

**RELOCATION OF SHA TIN SEWAGE TREATMENT
WORKS TO CAVERNS
UNDER ENVIRONMENTAL PERMIT
NO. EP-533/2017/A**

UPDATED IMPLEMENTATION PLAN

**FOR AIR PURIFICATION SYSTEM
INSTALLED AT AIR SENSITIVE RECEIVERS**

SUBMITTED BY:

**Drainage Services Department
(as the permit holder of the captioned EP)**

DATE:

27 May 2023

1 Introduction

1.1 Further to the commissioning test conducted in September 2022, the owner of Model Train Shop has requested to reduce the number of Air Purifiers (APS) to be installed at the Model Train Shop due to space constraint. Pursuant to Condition 2.29 of the Environmental Permit (EP-533/2017/A, an Updated Implementation Plan (UIP) is hereby deposited with the Director to update the recommendations in Environmental Review Report (ERR) submitted under the application for Variation of Environmental Permit (Application No.: VEP-618/2022) (the VEP application).

2 Justification for Proposed Changes

- 2.1 To consider the minimum number of APS required to meet the Acceptance Criteria, i.e. i) measured daily average of indoor NO₂ concentration at 40 µg/m³ or below; or ii) removal efficiency of 60% or above, on-site measurement was conducted on 21-22 November 2022 following the measurement method as described under Section (B) Commissioning Test Plan of Appendix 3.8E of the ERR submitted under VEP application.
- 2.2 Based on the monitoring results as summarised below and detailed in **Appendix A**, with the deployment of 1 no. of APS, both acceptance criteria could be met.

Date of Measurement	Measured Daily Average of Indoor NO ₂ Conc. (µg/m ³)	Measured Daily Average of outdoor NO ₂ Conc. (µg/m ³)	NO ₂ Removal Efficiency (%)
21-22/11/2022	4.73 (<40)	15.0	68.4 (>60)

3 Recommendations

3.1 As demonstrated by the on-site monitoring conducted on 21-22 November 2022, with the reduced number of APS from 3 nos. to 1 no., the acceptance criteria could still be complied with. It is recommended to update the recommendations in the ERR submitted under the VEP application to the recommendations as shown in **Appendix B**.

Appendix A

Monitoring result

Location	Date and Time	Indoor NO ₂ conc. (µg/m ³) ⁽¹⁾	Outdoor NO ₂ conc. (µg/m ³) ⁽¹⁾	NO ₂ Removal Efficiency (%)
Model Train Shop ⁽²⁾⁽³⁾	11/21/2022 16:00	3.8	19.1	68.4
	11/21/2022 17:00	5.0	25.6	
	11/21/2022 18:00	5.2	14.5	
	11/21/2022 19:00	5.0	12.8	
	11/21/2022 20:00	4.8	10.5	
	11/21/2022 21:00	4.0	9.2	
	11/21/2022 22:00	4.6	8.8	
	11/21/2022 23:00	3.6	8.0	
	11/22/2022 0:00	4.4	6.1	
	11/22/2022 1:00	4.2	5.9	
	11/22/2022 2:00	4.4	4.8	
	11/22/2022 3:00	3.4	5.0	
	11/22/2022 4:00	4.0	4.8	
	11/22/2022 5:00	3.6	8.0	
	11/22/2022 6:00	4.0	11.9	
	11/22/2022 7:00	4.8	21.4	
	11/22/2022 8:00	5.5	24.9	
	11/22/2022 9:00	6.7	20.9	
	11/22/2022 10:00	6.3	23.1	
	11/22/2022 11:00	5.7	30.0	
	11/22/2022 12:00	4.8	24.7	
	11/22/2022 13:00	6.3	17.8	
	11/22/2022 14:00	4.8	20.9	
	11/22/2022 15:00	4.6	20.7	
24-hr average	4.73	15.0		

Notes:

(1) Conversion factor of 1.913 was applied for NO₂ from ppb to µg/m³ at 20°C and at 1 atm.

(2) One unit of instrument was deployed for NO₂ measurements at indoor and outdoor each simultaneously.

(3) NO₂ measurements were carried out for the scenario at which the APS deployed was reduced to one unit as a result of space constraint therein as advised by the premises owner.

Appendix B

Updated Recommendations

(A) Implementation Plan

1) Provision of Air Purifier according to the following table:

Affected ASR	Affected Sensitive Area	Number of Portable Air Purifier	Proposed Air Purifier Model
A52 – North West Tsing Yi Interchange Maintenance Workshops	Workshop Office	2	2 x EC920
Total		2	
A55 – Lantau Link Visitor Centre, Viewing Platform & Model Train Shop	Lantau Link Visitor Centre	3 (for exhibition hall) 1 (for staff office)	3 x EC920 1 x BM150
	Nana Café	1	1 x EC920
	Model Train Shop	1	1 x EC920
Total		6	

(B) Performance Test Plan

- 1) Objective: To evaluate the performance of the Air Purifier
- 2) Schedule: On a monthly basis after commissioning
- 3) Measurement Method:
 - (a) measure the ambient NO₂ concentration at indoor and outdoor simultaneously (measurement locations to be determined by the Environmental Team on site);
 - (b) measure hourly NO₂ concentration in 24 hours to capture daily fluctuation on the measurement date;
 - (c) compare the NO₂ concentration at indoor and outdoor and determine the effectiveness of the Air Purifier.
 - (d) Measurement duration: 1 day
- 4) Acceptance Criteria:

Step 1: Calculate the NO₂ removal efficiency by the following equation:

$$\text{Removal efficiency (\%)} = \frac{\text{Outdoor NO}_2 - \text{Indoor NO}_2}{\text{Outdoor NO}_2} \times 100\%$$

Remark: The Outdoor and Indoor NO₂ concentration are referring to the daily average of the 24 hours NO₂ readings on the measurement day.

Criteria: the NO ₂ removal efficiency shall reach at least 60% or above
--

Remark: 60% is set from the assumption of the past performance in the available job reference and the anticipated fluctuations due to the possible measurement uncertainties.

Step 2: Compare the measured daily average of indoor NO₂ concentration against the absolute value of 40 µg/m³

Criteria: Measured daily average of Indoor NO₂ level shall be at 40 µg/m³ or below

It is to cater for the situation where the initial concentration may be on the low side which is difficult to achieve the target removal efficiency.

5) Action requires if non-compliance:

- (a) Check, clean, maintain or replace the filter(s); or
- (b) Replace the faulty Air Purifier by spare unit(s);
- (c) Repeat the performance test until the acceptance criteria is reached.

(C) Maintenance and Contingency Plan

- 1) If the acceptance criteria as stated in Item B(4) cannot be reached, replacement of the filter or deploy additional Air Purifier.
- 2) 1 no. spare unit is ready for immediate replacement of mal-functioned Air Purifier upon notification.
- 3) Regular maintenance schedule: The HEPA filter shall be replaced every 6 months while the NCCO filter shall be replaced every 3 years under normal operation condition inside this building.

(D) Responsibilities matrix

Actions	Responsibilities Parties
Implementation Plan	The Contractor of DC/2020/05
Commissioning Test Plan	The Environmental Team (for measurement);
Performance Test Plan	The Contractor of DC/2020/05 (for follow-up actions)
Maintenance and Contingency Plan	The Contractor of DC/2020/05

(E) Proposed Measurement Instrument

Proposed Instrument: Aeroqual Air Quality Monitoring Instrument AQS1 equipped with Nitrogen dioxide (NO₂) module [or equivalent]

By the specification, the instrument can reach the resolution of 0.1 ppb. Also, this instrument (AQS1) can achieve a high correlation, i.e. R²>0.9. Please see enclosed the product catalogue, specification and reference for the correlation assessment.