



# **Expansion of Hong Kong International Airport into a Three-Runway System**

Operational Air Quality Monitoring and Audit Plan

April 2023



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**Document reference:** 420831 | D6 | F2

**Information class:** Standard

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# Glossary

<b>2RS</b>	Two-Runway System
<b>3RS</b>	Three-Runway System
<b>AAHK</b>	Airport Authority Hong Kong
<b>AMO</b>	Airport Meteorological Office
<b>AOEC</b>	Airport Operation related Emissions Control
<b>APUs</b>	Auxiliary Power Units
<b>AQM&amp;A</b>	Air Quality Monitoring and Audit
<b>AQMS</b>	Air Quality Monitoring Station
<b>AQOs</b>	Air Quality Objectives
<b>ASRs</b>	Air Sensitive Receivers
<b>DEP</b>	Director of Environmental Protection
<b>EIA</b>	Environmental Impact Assessment
<b>EIAO</b>	Environmental Impact Assessment Ordinance
<b>EM&amp;A</b>	Environmental Monitoring and Audit
<b>EP</b>	Environmental Permit
<b>EPD</b>	Environmental Protection Department
<b>FSP</b>	Fine Suspended Particulate
<b>GSE</b>	Ground Services Equipment
<b>HKIA</b>	Hong Kong International Airport
<b>HKO</b>	Hong Kong Observatory
<b>I-2RS</b>	Interim Two-Runway System
<b>IATA</b>	International Air Transport Association
<b>ICAO</b>	International Civil Aviation Organization
<b>LTO</b>	Landing and Take-off
<b>NO</b>	Nitric Oxide
<b>NO<sub>2</sub></b>	Nitrogen Dioxide
<b>NO<sub>x</sub></b>	Nitrogen Oxides
<b>MGVs</b>	Medium Goods Vehicles
<b>MM</b>	Mott MacDonald
<b>PM<sub>2.5</sub></b>	Particulate Matter 2.5
<b>PM<sub>10</sub></b>	Particulate Matter 10
<b>RSP</b>	Respirable Suspended Particulate
<b>T2</b>	Terminal 2

# 1 Introduction

## 1.1 Background

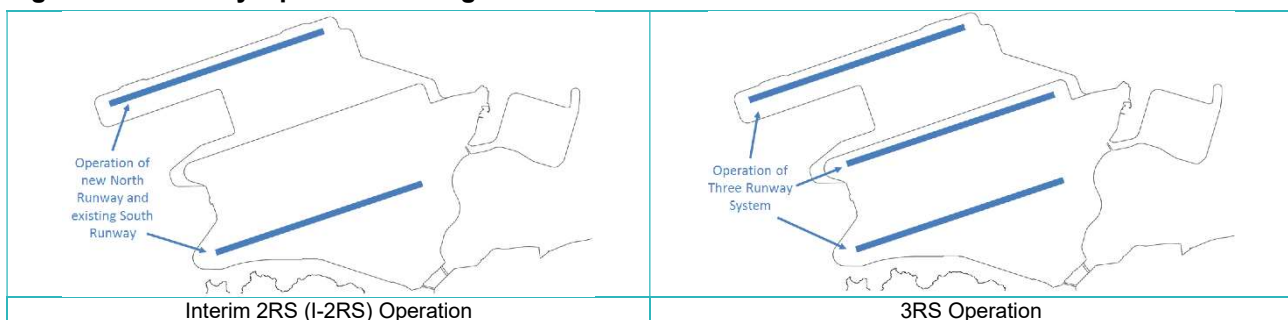
Under the Environmental Impact Assessment Ordinance (EIAO), the Environmental Impact Assessment (EIA) Report and the Environmental Monitoring and Audit (EM&A) Manual (Register No.: AEIAR-185/2014) prepared for the “Expansion of Hong Kong International Airport into a Three-Runway System” (hereafter referred to as the “3RS Project” or the Project ) have been approved by the Environmental Protection Department (EPD), and an Environmental Permit (EP) (Permit No.: EP-489/2014) has been issued for the Project.

The Project is planned to be located on a new land formation area immediately north of existing Hong Kong International Airport (HKIA) in North Lantau, covering a permanent footprint of approximately 650 ha. As stated in the approved 3RS EIA, the Project primarily comprises:

- New third runway with associated taxiways, aprons and aircraft stands;
- New passenger concourse building;
- Expansion of the existing Terminal 2 (T2) building; and
- Related airside and landside works, and associated ancillary and supporting facilities.

As presented in the approved 3RS EIA Report, the runway operational configuration will be implemented in phases as shown in **Figure 1.1** below. Upon completion of the new third runway and associated taxiways and with operation familiarisation of the third runway started on 8 July 2022 and formal commencement of operation started since 25 November 2022, the previous north runway is closed temporarily for modification works. During this period as described in the approved 3RS EIA Report, the existing South Runway and the new third runway (which is designated as the new North Runway) is currently in operation, which is hereafter referred to as the interim two-runway system (I-2RS). Upon completion of all essential infrastructure and facilities, the airport will be operated under the 3RS, which is hereafter referred to as the 3RS operation.

**Figure 1.1: Runway Operation Configuration**



The operational phase air quality impact assessment undertaken as part of the 3RS EIA had assessed the potential air quality impact on air sensitive receivers (ASRs) identified within 5km from the project boundary based on the highest aircraft emission scenario under normal operating conditions of the Project in accordance with the EIA Study Brief requirements.

As summarised in Section 5.3.7.1 of the approved 3RS EIA Report, no non-compliance against the Air Quality Objectives (AQOs) has been predicted at all the identified ASRs during the operation of the Project. Nevertheless, the Airport Authority Hong Kong (AAHK) has been implementing a number of measures and initiatives aimed at further reduction in air emissions from airport activities and operations at HKIA, and these efforts are expected to continue in the current I-2RS and subsequent 3RS operation.

Besides, pursuant to EP Condition 3.1(vi), Section 2.2 of the EM&A Manual was updated to include details of the air quality monitoring and audit requirements during the operation of the Project, and AAHK had committed

to carrying out regular reviews of the operation phase air quality monitoring results and relevant operation data in order to:

- Monitor the variations in pollutant concentrations and compare these with the operational phase air quality assessment results presented in the 3RS EIA Report;
- Determine the effectiveness of AAHK's measures and initiatives aimed at further reducing air pollutant emissions from airport activities and operations; and
- Identify follow-up actions and/or further investigation that may be undertaken where necessary with a view to further reducing air emissions associated with the operation of the Project.

Details of the operational phase air quality monitoring and audit (AQM&A) programme planned by AAHK are presented in this AQMA Plan.

Mott MacDonald (MM) has been appointed by AAHK as the Consultant to provide consultancy services for the 3RS Project, which include, among others, the preparation of this AQM&A Plan.

## 1.2 Purpose of this Plan

This AQM&A Plan has been prepared to set out details of the operational phase air quality monitoring and audit programme planned by AAHK, and these have taken into account AAHK's commitments set out in Section 2.2 of the Updated EM&A Manual.

## 1.3 Structure of this Plan

Following this introductory section, this AQM&A Plan is structured as follows:

Section 2	Overview of the Proposed Air Quality Monitoring and Audit Programme
Section 3	Regular Review of Air Quality Monitoring Results
Section 4	Regular Review of Emissions Inventory
Section 5	Regular Review of Effectiveness of Measures and Initiatives

## 2 Overview of Proposed Air Quality Monitoring and Audit Programme

### 2.1 AQM&A Program Elements

As described in Section 5.3.7.1 of the approved 3RS EIA Report, no non-compliance against the Air Quality Objectives (AQOs) has been predicted at all of the identified ASRs during the operation phase of the 3RS Project. Nevertheless, AAHK has been implementing a number of measures and initiatives aimed at further reduction in air emissions from airport activities and operations, and these efforts are expected to continue in the current I-2RS and subsequent 3RS operation.

Moreover, in preparing the Updated EM&A Manual, AAHK has made a commitment to undertake air quality monitoring and audit on a regular basis during the 3RS operation. As set out in Section 2.2 of the Updated EM&A Manual, the AAHK's AQM&A programme will consist of following key elements:

- **Regular Review of Air Quality Monitoring Results:**
  - Monitoring data obtained from the three existing air quality monitoring stations (AQMSs) currently operated by AAHK at HKIA, together with that obtained at Tung Chung AQMS operated by EPD will be used in the regular review of air quality monitoring results (Section 2.2.2.2 of the Updated EM&A Manual refers);
  - NO<sub>2</sub> is the key parameter for which available monitoring data obtained at AAHK's AQMS together with that obtained at EPD's AQMS in Tung Chung should be regularly reviewed during the operational phase of the Project. The regular review shall also analyse and present the measured NO and NO<sub>x</sub> concentrations for estimating the pollutant contribution due to airport operations (Section 2.2.2.6 of the Updated EM&A Manual refers);
  - To be prudent, available monitoring data on respirable suspended particulate (RSP) and fine suspended particulate (FSP) should also be included in the regular reviews (also see Section 2.2.2.6 of the Updated EM&A Manual);
  - A detailed examination of the temporal and spatial variations of pollutant levels measured at AAHK's AMSs shall be presented and the analysis shall take into consideration the available monitoring data obtained at EPD's AQMS in Tung Chung. With consideration of the available data including those on meteorological conditions (i.e., wind direction, wind speed, temperature, precipitation, etc.), the review shall also characterise the mean seasonal and diurnal variation of pollutant concentrations, with a view to evaluating the significance of the contribution of air quality impact from airport emissions on the nearby ASRs (Section 2.2.3.1 of the Updated EM&A Manual refers).
  
- **Regular Review of Emissions Inventory:**
  - The regular review shall include the compilation of an updated inventory of major emission sources, including emissions from aircraft landing and take-off (LTO) cycle associated with the airport operations (Section 2.2.3.1 of the Updated EM&A Manual refers); and
  
- **Regular Review of Effectiveness of Measures / Initiatives:**
  - The effectiveness of existing measures and initiatives implemented by AAHK aimed at further reducing air pollutant emissions from airport operation shall be evaluated (Section 2.2.3.2 of the Updated EM&A Manual refers).

As summarised above, based on the approved 3RS EIA Report, the Updated EM&A Manual had recommended that the AQM&A programme that AAHK has planned to do will focus on NO<sub>2</sub> and NO<sub>x</sub>, though RSP and FSP may also be covered as a prudent approach. While the AQM&A programme will be delivered as planned by AAHK and the details are presented in **Sections 3 to 5**, it is worth noting that background air quality in Hong Kong including the districts near HKIA has been improving and these are well reflected via the air quality monitoring data obtained in recent years at HKIA's AQMS and also at EPD's AQMS in Tung Chung as summarised below:

- The annual concentrations of NO<sub>2</sub> had been reduced from 43-51 µg/m<sup>3</sup> monitored between years 2008 to 2012 (i.e., exceeding the AQO of 40 µg/m<sup>3</sup> specified for annual NO<sub>2</sub>, as reported in Table 5.1.9 of the approved 3RS EIA Report) to 28-40 µg/m<sup>3</sup> obtained between years 2015 to 2020 (i.e., meeting the above-mentioned AQO as summarised in Table A.1 in **Appendix A**) at EPD's AQMS in Tung Chung; and
- The number of exceedance of the AQOs specified for 1-hour NO<sub>2</sub> at EPD's AQMS in Tung Chung had also been reduced from a maximum of 20 reported for year 2010 (i.e., exceeding the allowable exceedance of 18, as also reported in Table 5.1.9 of the approved 3RS EIA Report) to a maximum of 7 reported for years 2015 and 2018 (i.e., much less than the allowable exceedance of 18, as summarised in Table A.2 in **Appendix A**). Years 2019 and 2020 showed no exceedance of the 1-hour AQO for NO<sub>2</sub> at EPD's AQMS in Tung Chung.

From Tables A.1 and A.2 in **Appendix A**, it is also worth noting that while the air traffic movements (ATMs) at HKIA in 2020 had been significantly affected as a result of the COVID-19 pandemic, reducing from a total of 420,000 in year 2019 to 161,000 in year 2020 (see: <https://www.hongkongairport.com/en/the-airport/hkia-at-a-glance/fact-figures.page>) and representing a drop of more than 60% in ATMs, the annual concentrations of NO<sub>2</sub> monitored at EPD's AQMS in Tung Chung had only reduced for 15% from 32.9 µg/m<sup>3</sup> to 27.9 µg/m<sup>3</sup>, reflecting that there are other more significant sources of NO<sub>2</sub> at this AQMS though there are also contribution from the HKIA operation.

## 2.2 EP Submission

The Airport Operation related Emissions Control (AOEC) Plan has been prepared to satisfy the EP Condition 2.24, which is reproduced below. Taking into account the findings of the AQM&A programme, including the regular review of air quality monitoring results and emission inventory, the effectiveness of the measures and initiatives implemented by AAHK aimed at further reducing air pollutant emissions from the airport operation may be reviewed.

*The Permit Holder shall, no later than 3 months before the operation of the Project, deposit 3 hard copies and 1 electronic copy of an Airport Operation related Emissions Control Plan with the Director, detailing the measures to be taken to minimize and control the emissions due to the airport operation including but not limited to adopting fuel-efficient airside vehicles, promoting increased use of electric vehicles and electric ground services equipment, banning all idling vehicles on the airside and utilizing clean diesel and gasoline at the airfield.*

# 3 Regular Review of Air Quality Monitoring Results

## 3.1 Regular Review of Pollutant Concentration Data

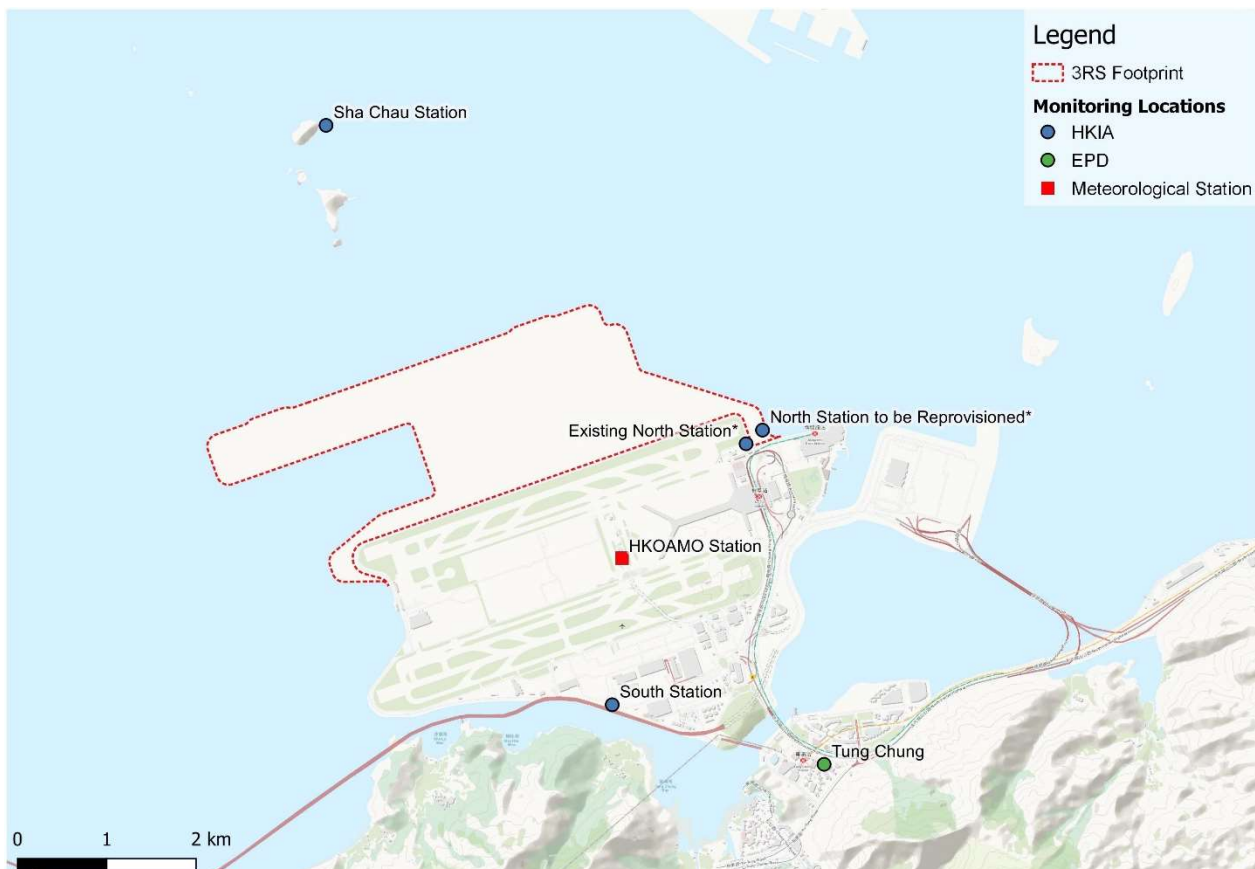
AAHK has made a commitment via the Updated EM&A Manual to undertake regular reviews of NO<sub>2</sub>, though RSP and FSP may also be covered as a prudent approach.

Pollutant concentration data for the above-mentioned pollutants will be collected using the following existing AQMS operated by AAHK. Their current locations are presented in **Figure 3.1**:

- North Station (PH1) at north of the main terminal building;
- South Station (PH5) at South Perimeter Road; and
- Sha Chau Station (SC) on Sheung Sha Chau island.

In addition to analysing the pollutant concentrations from data obtained from AAHK's three AQMS, pollutant concentrations measured at EPD's AQMS in Tung Chung (also see **Figure 3.1** for its location) will also be included within the analysis. The required data will be obtained from EPD for the review.

**Figure 3.1: Location of Air Quality Monitoring Stations**



\*Note: Due to planned decommissioning of the current Seawater Pump House 1 (SWPH-1), the existing North Station situated at the current SWPH-1 is planned to be re-provisioned at the new SWPH-1 in 2024 as shown above.

The existing techniques and equipment used by AAHK's contractor in air quality monitoring have been reviewed by the consultant as the Environmental Team (ET) and these are considered appropriate for use in ongoing measurements of the air pollutant concentrations in the current I-2RS and subsequent 3RS operation.

A summary of the annual mean and hourly data for AAHK's three AQMS at PH1, PH5 and SC as well as EPD's AQMS at Tung Chung will be included as part of the regular reviews. Such data will be analysed to identify any changes in long term trends of the data recorded at these monitoring locations. Annual mean concentrations of NO<sub>2</sub>, NO, NO<sub>x</sub>, RSP and FSP recorded at these four AQMS are presented in **Appendix A** for the years 2015 – 2020 to provide an example of the data and how these may be presented.

## 3.2 Temporal and Spatial Analysis

### 3.2.1 Approach

In addition to presenting summary tables of monitored pollutant concentrations as described in **Section 3.1** above, relevant temporal and spatial analysis of the monitored pollutant concentrations using measured data from the three AAHK's AQMS and also EPD's AQMS at Tung Chung will be undertaken on a regular basis as part of the review.

These analysis may focus on investigating into the differences in concentrations between monitoring locations, for example, obtained via subtracting concentrations recorded at Sha Chau Station from those obtained at the South Station under the northern wind direction at the same time. In the event more detailed statistical analysis is required, for example if monitored concentrations show an upward trend, or the simple analysis indicates the airport contribution to pollutant concentrations may be increasing, the following types of interrogation may be undertaken as further analysis:

- Time Variation Graphs - showing the average variation of pollutant concentrations by day of the week and hour of the day combined, hour of the day (diurnal variation), month of the year (seasonal variation) and day of week;
- Polar Plots - pollutant concentrations by wind speed and wind direction to show a graphical representation of the relationship between pollutant concentrations and the meteorological conditions;
- Polar Frequency Plots - to visualise the distribution of wind speeds and directions at each monitoring site showing the variation of pollutant variables;
- Trend Analysis – to calculate the smoothed trend line at each monitoring station in the period since it started operating, in order to see if, and to what extent air quality may be improving.
- De-weathering - to enable the effects of meteorological and temporal factors to be nominally removed to then allow the identification of the changes in concentrations which would, in theory, have been recorded if meteorological conditions and temporal influences had remained constant, thus identifying what changes in concentrations (and thus emissions) have taken place.

Taking into account the findings of the operational phase air quality assessment presented in the approved 3RS EIA Report when NO<sub>2</sub> was identified to be the key parameter of interest as reported above, it is considered that analysis will focus on NO<sub>2</sub>. However, the regular review shall also analyse and present the measured NO and NO<sub>x</sub> concentrations to facilitate analysis of pollutant contribution due to the airport operations.

### 3.2.2 Meteorological Data

Hong Kong Observatory (HKO) currently operates an Airport Meteorological Office (AMO) at the airport. The available meteorological data recorded by AMO will be taken into consideration in the detailed statistical analysis of air quality and meteorological datasets.

### 3.3 Review Frequency

As per Section 2.2.2.7 of the Updated EM&A Manual, the NO<sub>2</sub>, RSP and FSP monitoring data shall be reviewed after the first year of 3RS operation, and then at regular intervals of at least every five years during the first 20 years of operation. The frequency of the reviews may be subject to changes depending on the review results.

## 4 Regular Review of Emissions Inventory

### 4.1 Introduction

In addition to the regular review of monitoring results, AAHK has also made a commitment via the Updated EM&A Manual that the regular review shall include the compilation of an updated inventory of major emission sources, including emissions from aircraft in the landing and take-off (LTO) cycle associated with the airport operations. AAHK will collect relevant information for development of the latest airport emissions inventory as part of the review.

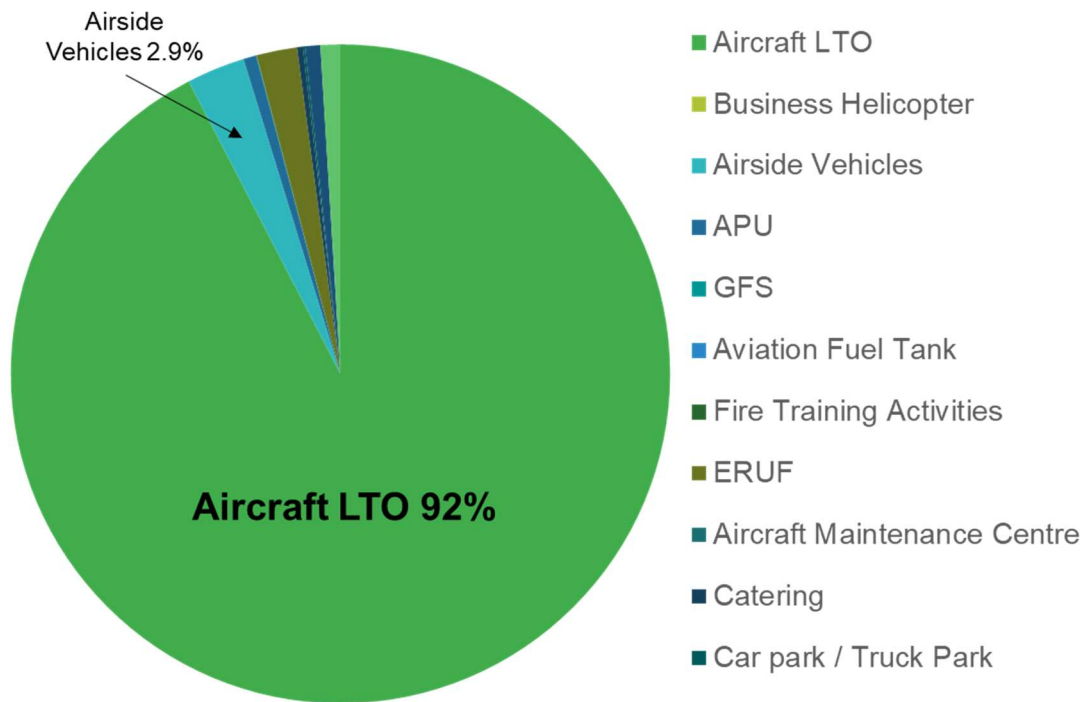
### 4.2 Approach to Emissions Inventory Compilation

The principal application of an updated emission inventory of major emission sources, to be delivered as part of the planned AQM&A programme, is to provide updated airport operation related data regularly to facilitate an evaluation of the effectiveness of the various measures and initiatives that have been implemented, in progress, or planned for implementation by AAHK for further reducing the air pollutants from airport operation.

Based on Table 5.3.59 of the approved 3RS EIA Report, which is reproduced in the form of a pie chart as shown in **Chart 4.1**, the most significant airport-related emission source is from aircraft in the LTO cycle, most notably for NO<sub>x</sub> where emissions in the aircraft LTO represent 92% of airport-related emissions. Airside vehicles, including ground services equipment (GSE), have been identified to be the next most dominant NO<sub>x</sub> emissions representing 2.9% of airport-related emissions.

According to Section 2.2.2.5 of the Updated EM&A Manual, NO<sub>x</sub> is the key air pollutant associated with airport operations. Therefore, to meet the commitment made by AAHK with respect to compiling an updated inventory of major emission sources as presented in Section 2.2.3.1 of the Updated EM&A Manual, it is considered that the periodic updating of the airport-related emissions inventory may focus on the top two highest emission sources, namely, aircraft LTO and airside vehicles, including GSE, which have, in aggregate, already accounted for 94.9% of airport-related NO<sub>x</sub> emissions.

**Chart 4.1: Summary of 3RS Emission Inventory for Airport Related Activities**



Note: Derived from Table 5.3.59 of the approved 3RS EIA Report.

### Emissions from Aircraft Landing and Take-off

Regarding the LTO cycle, the regular review shall focus on establishing an updated emissions inventory for a specific emission scenario or for a specific year based on available airport operational data at HKIA. The emission calculations shall be undertaken with consideration of aircraft fleet mix and movement data available for the 3RS operation at HKIA. Similar to the detailed analysis undertaken at the 3RS EIA stage, estimates of take-off time, climb-out time and approach time shall take into account the differences in performance of different aircraft, with consideration of available radar data that could be obtained from the Civil Aviation Department. The taxi-in and taxi-out time of aircraft shall also take into account operational data obtained by AAHK in the 3RS operation. Emissions characteristics of engines shall be derived from the International Civil Aviation Organisation (ICAO) aircraft engine emissions databank. Where data are not available for use in the emissions calculation, relevant assumptions will be made in the analysis.

Emissions for aircraft in LTO cycle (LTO nominally up to 3,000 feet or 914.4 metres above ground level) were calculated in the 3RS EIA Report by using ICAO engine exhaust emission data. The same approach may be used for the updated emissions inventory. This will include the same approach chosen to represent approach, taxi/idle, take-off and climb, as illustrated below:

- |                       |                                    |   |  |
|-----------------------|------------------------------------|---|--|
| ● Taxi:               | ● Take-off:                        | ● Climb:                                    | ● Approach:                                    |
| – taxi-out            | – take-off roll                    | – initial climb                             | – approach                                     |
| – hold at runway head | (from start-of-roll to wheels-off) | (i.e., wheels-off to throttle-back)         | (from 3,000 feet altitude to runway threshold) |
| – taxi-in             |                                    | – climb-out                                 | – landing roll                                 |
|                       |                                    | (from throttle-back to 3,000 feet altitude) | (from threshold to runway exit)                |

## **Emissions from Airside Vehicles and GSE**

In addition to the LTO cycle related emissions, progress in reducing emissions from airside vehicles and GSE, for which the details have been presented in the AOEC Plan, may be tracked via the establishment of relevant performance indicators, including number and percentage use of airside electric vehicles and electric GSE, and also total fuel consumption by non-electric airside vehicles and GSE on the airside.

Where further analysis is identified necessary for a specific emission scenario or year via development of an updated emissions inventories of airside vehicles and GSE, relevant airport operational data, including the distribution and characteristics of airside vehicles and GSE used at HKIA for the year of interest in the 3RS operation and vehicle fuel consumption data, etc. will be collected for analysis in development of the updated emissions inventory. Where data are not available, relevant assumptions will be made in the analysis.

### **4.3 Review Frequency**

As per Section 2.2.2.7 of the Updated EM&A Manual, the updated emission inventories of LTO cycle and also performance indicators/ updated emission inventories of airside vehicles and GSE may be reviewed after the first year of 3RS operation, and then at regular intervals of at least every five years during the first 20 years of operation. The frequency of the reviews may be subject to changes depending on the review results.

## 5 Regular Review of Effectiveness of Measures and Initiatives

### 5.1 Updated EM&A Manual Requirements

As presented in Section 2.2.3.2 of the Updated EM&A Manual, AAHK has committed to evaluating the effectiveness of existing and planned measures and initiatives implemented at HKIA for minimising and controlling the emissions due to the airport operation. These will allow follow-up actions and/or further investigation work to be undertaken, where necessary, with a view to further reducing air emissions associated with the operation of the Project.

### 5.2 Review Process

The AOEC Plan has been prepared in accordance with the EP Condition 2.24. The airport operation related emissions control measures that are already implemented, in progress, or planned for implementation at HKIA, are as summarised in **Table 3.1** of the AOEC Plan, with the following key categories:

- Banning idling engines – implemented;
- Promoting increased use of airside electric vehicles – Phase 1 implemented; Phase 2 in-progress; and Phase 3 planned for implementation;
- Promoting increased use of electric GSE – Phase 1 implemented; Phase 2 in-progress; and Phase 3 planned for implementation;
- Development of airside electric vehicle and electric GSE charging infrastructure – partly completed and partly in progress;
- Adopting fuel-efficient airside vehicles – partly completed and partly in progress;
- Utilizing clean diesel and gasoline at the airfield – partly completed and partly in progress.

As detailed in **Section 4.2** above, relevant performance indicators, including number and percentage use of airside electric vehicles and electric GSE, and also total fuel consumption by non-electric airside vehicles and GSE on the airside, will be established for tracking the process of emissions reduction. Further analysis via development of an updated emissions inventories of airside vehicles and GSE for a specific emission scenario or year would also be undertaken where necessary. Therefore, through the regular review of emissions from airside vehicles and GSE as part of the periodic emission inventory updating exercise, the effectiveness of these measures in reducing emissions associated with airside vehicles and GSE will be monitored.

Taking into account the findings of the AQM&A programme, including the regular review of air quality monitoring results and emissions inventories as presented in Sections 3 and 4 above, the effectiveness and implementation status of the existing and planned measures and initiatives aimed at further reducing air pollutant shall be regularly reviewed for identification of any required follow-up actions and/or further investigation.

### 5.3 Review Frequency

As per Section 2.2.2.7 of the Updated EM&A Manual, the effectiveness of the measures and initiatives will be reviewed after the first year of 3RS operation, and then at a regular interval of at least every five years during the first 20 years of 3RS operation. The frequency of the reviews may be subject to changes depending on the review results.

# Appendices

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## A. Data Presentation Examples for Regular Reporting of Monitored Pollutant Concentrations

**Table A.1: Annual Mean Concentrations of Air Pollutants in Years 2015 - 2020**

Site	Year	Annual Mean Conc. ( $\mu\text{g}/\text{m}^3$ ) <sup>a</sup>		
		NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
Sha Chau Station	2015	37.4	35.5	24.5
	2016	38.1	28.0	21.0
	2017	39.5	26.7	22.4
	2018	35.7	28.4	19.7
	2019	33.4	37.1	24.1
	2020	29.4	33.1	20.2
North Station	2015	<b>45.9</b>	37.7	24.7
	2016	<b>47.3</b>	30.5	19.7
	2017	<b>45.6</b>	35.7	24.6
	2018	<b>43.6</b>	30.0	17.8
	2019	<b>40.4</b>	31.4	18.4
	2020	35.7	23.8	15.6
South Station	2015	<b>48.8</b>	24.2	17.5
	2016	<b>48.6</b>	24.7	17.4
	2017	<b>51.6</b>	28.4	18.4
	2018	<b>50.4</b>	31.0	18.5
	2019	<b>45.6</b>	24.1	14.0
	2020	38.0	21.4	12.9
Tung Chung Station	2015	39.8	36.2	22.0
	2016	35.9	32.5	21.0
	2017	35.6	34.1	20.8
	2018	33.1	31.3	17.5
	2019	32.9	30.4	19.3
	2020	27.9	25.1	14.2
<b>Objective</b>		<b>40</b>	<b>50</b>	<b>35</b> <sup>b</sup>

<sup>a</sup> Exceedances of the objectives are shown in **bold**. Those happening at the North or South Stations are expected as these stations are located close to the emission sources at the airport.

<sup>b</sup> This is the historical AQO for annual PM<sub>2.5</sub> which was effective from 1 January 2014 to 31 December 2021. The prevailing AQO for annual PM<sub>2.5</sub> which has become effective since 1 January 2022 is 25  $\mu\text{g}/\text{m}^3$ .

**Table A.2: Exceedances of the Short term AQOs in Years 2015 - 2020**

Site	Year	Number of Exceedances <sup>a</sup>		
		1-hour Mean NO <sub>2</sub>	24-hour Mean PM <sub>10</sub>	24-hour Mean PM <sub>2.5</sub>
Sha Chau Station	2015	11	6	6
	2016	5	1	1
	2017	9	1	1
	2018	15	0	1
	2019	1	6	3
	2020	0	0	0
North Station	2015	13	6	5
	2016	4	2	0
	2017	14	2	2
	2018	<b>22</b>	2	2
	2019	0	0	0
	2020	0	0	0
South Station	2015	11	2	2
	2016	1	1	1
	2017	1	0	0
	2018	12	1	2
	2019	2	0	0
	2020	0	0	0
Tung Chung Station	2015	7	8	5
	2016	0	6	4
	2017	2	5	2
	2018	7	2	2
	2019	0	2	1
	2020	0	0	0
Allowable Number of Exceedances over the Corresponding Objective <sup>b</sup>		<b>18</b>	<b>9</b>	<b>9<sup>c</sup></b>

<sup>a</sup> Number of exceedances beyond the allowable number of exceedances are shown in **bold**. Those happening at the North or South Stations are expected as these stations are located close to the emission sources at the airport.

<sup>b</sup> This included the AQO of 200 µg/m<sup>3</sup> set out for 1-hour NO<sub>2</sub>, the AQO of 100 µg/m<sup>3</sup> set out for 24-hour PM<sub>10</sub> and also the historical AQO of 75 µg/m<sup>3</sup> from 1 January 2014 to 31 December 2021 set out for 24-hour PM<sub>2.5</sub>. The prevailing AQO sets out for 24-hour PM<sub>2.5</sub> which has become effective since 1 January 2022 is 50 µg/m<sup>3</sup>.

<sup>c</sup> This is the allowable number of exceedances under the historical AQO for 24-hour PM<sub>2.5</sub> which was effective from 1 January 2014 to 31 December 2021. Under the prevailing AQO for 24-hour PM<sub>2.5</sub> which has become effective since 1 January 2022, the allowable number of exceedances is 35.