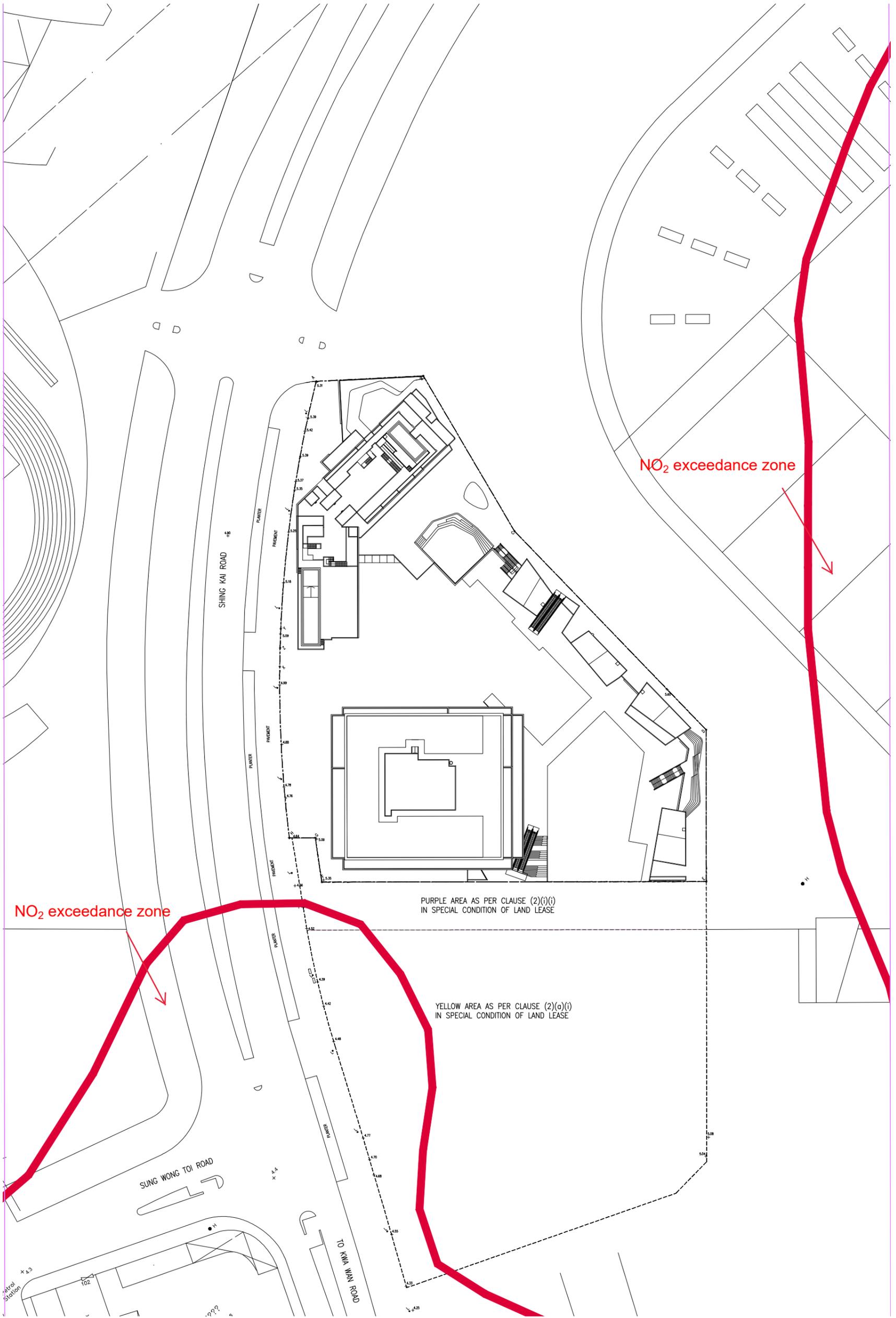
Figure A.8 Landscape Master Plan



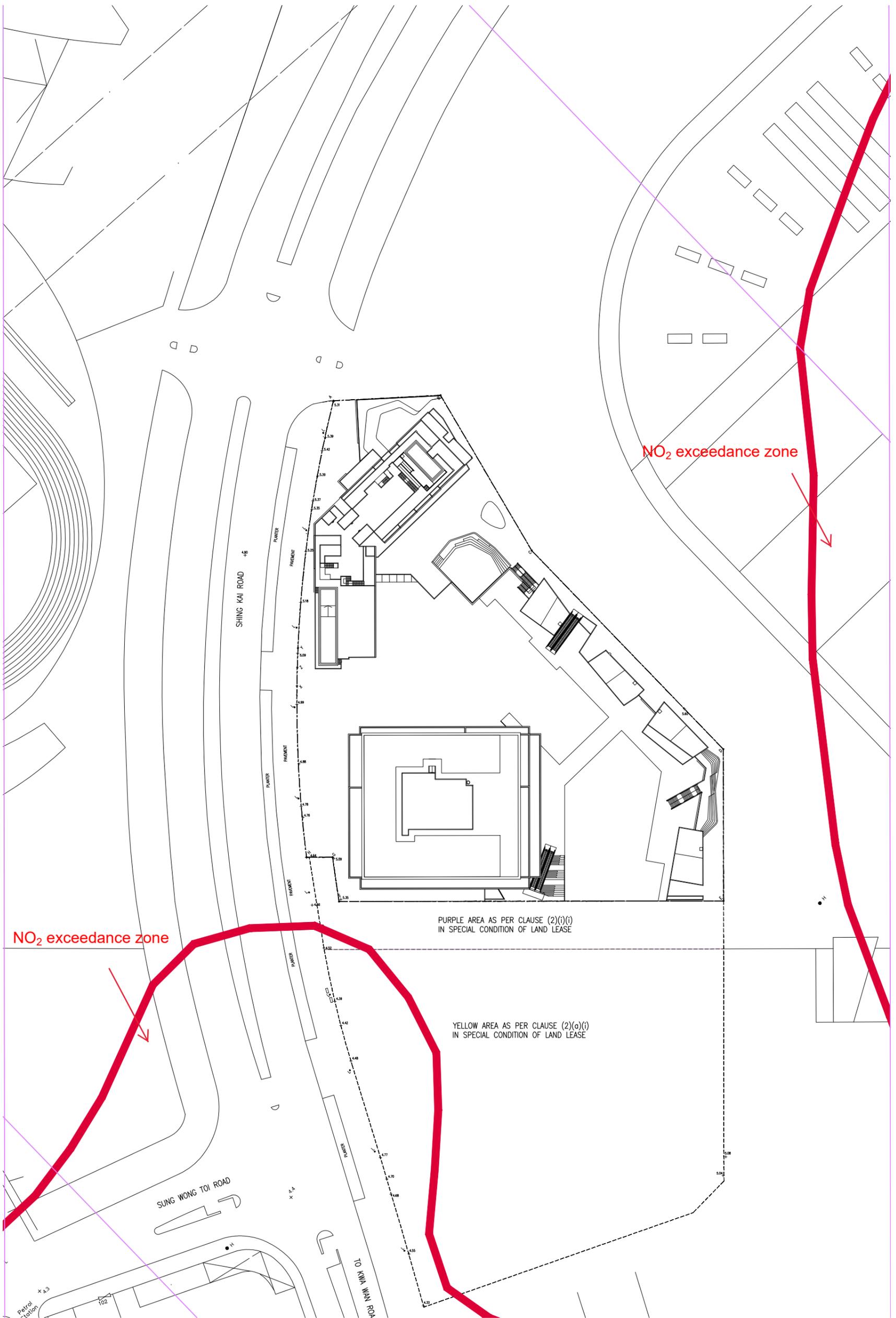
Figure B – Exceedance zone



Annual NO₂ concentration at 1.5mAG for "With Project and 60 Days Full Event" Scenario in 2023



Annual NO_2 concentration at 1.5mAG for "With Project and 60 Days Full Event" Scenario in 2026



Annual NO₂ concentration at 1.5mAG for "With Project and 60 Days Full Event" Scenario in 2036

Appendix B

“Specification for EV Charging Facilities and Payment System” under KTSP Contract (Contract No. HAB/KTSP/01)

L Specification for EV Charging Facilities and Payment System

L.1 General

- L.1.1** The electric vehicle (hereinafter referred as EV in this appendix) charging management and payment system for EV charging facilities in the Car Park shall be provided by the Contracted Party.
- L.1.2** The requirements of the EV charging facilities and payment system.
- L.1.2.1** The EV charging facilities and payment system includes but not limited to servers of remote monitoring system, servers of payment system, servers of car parking information sharing system, structure cabling, cable containment, payment kiosks and EV charging facilities.
- L.1.2.2** To provide a software and hardware of payment kiosk that integrated to the payment system and remote monitoring system and car parking information sharing system capable of handling EV charging facilities.
- L.1.2.3** To provide the remote monitoring system, payment system, car parking information sharing system, and structure cabling which capable of handling at least 60 nos. payment kiosks and 100% private car parking spaces equipped with EV charging facilities for real-time and online monitoring, as well as payment processing and data sharing without any delay.
- L.1.3** The Contracted Party shall provide a total solution for the above work and shall be fully responsible for provision of supervision, labours, transportation, and associated tools/equipment to ensure that the system are complied with the Employer's Requirements.
- L.1.4** The Contracted Party shall provide a car parking information sharing system. This information car parking information sharing system shall be free for public access for obtaining real-time parking availability data of Car Parks and information of EV charging facilities. The data shall include, but not limited to the number of vacant private car parking spaces, headroom and available EV charging spaces and disabled car parking. The system shall allow the access of Car Park information to public through internet and/or smart devices applications (apps). The Contracted Party shall read in conjunction with Part IX of the Employer's Requirements for the mobile apps requirements. All car parking information and EV charging facilities information shall also be freely shared with the smart parking mobile app and the my Kowloon East apps, which is developed by the Energizing Kowloon East Office, Development Bureau, the HKSAR Government. Details of the mobile apps shall refer to the link below. The Contracted Party shall coordinate with relevant parties and provide all necessary hardware and software to ensure the information to be shared successfully.
- L.1.5** Link for Smart Parking Mobile App:
http://www.ekeo.gov.hk/en/smart_city/smart_parking_mobile_app.html

L.2 EV Charging Facilities for Standard Charging (2.86kW)

- L.2.1** The provision of EV charging facilities shall include but not limited to the following:
- L.2.1.1** minimum 66.7% of the total private car parking spaces shall be provided with EV charging facilities with output power not less than 2.86kW. The output current either for BS1363 13A or IEC 62196 type 2 socket shall be limited to 13A;
- L.2.1.2** the socket shall be placed on the front panel of the EV charging facilities for easy insertion and unplugging of charging cable;
- L.2.1.3** the charging facilities shall include a LED display screen to indicate charger status including but not limit to on, off and error;
- L.2.1.4** an on/off individual switch shall be provided to each EV charging facilities as means of isolation to switch on after plugging and switch off before unplugging of the charging cable cord;

- L.2.1.5 the BS 1363 socket shall be a degree of protection of at least IP55 to protect ingress of dust and water. The Contracted Party may consider to adopt the IEC 62196 type 2 socket but the output current shall be limited to 13A;
- L.2.1.6 the nominal input voltage shall be 220V, 1-phase;
- L.2.1.7 the charging facilities shall be equipped with built-in overload protection;
- L.2.1.8 the charging facilities shall be able to stop the charging process automatically when the electric vehicle is fully charged or the connector is disconnected from the charger or disconnected from the EV;
- L.2.1.9 in case of electricity outage, after restoration of power supply to the EV charging facilities, the system shall be able to re-start the charging automatically. If two types of sockets (13A socket outlet and IEC 62196 type 2 socket) are both provided, warning signal shall be provided and the warning message shall be indicated on the panel of the charging facilities to ensure the charging facilities should not be plugged by the two sockets at the same time. Interlock shall be provided so as to ensure charging current is provided from only one of the two sockets at any time. Charging process shall not be activated if the charger detects that plugs are connected to both sockets simultaneously;
- L.2.1.10 The socket for EV charging shall be interlocked with the plug during the charging process;
- L.2.1.11 The outlet for EV charging shall be fail-safe design, i.e. to allow the user to unplug the charging cable when the electricity supply to the charging facilities is interrupted or suspended; and
- L.2.1.12 The charging facilities shall be able to be rebooted via the remote monitoring system.

L.3 EV Charging Facilities for Medium Charging (7kW)

- L.3.1** The design of EV charging facilities shall include but not limited to the following:
 - L.3.1.1 minimum 33.3% of the total private car parking spaces shall be provided with EV charging facilities with output power not less than 7kW, which is compatible with minimum rating of 32A medium charging;
 - L.3.1.2 the socket shall be placed on the front panel of the EV charging facilities for easy insertion and unplugging of charging cable;
 - L.3.1.3 the charging facilities shall include a LED display screen to indicate charger status including but not limit to on, off and error;
 - L.3.1.4 an on/off individual switch shall be provided to each EV charging facilities as means of isolation to switch on after plugging and switch off before unplugging of the charging cable cord;
 - L.3.1.5 IEC 62196 type 2 socket shall be a degree of protection of at least IP54 in order to protect ingress of dust and water;
 - L.3.1.6 the nominal input voltage shall be 220V, 1-phase, 50Hz or 380V, 3-phase;
 - L.3.1.7 the charging facilities shall be equipped with built-in overload protection;
 - L.3.1.8 the charging facilities shall be able to stop the charging process automatically when the electric vehicle is fully charged or the connector is disconnected from the charger or disconnected from the EV;
 - L.3.1.9 in case of electricity outage, after restoration of power supply to the EV charging facilities, the system shall be able to re-start the charging automatically;
 - L.3.1.10 the socket for EV charging shall be interlocked with the plug during the charging process;
 - L.3.1.11 the outlet for EV charging shall be fail-safe design, i.e. to allow the user to unplug the charging cable when the electricity supply to the charging facilities is interrupted or suspended; and
 - L.3.1.12 the charging facilities shall be able to be rebooted in the Remote Monitoring System.

Appendix C

Employer's Requirement on De- NOx paint

- C. Applicator qualifications: Minimum 5 years experience in the application of specified paints and minimum 10 years experience in the application of PVDF and powder coatings.
- D. Application criteria:
 - i. Apply each coat of paint (except primers) with a slightly different tint from the finish colour, so that each coat may be identified during inspection.
 - ii. Obtain Supervising Officer's approval for each coat prior to applying additional coats.
- E. Tests and inspections:
 - i. Supervising Officer may perform random testing of any portion of the coating process to verify conformance with coating manufacturer's recommendations and requirements specified herein.
 - ii. Coatings not applied in accordance with manufacturer's recommendations and as specified herein shall be completely removed and new coatings applied as directed by Supervising Officer.

B.18.1.5 Environmental requirements:

- A. The Contracted Party shall comply with the following:
 - i. Materials shall be resistant to ultra-violet, ozone, mildew, pests and have low or zero VOC emissions when curing.
 - ii. All paints and coatings specified shall be sourced locally, i.e. within 800km of the Site.
 - iii. All materials specified shall not contain any toxic component such as formaldehyde, or toxic metallic component such as mercury, lead, cadmium or chromium.
 - iv. No halogenated solvent shall be used.
 - v. The Contracted Party shall devise a detailed plan on the application and implementation of the use of De-NOx paints at strategic locations as one of best practicable means to the satisfaction of EPD and Supervising Officer.
 - vi. The maximum VOC limits for paints and coatings shall be in accordance with EPD requirements.

B.18.1.6 Submittals:

- A. The Contracted Party shall refer to the following list of information to be provided. The information shall include but not be limited to the items listed below:
 - i. Samples shall be submitted with minimum 1 colour sample for each colour of each paint or coating type selected. Provide a schedule indicating locations for each colour. Provide completely dry (tack-free) colour samples in the gloss or sheen specified.
 - a. Product data shall include 3 copies of the following:
 - b. manufacturer's technical data sheets (including VOC content);
 - c. published instructions; and
 - d. material safety data sheets, colour name and number, sheen name and gloss units, and number of coats for each coat.
 - ii. Certification shall comprise:
 - a. Provide each shipment of materials delivered to job site with an affidavit from manufacturer, certifying that each classification or type of material furnished complies with Specifications requirements. For PVDF2 coating system provide copy of licence agreement from the applicators, coating supplier, and confirm that coating procedures comply with the licencing agreement.
 - iii. The Contracted Party shall provide a method statement to describe all paint applications and substrates.

B.18.1.7 Product handling

A. The Contracted Party shall:

- i. Identify each container with manufacturer's name, brand name, material type, stock number, colour, and application instructions, including reducing instructions, if permitted.
- ii. Storage:
 - a. Store materials in a protective structure separated from building under construction.
 - b. Stack and store paint containers so that labels clearly display manufacturer's name, type of paint, colour, batch number, and instructions.
- iii. Mixing:
 - a. To maximum extent practicable, factory mix each paint material to colour, gloss, and consistency for application directly from container.
 - b. Conform to manufacturer's instructions for reducing/thinning.
- iv. Housekeeping:
 - a. Maintain paint storage and mixing area neat and clean at all times. Take precautions to prevent fires.
 - b. Immediately after use, dispose of soiled, oily rags in covered metal containers in accordance with governing environmental regulations.

B.18.1.8 Project conditions:

A. The Contracted Party shall comply with the following:

- i. Apply paint materials only during environmental conditions as recommended by paint manufacturer. Immediately notify Supervising Officer when paint materials cannot be applied in accordance with paint manufacturer's instructions and recommendations.
- ii. Ensure surfaces shall be thoroughly dry prior to applying paint material
- iii. Do not apply paint materials during damp or inclement weather or on wet surfaces. Ensure surfaces shall be thoroughly dry prior to applying paint materials. Provide temporary structures/enclosures.

B.18.1.9 Maintenance

- A. The Contracted Party shall compile and maintain a listing of all paint colours with factory batch number and formulation code for every paint type and colour used in the project. Submit complete list to the Supervising Officer for future maintenance reference.

B.18.1.10 Warranty

- A. The Contracted Party shall provide warranty including colour fastness warranties and covering film defects, chalking and loss of sheen, peeling, and blistering, shall be submitted along with product submittals.

B.18.2 Products

The products and materials proposed by the Contracted Party shall comply with the requirements under B.18.2 below:

B.18.2.1 Materials

- A. Powder coating:

Powder shall consist of polyester and epoxy resin (for polyester, at least 70% triglycidyl isocyanurate in the residue solids) applied electrostatically onto pre-treated and cleaned metal surfaces and then cured by a heat bake process.

B. PVF₂ (or PVDF)

High performance (Grade One) fluoropolymer coating having at least 70% PVF₂ (PVDF) or resin content, factory spray applied on to chemically pre-treated surfaces and cured by heat bake process. Provide a 3-coat system complete with clear top coat of PVF₂ (PVDF) or resin content. Clear top coat shall have minimum DFT of 20 microns.

C. Masonry paint:

Water based vinyl copolymer emulsion paint system with smooth and matt finish.

- i. Description: Waterbased polyurethane exterior emulsion, with abrasion resistance in low sheen finish.
- ii. Application: For internal and external masonry construction surface (such as brick, stone, concrete block, stucco).

D. Emulsion paint:

- i. Description: Water based 100% acrylic co-polymer emulsion washable anti-mould coating, low sheen finish, VOC and odour free.
- ii. Application: For interior use to office type areas, BOH ceiling soffits, BOH staircases, BOH plant rooms.

E. Acrylic enamel wall paint:

- i. Description: Water based acrylic resin coating semi-gloss finish with strong abrasion resistance (ASTM D 4060, result: <46mg loss), low flame spreading rating (over non-combustible surfaces to BS 476 Part 7).
- ii. Application: For interior use where hard finished surface is required, e.g. to electrical plant rooms.
- iii. Means of application: Spray applied.

F. Epoxy paint:

- i. Description: Water based acrylic polyimide epoxy (2 component), semi-gloss finish with high volume solids and scrub resistance and highly washable, chemical and stain resistance (ASTM 1308).
- ii. Application: For interior use where abrasion resistance and chemical resistance is required, e.g. to high impact corridors where higher performance is required than acrylic enamel for durability.
- iii. Means of application: Spray applied.

G. Interior metal paint:

- i. Description: Water based oil alkyd resin based enamel, gloss finish, low flame spreading rating (over non-combustible surfaces, Class A: 0-25 to BS 476 Part 4).
- ii. Application: For interior metal work.

H. Exterior metal paint:

- i. Description: Water based epoxy primer plus two coats aliphatic acrylic urethane finish.
- ii. Application: For external metal work where UV resistance is required.

I. Bitumen paint:

- i. Cold refined petroleum asphalt bituminous mastic containing no asbestos fibres.

J. Mineral silicate paint:

Non-toxic, low pigmentation, natural inorganic mineral paint system, when applied to concrete substrate, forming a 'breathable' layer below concrete surface for water repellency, carbonation protection and vapour permeability. The paint system shall include two coats of paint composed of pure inorganic mineral fillers, UV stable natural oxide colour pigments and water borne potassium silicate binder that meets the standard DIN-18-363. The Contracted part shall provide colour wash finish to fairfaced concrete. Colour shall be selected from the standard colour range supplied by the manufacturer. Gloss level shall be matt. Surface preparation shall follow the manufacturer's specification.

K. Acrylic texture coating:

Water-based textured acrylic paint system (4 coat) comprising:

- i. one premixed water based sealer coat;
- ii. one modied acrylic resin texture coat;
- iii. minimum two polyurethane finishing coats; and
- iv. thickness of coating depends on texture coating selected.

L. Stone texture coating:

Water-based textured acrylic paint system comprising:

- i. one 2-pack silicate primer sealer coat;
- ii. two coats of stone texture coat;
- iii. two coats of silicon resin water based clear finishing coats; and
- iv. thickness of coating depends on texture coating selected.

M. Wall (and soffit) sealer:

Single component, water based coloured acrylic coating with strong adhesion to cementitious surfaces, semi-gloss.

N. Floor sealer (trafficable):

Two components, water based coloured epoxy system, hard wearing, semi-matt, coefficient of friction not less than 0.5 in accordance with ASTM D2047.

O. Floor sealer (non - trafficable):

- i. single component: water based coloured acrylic coating with strong adhesion to cementitious surfaces, semi-gloss; and
- ii. application: under raised floor system

P. Silane concrete penetrant:

Penetrating type treatment consists of silane blends that penetrate into concrete and bonds with silica or alumina containing materials to inhibit water penetration. The treatment shall contain the correct percentage of solids to make it suitable for vertical application and complying with the following requirements:

- i. composition: Alkylalkoxysilane or low-modular siloxane as active agent;
- ii. application: one or two coat spray, roller or brush applied; and
- iii. colour: clear.

Q. Sol-silicate photocatalytic exterior paint (De-NOx paint):

- i. Description: A sol silicate photocatalytic mineral based painting (2 coat) system, UV and acid resistant, anti-static, high weathering resistance, alkaline, non-flammable, lightfast, mineral matt finish, water vapour permeable, non-film foaming and microporous, highly water repellent, resists algal and fungal growth.

- ii. Property: The paint shall use light energy to reduce air pollution and convert Nitrogen Oxides (NOx) and other harmful pollutants including formaldehyde and acetaldehyde into harmless nitrates.
 - a. suitable substrates: all mineral, absorbent surfaces; and
 - b. application: 2 coat undiluted system, applied by brush, roller, or air-less spray with a minimum period of 12 hours between coats.

R. Photocatalytic interior mineral paint (De-NOx paint):

- i. Description: A sol silicate photocatalytic mineral based painting (2 coat) system, scrub-resistant, free from solvents, plasticisers and biocides, non-flammable, resistant to mould and fungal growth, anti-bacterial action, resistant to disinfectants, suitable for allergy sufferers, safe for application in food preparation areas.
- ii. Property: The paint shall use photocatalytic pigments to reduce noxious gases and odours by transforming them into natural substances.
 - a. suitable substrates: all mineral plasters, concrete, plasterboard; and
 - b. application: 2 coat undiluted system, applied by brush, roller, or air-less spray with a minimum period of 5 hours between coats.

B.18.3 Execution

The execution of works proposed by the Contracted Party shall comply with the requirements below and the Contracted Party shall:

B.18.3.1 Examination

- A. Examine surfaces scheduled to receive paint finishes for conditions that will adversely affect execution, permanence, and quality of work.
 - i. Inspect metal items specified under other sections to be pretreated or primed prior to finish painting under this section.
 - ii. Verify that taped joints of gypsum board surfaces are smooth, free of raised or depressed areas, or scuffed face paper.
 - iii. Verify that in-situ concrete has cured for not less than 28 days.
 - iv. Perform moisture, adhesion, and similar tests to determine suitability of surfaces to receive paint materials.
- B. Do not apply paint or finish until unsatisfactory conditions have been corrected.
- C. Do not apply finish to wet, damp, dusty, dirty, fingermarked, rough, unfinished, or defective surfaces. Repair imperfections as described for each type of material and fill with appropriate, compatible patching materials.
- D. Faulty subsurface will not excuse defective painting work.
- E. Deliver, erect, and maintain temporary structures/enclosures during adverse climate conditions.

B.18.3.2 Preparation of surfaces

- A. General:
 - i. Clean substrates in accordance with manufacturer's recommendations. Remove powder residue, zinc hydroxide residue (galvanised metal), dirt, dust, oil, grease, wax, loose, cracked, peeled or otherwise un-bonded coatings, efflorescence, mildew, loose particles, stains, mortar and similar foreign substances detrimental to application, performance, or appearance of finishes.
 - ii. Clean out and fill holes, checks, splits, cracks and other surface irregularities with suitable patching compound. Finish repairs to match adjacent surface profile, colour, and texture. Two-component filler material shall be mixed under the supervision of a

Appendix D

NAMI PCO NANO **Reactor Powerpoint** **Summary Information**

CORE Air Purification System

2020 Q3



Target Energy Solutions Limited
達標能源管理有限公司

CORE IAQ Solutions

About NAMI

The Nano and Advanced Materials Institute Limited (NAMI), established in 2006, was designated by the Innovation and Technology Commission as a Research and Development Centre for nanotechnology and advanced materials. NAMI undertakes and provides support for market-oriented research in nanotechnology and advanced materials, and strives for commercialization of the technologies to promote the economic growth of Hong Kong as a knowledge-based economy.

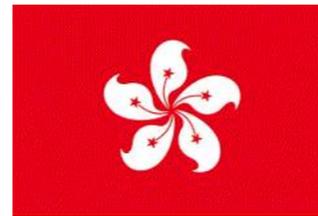
Source: <http://www.nami.org.hk/en/nami/introduction.html>



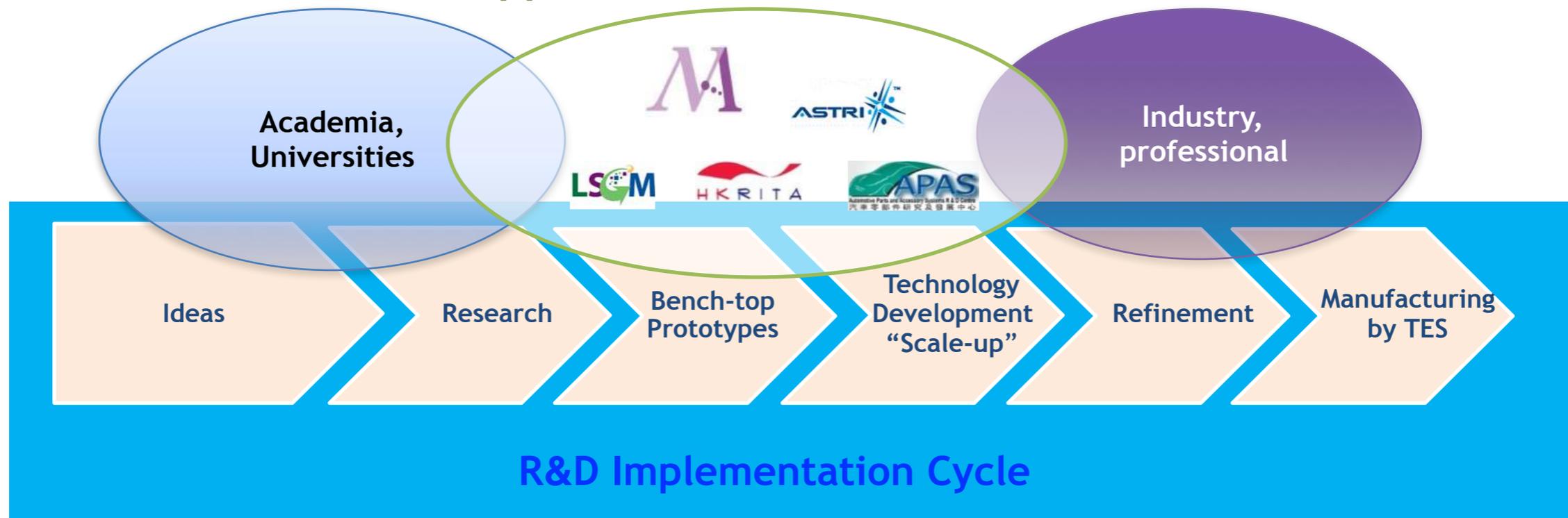


NAMI: *An Applied Research Centre*

NAMI was established in 2006 by the Hong Kong Government for applied research & advance materials platform to offer technology upgrade to Hong Kong industries



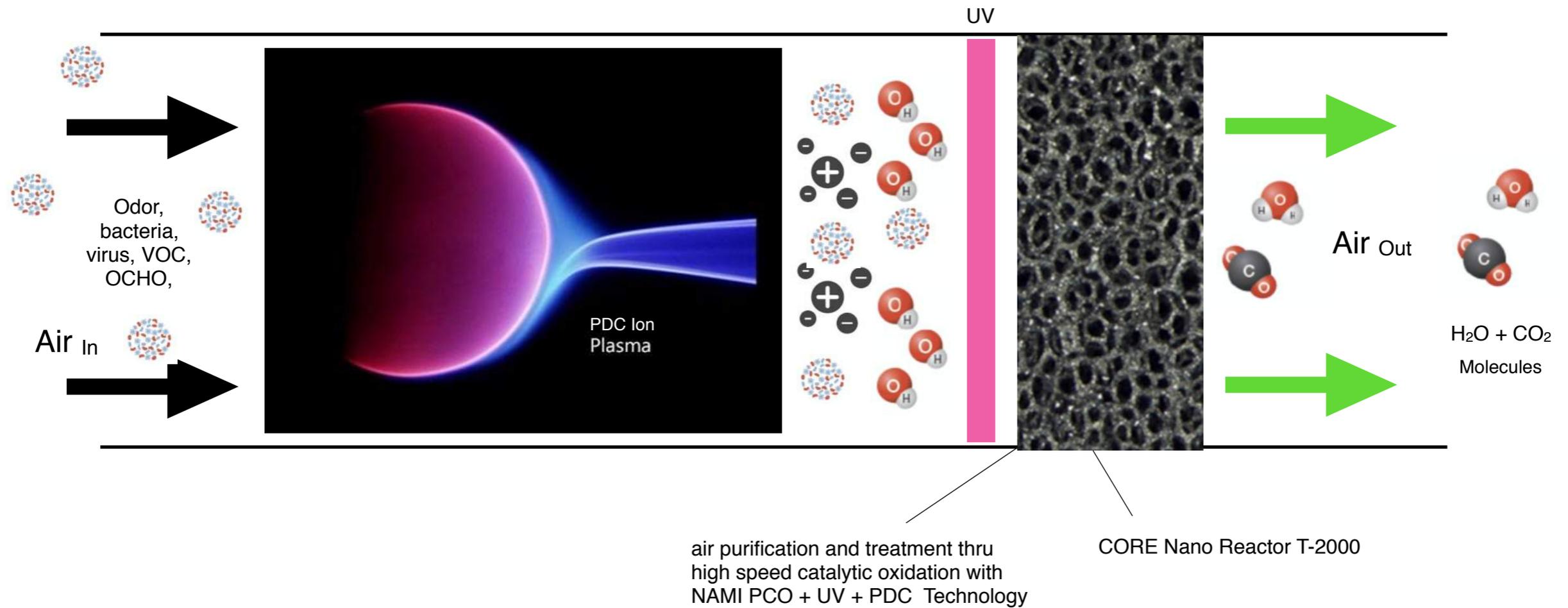
Applied Research Platform



Environmental

Project Code	Patent Title	Grant Date
ITP/029/09NP	System and method for air purification using an enhanced multi-functional coating based on in-situ photocatalytic oxidation and ozonation (US)	10 September 2013
	基于原位光催化氧化和臭氧化使用增强的多功能涂层的空气净化系统和方法 (CN)	12 March 2014
	System and method for air purification using enhanced multi-functional coating based on in-situ photocatalytic oxidation and ozonation 基於原位光催化氧化和臭氧化使用增强的多功能塗層的空氣淨化系統和方法 (HK)	13 June 2014
	基於原位光催化氧化和臭氧化使用增强的多功能塗層的空氣淨化系統和方法 Sistema e método para purificação do ar usando o revestimento multi-funcional reforçado com base me pn-situ oxidação fotocatalítica e ozonização (MAC)	11 August 2014
	System & method for air purification using an enhanced multi-functional coating based on in-situ photocatalytic oxidation & ozonation (EP)	13 July 2016
ITP/031/13NP	Plasam driven catalyst system for disinfection and purification of gases (US)	22 September 2015

CORE AIR PURIFICATION PROCESS



REACTION RATE

- Low Speed : Natural decay
- Medium Speed : UV, Ionisation, Activated Carbon
- High Speed : NAMI PCO/PDC, RTO & etc

Note: CORE stands for Catalytic Oxidation Reaction Engine

Features & Benefits

1. **QUICK REMOVAL** - Odor, bacteria/virus and gas state pollutants like formaldehyde, VOC, ammonia, NO_x, H₂S, O₃ & CO
2. **SAVE ENERGY** - UV-A + PDC plasma to activate air treatment
3. **POWERFUL** - Odor removal without ozone as by-product
4. **LONG TERM** - IAQ performance will be consistent and long term
5. **EASY TO MAINTAIN** - All consumables are “plug-and-play” only



CORE Nano Reactor

**3D Open Pore Structure
High Surface Area**

NAMI Photocatalytic Oxidation (PCO)

NAMI's TECHNOLOGIES AND ITS ADVANTAGES

1. Photocatalytic Coating

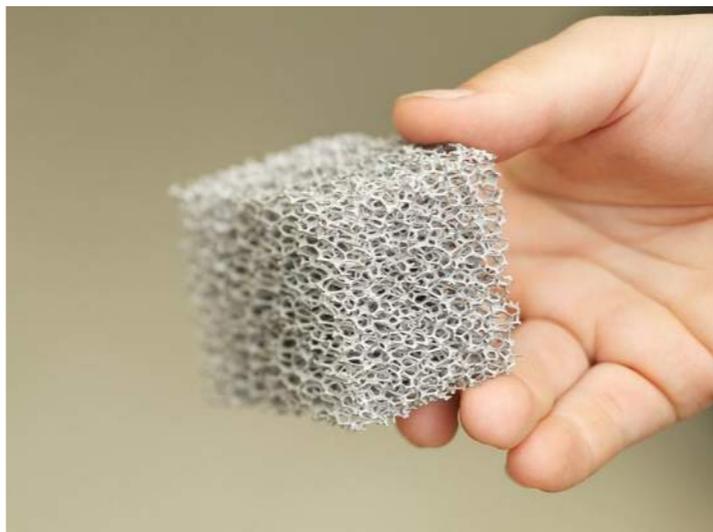
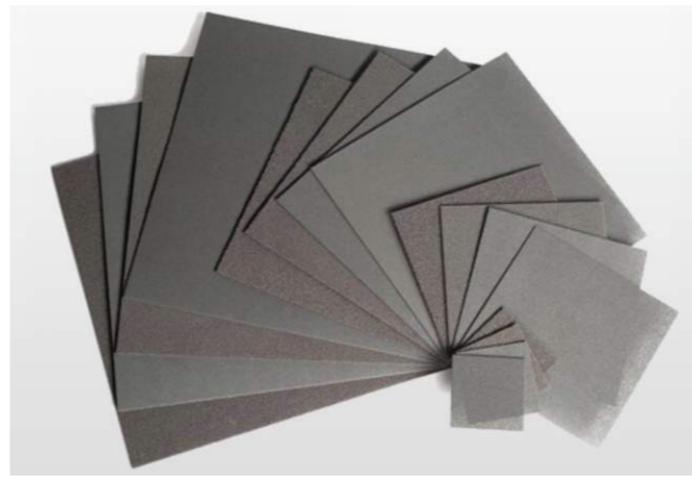
- The annealing temperature of the coating is low so it can be applied on the substrates which cannot withstand high temperature.
- The coating is suitable for various substrates, such as glass, ceramic, and metal.
- The coating has self-cleaning property so it not only maintains the surface cleanness by itself but also removes air pollutants.
- UV-A is enough to active the photocatalytic function of the coating.

2. Nano-Porous TiO₂ Photocatalytic Air Filter

- Porous structure possesses high specific area which offers more active sites for carrying out catalytic reactions

3. Air Purification Unit

- Air pollutant removal efficiency can be improved by fin structure which increase the surface area for depositing photocatalyst, the contact area between air pollutants in the airflow and the photocatalyst



SPECIFICATION & PERFORMANCE

1. Remove 90% nitric oxide
2. Remove 99.9% formaldehyde
3. Kill 99.9% bacteria and virus
4. Zero ozone generation
5. Remove TVOC

TECHNOLOGY IP

1. System and Method for Air Purification Using an Enhanced Multi-functional Coating Based on In-situ Photocatalytic Oxidation and Ozonation, US 8,529,831, HK 1176031, EUO 11848959
2. 基于原位光催化氧化和臭氧化使用增强的多功能涂层的空气净化系统和方法, CN 102811794 B
3. 一种空气及水净化材料的制备方法, CN 103586090 A
4. Air Purification Unit, US 14/166,866
5. 空气净化装置, CN 201410088422.9

CORE Nano Reactor

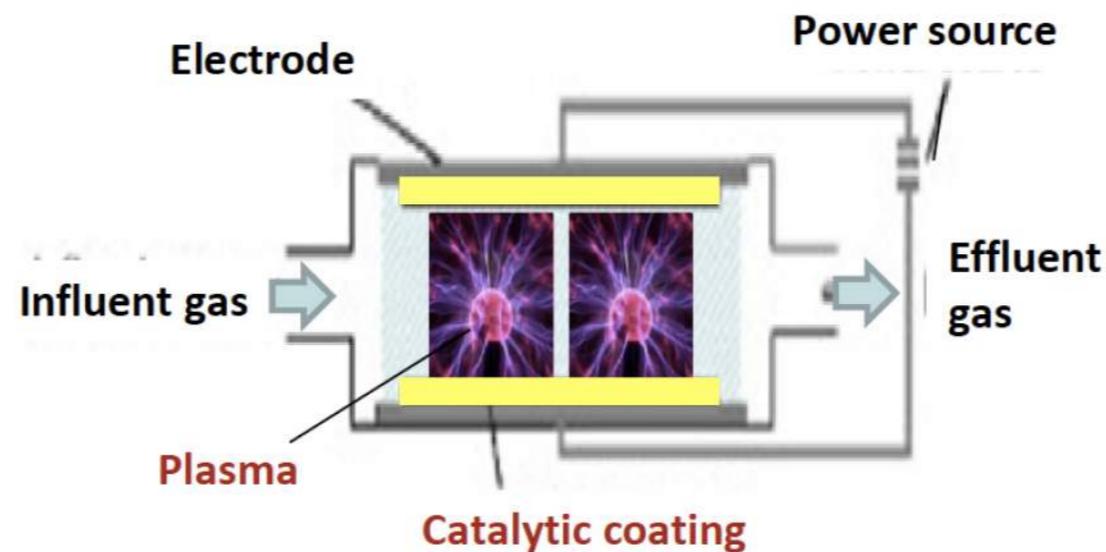
- Using specially designed (NAMI's patented nano catalyst coating immobilized on 3D porous reactor
- More effective because of more active sites for carrying out catalytic deodorization reactions
- Features: Compact design, ease of use, odor removal and anti-bacteria

Bacteria	Efficiency
E.Coli	99.9%
Bacteriophage ϕ X174	99.9%

Source :  納米及先進材料研發院有限公司
Nano and Advanced Materials Institute Limited

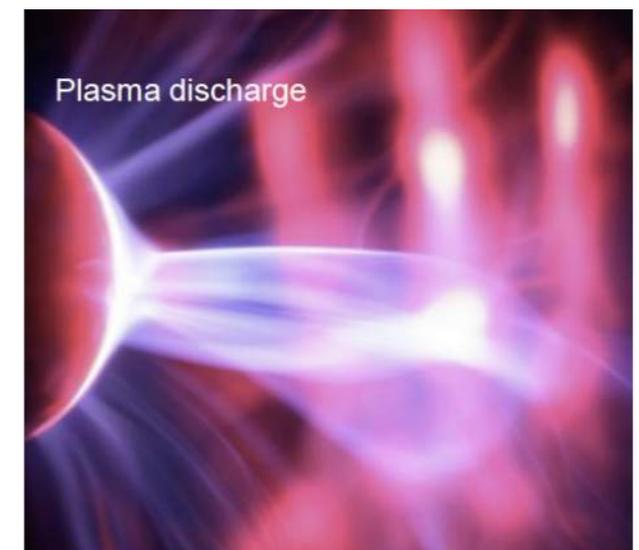
Plasma-Driven Catalysis (PDC) Technology

- NAMI PDC technology is based on Dielectric Barrier Discharge (DBD) plasma
- Syngeneic effect between plasma and photocatalyst
- Photocatalyst activated by plasma without UV radiation



Features

- Strong oxidant power of the plasma discharge
- Anti-bacteria and strong VOC removal (1-1,000ppm)
- Superior removal efficiency of high concentration various pollution species at high air flow rate
- PDC is scalable for HVAC applications in buildings
- Best performance with NAMI PCO nano reactor
- Low power consumption
- Low by-products - Ozone level less than 5 ppb (UL 867)





Differentiation of NAMI Plasma Generator

	Norm Air Plasma Generator	NAMI Patented Plasma Generator
Reactive Species	Less ROS (Reactive O Species)	More ROS
Pollutant Release	O_3	O_3 Almost zero
Working distance	Within 10cm	Over 100cm
Disinfection	Weak	Strong
VOC Removal Rate	Weak	Strong
Mobility	Stationary	Portable
Functions	Less	Multi-functional with different catalyst



CMA Testing and Certification Laboratories

廠商會檢定中心

TEST REPORT

Report No. : AZ0018115(5)

Date : 06 May 2020

Application No. : LZ009671(1)

Results

Removal Test (Testing period: 60 minutes)

Operation Time (minutes)	TBC	VOC	HCHO	CO	NO ₂	H ₂ S	NH ₃	NO	YM
Unit	CFU/m ³	ppbv	ppmv	ppmv	mg/m ³	ppmv	mg/m ³	mg/m ³	CFU/m ³
0	513	5,930	1.43	10	1.38	0.522	0.163	1.49	32
15	72	522	0.22	0	0.12	0.020	0.009	0.20	5
30	44	664	0.27	1	0.10	0.024	0.015	0.27	1
60	50	631	0.10	0	0.09	0.018	0.012	0.22	3

Ozone Emission Test (Testing period: 24 hours)

Parameter	Ozone
Unit	ppbv
Minimum	2
Maximum	5
Average	3.8

Ozone Emission Test (Testing period: 24 hours)



**CMA Testing
and Certification
Laboratories**

廠商會檢定中心

TEST REPORT

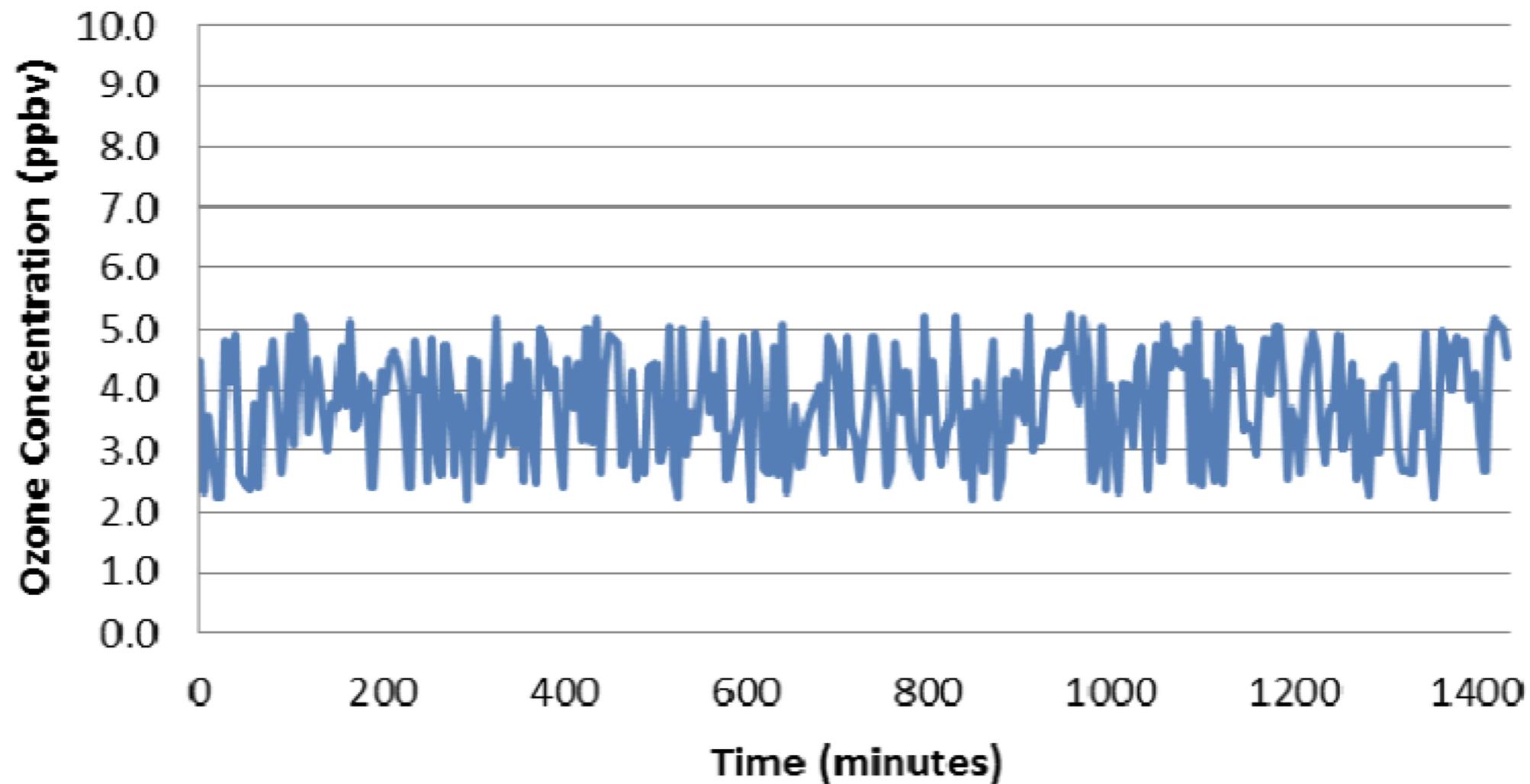
Parameter	Ozone
Unit	ppbv
Minimum	2
Maximum	5
Average	3.8

Report No. : AZ0018115(5)

Date : 06 May 2020

Application No. : LZ009671(1)

Ozone Concentration Chart (24 hours)



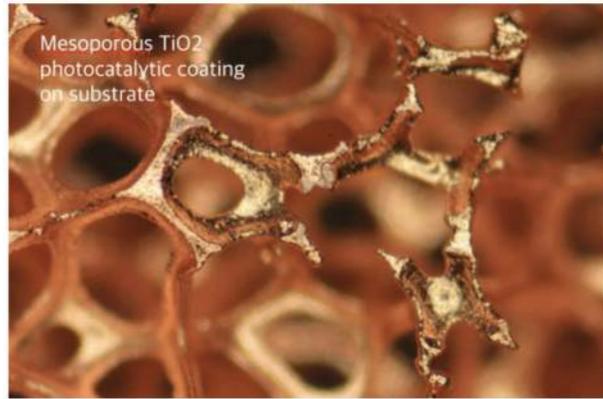
Appendix II

IAQ SYSTEM COMPARISON BETWEEN UV, OXYGEN AIR PURIFIER WITH CORE AIR PURIFICATION SYSTEM USING NAMI PCO+PDC TECHNOLOGY

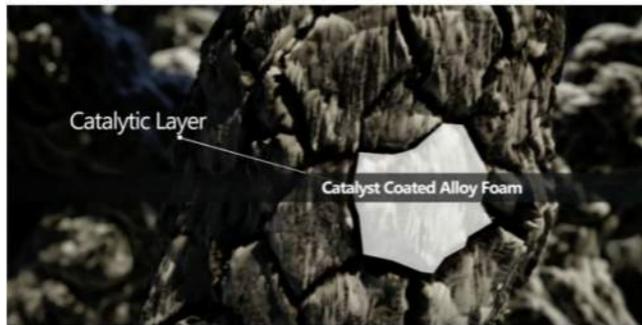
REMOVAL EFFICIENCY	UV	AP	NAMI PCO + PDC
Airborne Bacteria	90 – 95%	90 – 95%	90 – 95%
Ozone, O3	0.00%	25 ppb	< 25 ppb
Airborne Particulates	-	95%	95%
TVOC	-	80 – 85%	80 – 85%
Hydrogen Sulphide, H2S	-	95%	95%
Formaldehyde, HCHO	-	-	80 – 85%
Ammonia, NH3	-	-	80 – 85%
NO	-	-	80%
NO2	-	-	90%
CO	-	-	TBC

Note: AP stands for Oxygen Air Purifier or Bio-Oxygen Generator

CORE Nano Reactor - Working Principle



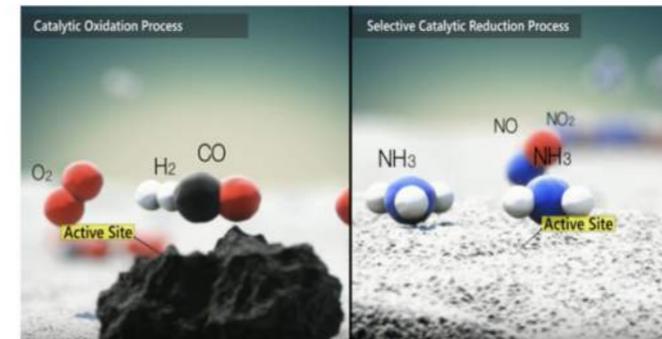
NAMI PCO Coating



CORE Nano Reactor

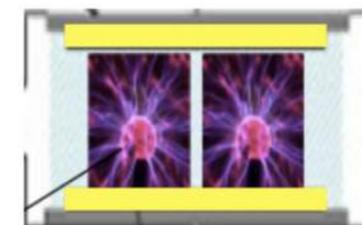


CORE nano reactor will be regenerated. Air purification will never end



Reaction rate and toxic gas removal rate increase

With NAMI PDC Technology





Indoor Air Quality Standard

	U.S.A ASHREA62-2007	China GB/T18883-2002	Hong Kong (8 hrs)	WHO
Formaldehyde	< 27ppb (8 hrs) < 76ppb (1 hr)	< 80ppb (1 hr)	< 24ppb (Excellent) < 81ppb (Good)	< 81ppb (30 mins)
Nitric Dioxide	< 50ppb (1 year) < 237ppb (1 day)	< 127ppb (1 hr)	< 21ppb (Excellent) < 80ppb (Good)	< 100ppb (1 hr) < 20ppb (1 year)
Ozone	< 50ppb	< 80ppb (1 hr)	< 25ppb (Excellent) < 61ppb (Good)	< 64ppb (8 hr)

NAMI photocatalyst technology can remove these three air pollutants so as to achieve indoor air standards in different countries and regions.

Bacteria Killing Efficiency

Bacteria	Efficiency
E.Coli	99.9%
Bacteriophage ϕ X174	99.9%

Source from  納米及先進材料研發院有限公司
Nano and Advanced Materials Institute Limited

HK EPD IAQ Standards

Parameter	Unit	Averaging Time	IAQ Objectives	
			Excellent Class	Good Class
Room Temperature	°C	8 hours	20 to < 25.5	< 25.5
Relative Humidity (RH)	%	8 hours	40 to < 70	< 70
Air Movement	m/s	8 hours	< 0.2	< 0.3
Carbon Dioxide (CO ₂)	mg/m ³ (ppmv)	8 hours	< 1 440 (<800)	< 1 800 (< 1,000)
Carbon Monoxide (CO)	µg/m ³ (ppmv)	8 hours	< 2 000 (< 1.7)	< 10 000 (< 8.7)
Respirable Suspended Particulates (PM ₁₀)	µg/m ³	8 hours	< 20	< 180
Nitrogen Dioxide (NO ₂)	µg/m ³ (ppbv)	8 hours	< 40 (< 21)	< 150 (< 80)
Ozone (O ₃)	µg/m ³ (ppbv)	8 hours	< 50 (< 25)	< 120 (< 61)
Formaldehyde (HCHO)	µg/m ³ (ppbv)	8 hours	< 30 (< 24)	< 100 (< 81)
Total Volatile Organic Compounds (TVOC) (see Para. 4 for alternative compliance arrangement for Good Class IAQ)	µg/m ³ (ppbv)	8 hours	< 200 (< 87)	< 600 (< 261)
Radon (Rn)	Bq/m ³	8 hours	< 150	< 200
Airborne bacteria	cfu/m ³	8 hours	< 500	< 1 000

TES CORE PCO T-2000 Nano Reactor Plate

TES CORE T-2000 nano reactor plates are made of special metal alloy substrate with high-tech NAMI PCO coating for various air purification applications. Performance level is directly proportional to number of nano reactor plates applied.

The CORE nano reactor plate has 40 times more surface area (Contacting Area) than typical reactor substrate. With NAMI patented PCO coating applied, high speed air purification is carried out to remove bacteria, Ozone, TVOC, formaldehyde, H₂S and bad odors.



Actual metal alloy substrates

- Patented NAMI PCO coating on metal alloy substrate
- Low pressure drop with vast contact surface area
- Enhance performance with additional plasma generator
- Long service life - 10 Years Product Guarantee
- Easy to maintain (Vacuum cleaning or washing)

Model	Trim Size (H x W x T) (mm)
T-2000 Nano Reactor	500 x 500 x 20

Ceiling Mount Model: H100



Features

- Come with HEPA filter + CORE nano reactor
- UV-A irradiation and/or plasma driven
- High speed removal of odors, bacteria, formaldehyde, VOCs, NH3 and etc
- Two speed - High (250 CMH)/Low (120 CMH)
- Low noise (< 50 db)
- Low power consumption (120W)



Stand-Alone Model: C100

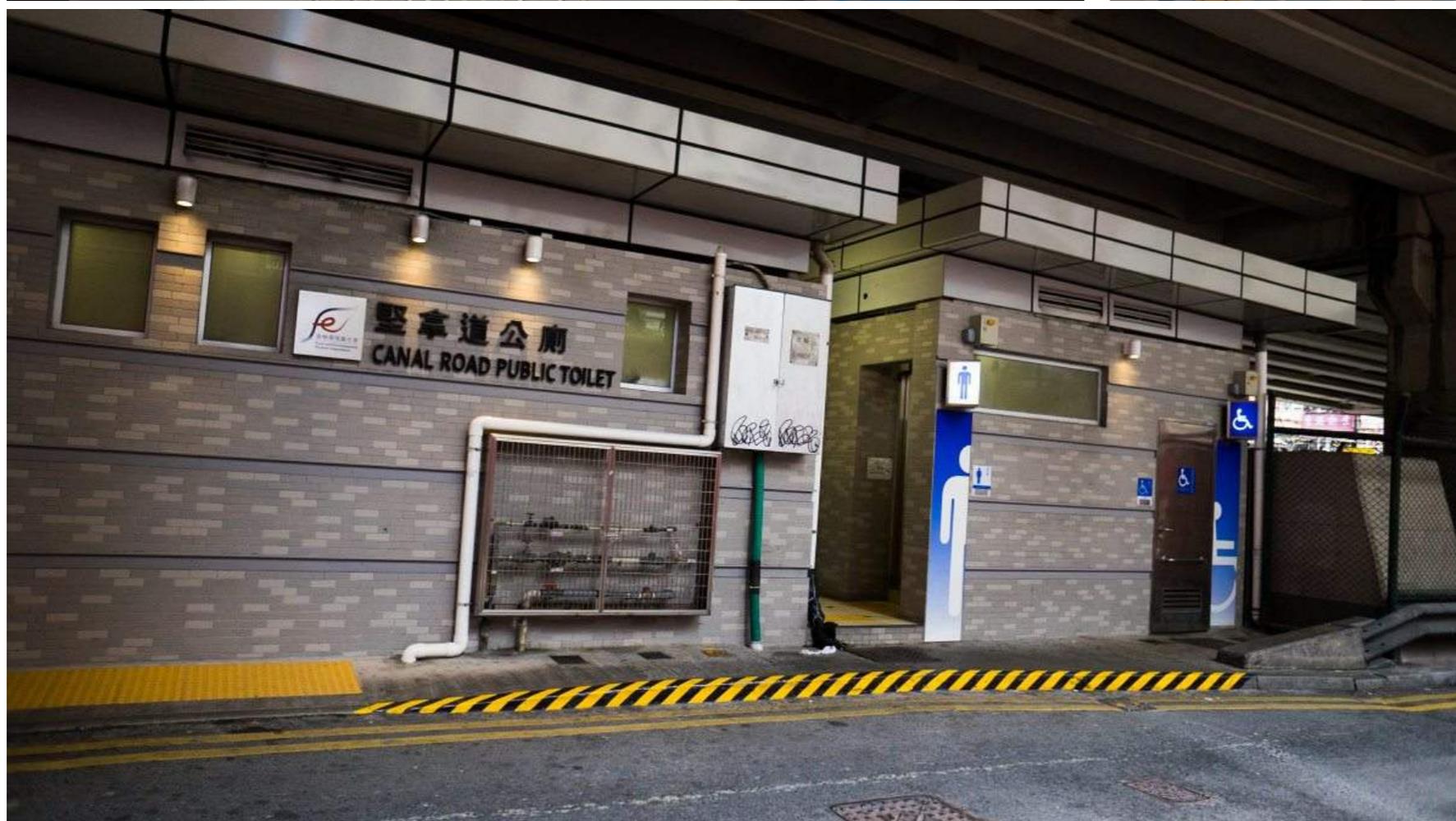
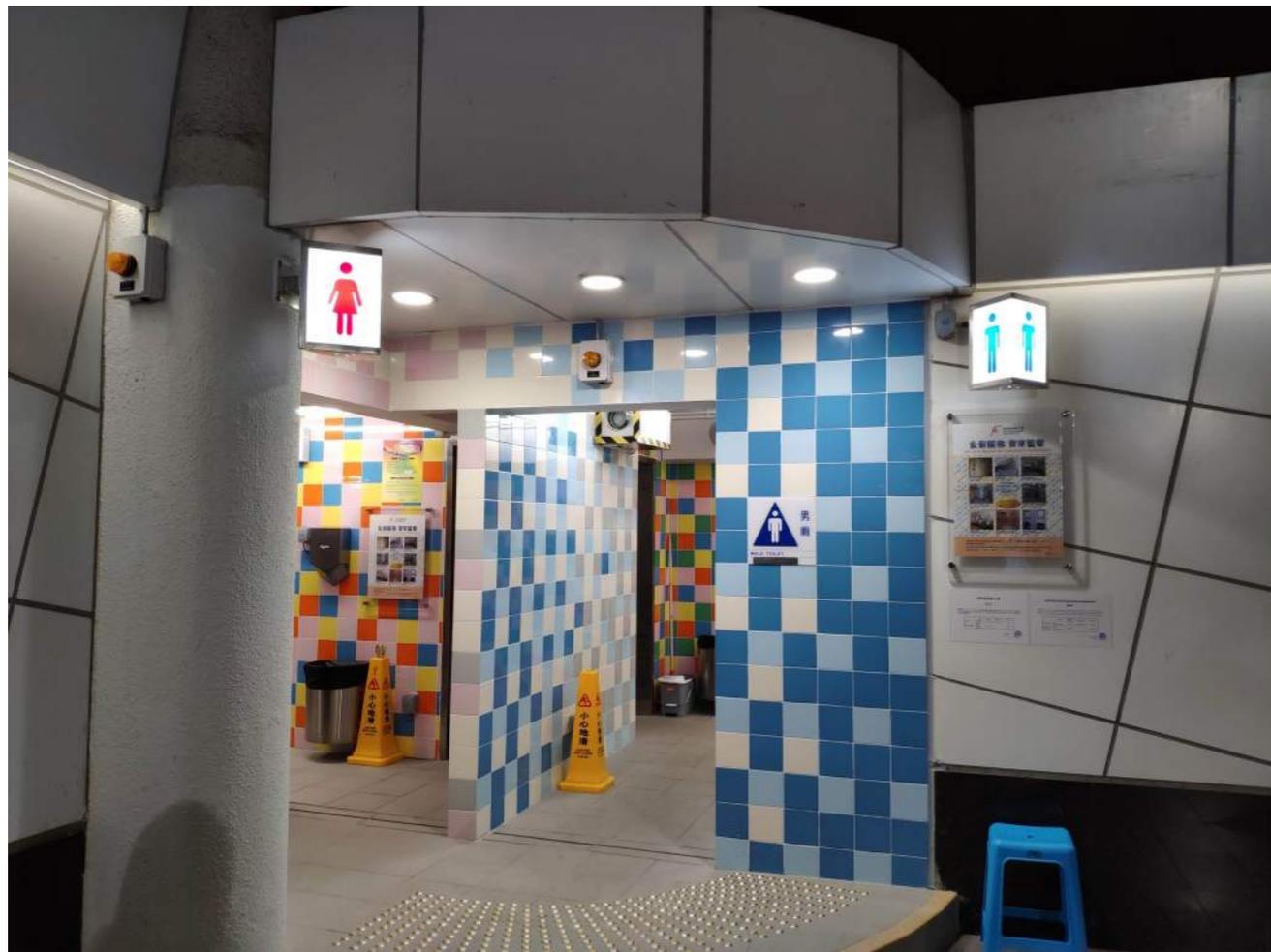
Features

- Come with HEPA filter + CORE nano reactor
- UV-A irradiation and/or plasma driven
- High speed removal of odors, bacteria, formaldehyde, VOCs, NH3 and etc
- Air Treatment Rate (150 CMH)
- Low noise (< 45 db)
- Low power consumption (100W)



Project Reference





FEHD
Toilets

DSD
West Kowloon
Sewage Pumping
Station



Online

IAQ-033

H2S	0 ppm
TVOC	44 ppb
Humidity	50 %
Temp	29.2 °C



Target Energy Solutions Limited
達標能源管理有限公司

Contact Us

Unit 10, 5/F
43-45 Tsun Yip Street,
Kwun Tong, Kowloon,
Hong Kong

Tel: (852) 2345 0298
Email: info@targetensol.com



Appendix I

CORE H50 Air Purifying Unit

Air Flow Rate : 90 CMH

Air Treatment:

- 1) Dust filter
- 2) NAMI PDC plasma generator
- 3) NAMI PCO nano reactor

Power Consumption: 30W

Casing: Stainless Steel

Weight: 10 kg (approx.)

Dimension: 150 x 150 x 420 mm



型號 / Model No.	TES H50 空氣淨化器 / Air Purifying Unit	
適用面積 / Applicable Area (每小時換氣2次, 2 air exchange/hr)	平方尺 / ft2	50 ft2
	平方米 / m2	5 m2
電源 / Power Supply	伏特 / 赫, V/Hz	220V/50Hz
風速 / Fan Speed	級數 / Levels	均速
用電量 / Power Consumption	瓦 / W	30W
風量 / Air Flow Rate	立方米/小時, CMH	90 CMH
音量 / Sound Level	dB(A)	55 dB(A)
空氣處理技術 / Air Treatment Technology	第一階段, 1st Stage	前期濾網 Pre Filter
	第二階段, 2nd Stage	NAMI PCO 納米反應器 + 等離子產生器 NAMI PCO Nano Reactor + NAMI PDC Plasma Generation Unit
產品尺寸 / Dimension	L x W x H (mm)	420 x 150 x 150mm
重量 / Weight	公斤 / kg	10 kg
外殼物料 / Case Material	金屬 / Metal	顏色: 銀色 / Silver

Ceiling Type Model: TES H150

Features

- HEPA filter + NAMI PCO + NAMI PDC plasma generation technology
- High speed removal of odors, bacteria, virus, VOCs, O₃, NH₃, etc
- Two speed Fan – Hi/Lo at 198/165 CMH
- Sound level (approx. 45 dB)
- Power consumption (100W)



型號 / Model No.	TES H150 空氣淨化器 / Air Purifying Unit	
適用面積 / Applicable Area (每小時換氣2次, 2 air exchange/hr)	平方尺 / ft2	250 ft2
	平方米 / m2	25 m2
電源 / Power Supply	伏特 / 赫, V/Hz	220V/50Hz
風速 / Fan Speed	級數 / Levels	高、低速
用電量 / Power Consumption	瓦 / W	100W
風量 / Air Flow Rate	立方米/小時, CMH	Hi: 198 CMH / Lo: 165 CMH
音量 / Sound Level	dB(A)	55 dB(A)
空氣處理技術 / Air Treatment Technology	第一階段, 1st Stage	高效濾網 HEPA Filter
	第二階段, 2nd Stage	NAMI PCO 納米反應器 + 等離子產生器 NAMI PCO Nano Reactor + NAMI PDC Plasma Generation Unit
產品尺寸 / Dimension	L x W x H (mm)	700 x 350 x 370mm
重量 / Weight	公斤 / kg	15 kg
外殼物料 / Case Material	金屬 / Metal	顏色: 白色 / White



Target Energy Solutions Limited
達標能源管理有限公司

Ceiling Mount Model: TES H1000

Features

- HEPA filter + NAMI PCO + NAMI PDC plasma generation technology
- High speed removal of odors, bacteria, virus, VOCs, O₃, NH₃ and etc
- Two speed Fan – Hi/Lo at 2200/1750 CMH
- Sound level (approx. 65 dB)
- Power consumption (400W)



型號 / Model No.	TES H1000 空氣淨化器 / Air Purifying Unit	
適用面積 / Applicable Area (每小時換氣2次, 2 air exchange/hr)	平方尺 / ft2	3300 ft2
	平方米 / m2	330 m2
電源 / Power Supply	伏特 / 赫, V/Hz	220V/50Hz
風速 / Fan Speed	級數 / Levels	高/低速
用電量 / Power Consumption	瓦 / W	400W
風量 / Air Flow Rate	立方米/小時, CMH	Hi: 2,200 CMH / Lo: 1,750 CMH
音量 / Sound Level	分貝 / dB(A)	65 dB(A)
空氣處理技術 / Air Treatment Technology	第一階段 / 1st Stage	高效濾網 HEPA Filter
	第二階段 / 2nd Stage	NAMI PCO 納米反應器 + 等離子產生器 NAMI PCO Nano Reactor + NAMI PDC Plasma Generation Unit
產品尺寸 / Dimension	L x W x H (mm)	1,000 x 580 x 580mm
重量 / Weight	公斤 / kg	35 kg
外殼物料 / Case Material	金屬 / Metal	顏色: 白色 / White

Appendix II

Maintenance Requirements

1. NAMI PCO Nano Reactor (TES T-2000)
 - Regular Inspection - every 6 months

2. NAMI PDC Plasma Generation Unit (TES PDC-2000)
 - Regular Inspection - every 6 months

3. For TES H50/H150/H1000 Air Purifying Unit
 - Regular Inspection - every 6 months

Consumables

1. NAMI PCO Nano Reactor (TES T-2000)
 - No parts or consumable
2. NAMI PDC Plasma Generation Unit (TES PDC-2000)
 - Consumables - fuse, LED, transformer, PDC module (to be replaced when necessary & no need to replace entire device)
3. For TES H50/H150/H1000 Air Purifying Unit
 - Consumables - fuse, LED, fan unit, PDC module (to be replaced when necessary& no need to replace entire device)

Appendix III

Appendix III

IAQ SYSTEM COMPARISON BETWEEN UV, OXYGEN AIR PURIFIER WITH CORE AIR PURIFICATION SYSTEM USING NAMI PCO+PDC TECHNOLOGY

REMOVAL EFFICIENCY	UV	AP	NAMI PCO + PDC
Airborne Bacteria	90 – 95%	90 – 95%	90 – 95%
Ozone, O3	0.00%	25 ppb	< 25 ppb
Airborne Particulates	-	95%	95%
TVOC	-	80 – 85%	80 – 85%
Hydrogen Sulphide, H2S	-	95%	95%
Formaldehyde, HCHO	-	-	80 – 85%
Ammonia, NH3	-	-	80 – 85%
NO	-	-	80%
NO2	-	-	90%
CO	-	-	90%

Note: AP stands for Oxygen Air Purifier or Bio-Oxygen Generator

System Features

1. **GAS REMOVAL** - Specially design for decomposition of bad odor, bacteria, viruses and gas state pollutants like NO_x , H_2S , formaldehyde, VOCs, ammonia NH_3 , carbon monoxide CO & Ozone O_3 by means of high speed catalytic oxidation
2. **SURFACE AREA** - NAMI PCO technology in CORE nano reactor comes with a mesoporous TiO_2 photocatalytic coating immobilised on 3D metal porous filter. It provides a lot more contacting area than others.
3. **SAVE ENERGY** - In our proposed air purification system with NAMI's technology, the power consumption of a typical PDC plasma generation unit is 20 watt.
4. **CLEAN** - NAMI's technology, our proposed IAQ system would produce very minimal by-products (CO_2 and H_2O). (Note: it will not produce ozone)
5. **LONG TERM** - IAQ performance will be consistent without degradation.
6. **EASY TO MAINTAIN** - Very few consumable - only regular filter replacement



PERFORMANCE TEST OF AIR PURIFICATION

18 August 2021

1. INTRODUCTION

CMA Testing & Certification Laboratories was appointed to conduct a performance test on chemical removal efficiency of air purifier.

2. OBJECTIVES

To investigate the removal performance efficiency and the concentration for the following chemicals:

1. Nitric Oxide / Nitrogen Dioxide - Active pump sampling by NIOSH method 6014

3. Methodology

Removal Efficiency of Nitric Oxide / Nitrogen Dioxide

Initial Concentration:

The known concentration of Nitric Oxide / Nitrogen Dioxide gas will be generated gradually and purged into 27 cubic-meter testing chamber. Testing gas will be generated for 10 minutes for stable concentration. The first gas sample will be collected at control chamber immediately; it is the initial gas concentration of the test. The concentration will be controlled within 0.75 to 1.25 ppm. The Nitrogen Dioxide sample(s) that will be collected by sorbent and treated as the "Initial Concentration".

Final Concentration:

After collected the initial sample, the air purifier(s) will be turned on for treating the air for a certain period. Air sample(s) will be collected by sorbent and treated as the "Final Concentration".

Laboratory Test and Calculation:

The Nitrogen Dioxide sample(s) collected in the sorbent were extracted and measured by Flow Injection Analysis (FIA) technique. Results were recorded and removal efficiency was calculated as the following:

$$\% \text{ Removal efficiency} = \frac{\text{initial concentration} - \text{final concentration}}{\text{initial concentration}} \times 100\%$$



Detailed Sampling Procedure of the sampling will be as below:

1. Calibrate the sampling pump with a representative sampler in line.
2. Immediately before sampling, break ends of sampler and attach to pump.
3. Sample at an accurately known flow rate of up to 0.2 L/min.
4. Cap the sampler and transfer to laboratory for analysis.
5. Sorbent in the sampler will be extracted and reacted with color reagent, and NO_x concentration will be measured colorimetrically by FIA.

The Nitrogen Dioxide sample(s) collected in the sorbent

Table 1: summary of the test method

Item	Detection Method	Remark	NIOSH Safety level	Measurement duration
NO/NO ₂	SORBENT TUBE sampling NIOSH 6014	Sampling with lab test;	REL 1 ppm (1.8mg/m ³)	To be confirmed

Remark:

1. Treatment period shall be suggested by the client to ensure that the air purifier will have reached the maximum efficiency.



4. Accreditations and Competency

1. First (1st) Accredited Indoor Air Quality Certification Issuing Body (IAQ CIB) by EPD in Hong Kong.
2. HKIAS Accredited Inspection Body for Indoor Air Quality.
3. HOKLAS Accredited Laboratory under Environmental Testing.



Appendix – HOKLAS Certificate



Hong Kong Accreditation Service
香港認可處

Certificate of Accreditation
認可證書

This is to certify that
特此證明

CMA INDUSTRIAL DEVELOPMENT FOUNDATION LIMITED
香港中華廠商聯合會工業發展基金有限公司

Rm. 1302, Yan Hing Centre, 9-13 Wong Chuk Yeung Street, Fo Tan, Shatin, New Territories, Hong Kong
香港新界沙田火炭黃竹洋街9-13號仁興中心1302室

has been accepted by the HKAS Executive, on the recommendation of the Accreditation Advisory Board, as a
在認可諮詢委員會的建議下獲香港認可處執行機關接受為

HKIAS Accredited Inspection Body
「香港檢驗機構認可計劃」認可檢驗機構

This inspection body meets the requirements of ISO/IEC 17020:2012 as a
Type A Inspection Body
and it has been accredited for performing specific inspections as listed in the scope of accreditation
within the inspection field of

Indoor Air Quality

此檢驗機構符合ISO/IEC 17020:2012對於下述類別檢驗機構所訂的要求
甲類檢驗機構

並獲認可進行載於認可範圍內下述檢驗領域中的指定檢驗工作
室內空氣質素

This accreditation to ISO/IEC 17020:2012 demonstrates technical competence for a defined scope and the operation of an inspection body quality management system (see joint AF-LAC-ISO Communiqué).
此項ISO/IEC 17020:2012的認可資格證明此檢驗機構具備指定範疇內所須的技術能力
並實施一套檢驗機構質量管理體系(見國際認可論壇、國際實驗室認可合作組織及國際標準化組織的聯合公報)。

The common seal of the Hong Kong Accreditation Service is affixed hereto by the authority of the HKAS Executive
現經香港認可處執行機關授權在此蓋上香港認可處的印章

WONG Wang-wah, Executive Administrator
執行幹事 黃宏華
Issue Date: 4 February 2015
簽發日期：二零一五年二月四日

Registration Number:
註冊號碼：HKIAS 015



Date of First Registration: 4 December 2007
首次註冊日期：二零零七年十二月四日



Hong Kong Accreditation Service
香港認可處

Certificate of Accreditation
認可證書

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特此證明

CMA INDUSTRIAL DEVELOPMENT FOUNDATION LIMITED

香港中華廠商聯合會工業發展基金有限公司

Rm. 1302, Yan Hing Centre, 9-13 Wong Chuk Yeung Street, Fo Tan, Shatin, New Territories, Hong Kong

香港新界沙田火炭黃竹洋街9-13號仁興中心1302室

has been accepted by the HKAS Executive, on the recommendation of the Accreditation Advisory Board, as a
為香港認可處執行機關根據認可諮詢委員會建議而接受的

HOKLAS Accredited Laboratory
「香港實驗室認可計劃」認可實驗室

This laboratory meets the requirements of ISO / IEC 17025 : 2005 – General requirements for the competence
此實驗室符合ISO / IEC 17025 : 2005 – 《測試及校正實驗室能力的通用規定》所訂的要求，
of testing and calibration laboratories and it has been accredited for performing specific tests or calibrations as
獲認可進行載於香港實驗室認可計劃《認可實驗室名冊》內下述測試類別中的指定
listed in the HOKLAS Directory of Accredited Laboratories within the test category of
測試或校正工作

Environmental Testing
環境測試

This laboratory is accredited in accordance with the recognised International Standard ISO / IEC 17025 : 2005.
本實驗室乃根據公認的國際標準 ISO / IEC 17025 : 2005 獲得認可。
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory
這項認可實證顯示在指定範疇所需的技術能力及實驗室質量管理體系的運作
quality management system (see joint IAF-ILAC-ISO Communiqué).
(見國際認可論壇、國際實驗室認可合作組織及國際標準化組織的聯合公報)。

The common seal of the Hong Kong Accreditation Service is affixed hereto by the authority of the HKAS Executive
香港認可處根據認可處執行機關的權限在此證書上通用印章

CHAN Sing Sing, Terence, Executive Administrator
執行幹事 陳成城
Issue Date : 5 May 2009
簽發日期：二零零九年五月五日

Registration Number : **HOKLAS 004**
註冊號碼：

Date of First Registration : 3 October 2005
首次註冊日期：二零零五年十月三日



This certificate is issued subject to the terms and conditions laid down by HKAS
本證書按照香港認可處訂立的條款及條件發出

L 000446

Appendix E

Certificate by
Environmental Team,
Mott Donald

Appendix F

Verification Certificate by **Independent** **Environmental Checker**
