Odour Monitoring Report for Harbour Area Treatment Scheme Stage 2A (Operational Phase) (October 2022)

Report No.: OT_2022014

Prepared by: _____

Tang Chung Hang, Frankie

Reviewed by: _____

Lo Ting Yi, Ivy

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1. Introduction

1.1. Background

1.1.1. Bestwise – Sun Fook Kong Joint Venture (the Contractors) appointed 3NV Technology Limited (3NV) to undertake the Odour Monitoring for the Operational Phase of the Harbour Area Treatment Scheme Stage 2A (hereafter referred to as "the Project").

1.1.2. The Project is reference to Environmental Permit No. EP-322/2008/G issued on 9th May 2014 by the Environmental Protection Department (hereinafter called EPD) to the Drainage Services Department (hereinafter called the DSD) as the Permit Holder and the EM&A Manual for the HATS Stage 2A.

1.1.3. The odour measurement and odour patrol shall be conducted in the first five years upon commissioning of the expanded SCISTW. For the 1st year, odour monitoring shall be conducted every three months. For the 2nd to 5th year, if the monitoring results from the 1st year comply with the requirements stated in Section 2.38 and Section 2.41 of EM&A Manual, the frequency of the monitoring could be reduced to once every 6 months subject to EPD's approval.

1.2. Objectives of the monitoring

1.2.1. The objective of odour patrol and odour measurement is to compare the result obtained from the operational phase with the baseline data at the designated points in order to determine the impact from the operation.

1.3. Objectives of the Report

1.3.1. The purpose of the odour monitoring report for the operational phase is to provide analysis and graphical presentation to determine if there are any changes of odour impacts with respect to the implementation of HATS Stage 2A.

2. Odour Patrol

2.1. Monitoring Requirement

2.1.1. An odour patrollist with at least 3 independent trained personnel / competent persons, will be provided to conduct the odour patrol work at 23 designated odour monitoring locations and at the site boundary of 8 PTW and the SCISTW. The patrollist will be "calibrated" with reference to European Standard Method: BS EN13725 to ensure the patrollist odour sensitivity within 20-80 ppb/V. The

Odour Certificates are shown in **Appendix B**.

2.1.2. The monitoring shall not be conducted on rainy days. Meteorological conditions including ambient temperature, relative humidity, wind speed and wind direction will be recorded with photo showing the sampling locations during each monitoring.

2.1.3. The independent trained personnel / competent persons shall:

- have their individual odour threshold of n-butanol in nitrogen gas in the range of 20 to 80 ppb/v required by the European Standard Method (EN 13725).
- be at least 16 years of age and willing and able to follow instructions.
- be free from any respiratory illnesses.
- be engaged for a sufficient period to build up and monitor/detect at several monitoring location;
- not be allowed to smoke, eat, drink (except water) or use chewing gum or sweets 30 min before and during odour intensity analysis;
- take great care not to cause any interference with their own perception or that of others by lack of personal hygiene or the use of perfumes, deodorants, body lotions or cosmetics;
- not communicate with each other about the results of their choices.

2.2. Monitoring Frequency

2.2.1. Odour Patrol shall be conducted every three months for the first year of operation for 8 PTWs and expended SCISTW. The first odour monitoring shall be conducted within one month, after the operation of the upgraded PTWs and expended SCISTW. Subsequent odour monitoring shall be conducted at the 4th, 7th and 10th month.

2.3. Monitoring Location

2.3.1. According to section 2.23 of the EM&A Manual, odour patrol monitoring will be conducted at the odour monitoring locations listed in **Table 2.1** and at the site boundary of 8 PTWs and SCISTW.

2.3.2. The layout of odour patrol monitoring locations is shown in **Appendix A**.

Table 2.1 Odour Patrol Monitoring Locations

ASR ID in EIA Report	Monitoring Station ID	Location
NP3	OM_NP1	King's Road Playground & Skating Area
NP4	OM_NP2	Customs HQ Tower (planned)
NP5	OM_NP3	K. Wah Centre
WC3	OM_WC1	Society for the Prevention of Cruelty to Animals
WC4	OM_WC2	Rest Garden near Wan Chai Interchange
C1	OM_C1	Sheung Wan Fire Station
C2	OM_C2	Water Front Divisional Police Station
C3	OM_C3	Sheung Wan Gala Point
FM2	OM_FM1	Western Wholesale Food Market
SB1	OM_SB1	University of Hong Kong Stanley Ho Sports Centre Pitch
SB2	OM_SB2	Home for the Elderly
SB3	OM_SB3	Maclehose Medical Rehabilitation Centre
SB4	OM_SB4	The Duchess of Kent Children's Hospital
CB1	OM_CB1	Cyber Centre
CB2	OM_CB2	Le Meridien Cyberport
WF2	OM_WF1	Wah Ming House, Wah Fu Estate
AB4	OM_AB1	Dairy Farm Ice and Cold Storage

ALC3	OM_ALC1	Shell Ap Lei Chau Depot
SCI1	OM_SCI1	Government Dockyard Offices
SCI3	OM_SCI2	COSCO Hit Terminal
SCI4	OM_SCI3	KMB Depot Office
SCI5	OM_SCI4	Planned FSD Diving Rescue and Diving Training Centre
SCI6	OM_SCI5	Club House

2.4. Monitoring Parameters

2.4.1. During the patrolling, the meteorological and surrounding information are recorded:

- the prevailing weather condition;
- the wind direction;
- the wind speed;
- location where odour is spotted;
- source of odour;
- perceived intensity of the odour;
- duration of odour; and
- characteristics of the odour detected
- some relevant meteorological data such as daily average temperature, and daily average humidity, on the day of odour patrol should be obtained from the nearest Hong Kong Observatory station for reference.

2.4.2. The perceived intensity is to be divided into 5 levels which are ranked in a descending order as shown in **Table 2.2**.

Table 2.2 Description of Odour Intensity Levels

Odour Level	Odour Intensity	Classification Criteria
0	Not detected	No odour perceives or an odour so weak that it cannot be easily characterised or described
1	Slight	Slight identifiable odour, and slight chance to have odour nuisance
2	Moderate	Moderate identifiable odour, and moderate chance to have odour nuisance
3	Strong	Strong identifiable, likely to have odour nuisance
4	Extreme	Extreme severe odour, and unacceptable odour level

3. Odour Patrol Monitoring Result

3.1. Odour Intensity

3.1.1. The odour patrol monitoring result on 21st October 2022 is summarized in **Table 3.1**. The field record and photo record at the ASRs during the patrols are attached in **Appendix C**.

Table 3.1 Summary of the Odour Patrol Results

Monitoring Location	Odour Patrol Member		
	O-1	O-2	O-3
	Odour Intensity (0 to 4)		
OM_NP1	0	0	0
OM_NP2	0	0	0
OM_NP3	0	0	0
North Point PTW Boundary	0	0	0
OM_WC1	0	0	0
OM_WC2	0	0	0
Wan Chai East PTW Boundary	1	1	1

OM_C1	0	0	0
OM_C2	0	0	0
OM_C3	0	0	0
Central PTW Boundary	0	0	0
OM_FM1	0	0	0
OM_SB1	0	0	0
OM_SB2	0	0	0
OM_SB3	0	0	0
OM_SB4	0	0	0
Sandy Bay PTW Boundary	1	1	1
OM_CB1	0	0	0
OM_CB2	0	0	0
Cyberport PTW Boundary	1	1	0
OM_WF1	0	0	0
Wah Fu PTW Boundary	0	0	0
OM_AB1	0	0	0
Aberdeen PTW Boundary	0	0	0
OM_ALC1	0	0	0
Ap Lei Chau PTW Boundary	0	0	0
OM_SCI1	0	0	0
OM_SCI2	1	1	1
OM_SCI3	1	1	1
OM_SCI4	0	0	0
OM_SCI5	0	0	0
SCISTW Boundary Location A	1	1	1
SCISTW Boundary Location A1	1	1	1
SCISTW Boundary	1	1	1

Location B			
SCISTW Boundary Location C	2	2	2
SCISTW Boundary Location D	0	0	0

3.2. Meteorological Conditions

3.2.1. The meteorological conditions (including temperature, wind speed, wind direction, relative humidity) from the nearest Hong Kong Observatory's Weather Stations for each of the odour patrols were provided for reference in **Appendix D**.

3.3. Odour Patrol Result Discussion

3.3.1. Generally, the odour intensities detected around the SCISTW and PTWs were found to be ranging from level 0 up to level 2. Level 2 was recorded at one monitoring locations. With reference to the Action / Limit Level as shown in **Table 3.2**, the location met the action level. However, at Location C of SCISTW, garbage odour was recorded, and the nearby refuse transfer station was considered as the potential odour source. Hence, the exceedance is concluded not related to the project.

Table 3.2 Action / Limit Levels of the Odour Patrol

Parameter	Action	Limit
Odour Nuisance	Odour Intensity of 2 is measured from odour patrol	Odour Intensity of 3 or above is measured from odour patrol

3.3.2. By comparing our impact monitoring data with the baseline monitoring data, generally, there are no significant difference between two sets of data. A summary table are shown in **Table 3.3**.

Table 3.3 Comparison between Baseline Data and Impact Data of Odour Patrol

Monitoring Location	Operational Phase Baseline*	Operational Phase Impact#

	Odour Intensity (0 to 4)	
OM_NP1	0	0
OM_NP2	0	0
OM_NP3	0	0
North Point PTW Boundary	0	0
OM_WC1	0	0
OM_WC2	0	0
Wan Chai East PTW Boundary	0	1
OM_C1	0	0
OM_C2	0	0
OM_C3	0	0
Central PTW Boundary	0	0
OM_FM1	0	0
OM_SB1	0	0
OM_SB2	0	0
OM_SB3	0	0
OM_SB4	0	0
Sandy Bay PTW Boundary	0	1
OM_CB1	0	0
OM_CB2	0	0
Cyberport PTW Boundary	0	1
OM_WF1	0	0
Wah Fu PTW Boundary	0	0
OM_AB1	0	0
Aberdeen PTW Boundary	0	0
OM_ALC1	0	0
Ap Lei Chau PTW Boundary	0	0
OM_SCI1	0	0
OM_SCI2	0	1

OM_SCI3	1	1
OM_SCI4	0	0
OM_SCI5	0	0
SCISTW Boundary Location A	1	1
SCISTW Boundary Location A1	1	1
SCISTW Boundary Location B	2	1
SCISTW Boundary Location C	3	2
SCISTW Boundary Location D	1	0

Remark(s):

1. * The Largest Data throughout the baseline period are extracted.
2. # The Largest Data among the three Odour Patrol Member are extracted.

4. Summary of Odour Patrol Result

4.1. Conclusion

4.1.1. In general, the odour patrol result is similar to the baseline data. There was one action level exceedances recorded but the exceedance at SCISTW is found to be related to nearby refuse transfer stations.

4.2. Recommendations

4.2.1. With the odour patrol result, it is recommended to take more attention on Wan Chai East PTW, Sandy Bay PTW, Cyberport PTW and SCISTW to ensure the odour nuisance will not be deteriorated.

4.3. Exceedance

4.3.1. There was one action level exceedance recorded at SCISTW Boundary Location C.

4.3.2. **Table 4.1** shown the Event/Action Plan for Operation Air Quality Monitoring.

Table 4.1 Event/Action Plan for Operation Air Quality Monitoring

Event	Action	
	Person-in-charge of Odour Monitoring	DSD

Action Level		
Exceedance of action level	1. Identify source/reason of exceedance; 2. Repeat odour patrol to confirm finding; 3. Repeat odour measurement at exhaust stacks of deodorization system of SCISTW (if exceedance at SCISTW) to confirm finding	1. Carry out investigation to identify the source/reason of exceedance. 2. Investigation shall be completed within 2 week; 3. Implement more mitigation measures if necessary.
Limit Level		
Exceedance of Limit level	1. Identify source / reason of exceedance; 2. Repeat odour patrol to confirm finding; 3. Repeat odour measurement at exhaust stacks of deodorization system of SCISTW (if exceedance at SCISTW) to confirm finding 4. Increase monitoring frequency to monthly; 5. If exceedance stops, cease additional monitoring.	1. Carry out investigation to identify the source/reason of exceedance. Investigation shall be completed within 2 week; 2. Rectify any unacceptable practice; 3. Formulate remedial actions; 4. Ensure amended working methods and remedial actions properly implemented; 5. If exceedance continues, consider what mitigation

		measures shall be implemented.

4.3.3. According to the event and action plan, the reason / source of exceedance should be first identified. The investigation report is attached in **Appendix H**.

5. Odour Measurement

5.1. Monitoring Requirement

5.1.1. Air samples will be collected by passive sampling technique at the odour monitoring station. A NalophanTM sampling bag will be placed inside an air-tight sampler and then drawn to vacuum for sampling. Approximately 60 litres of the gas sample is collected into the sampling bag for testing. A diagram of the passive sampling equipment that will be used for the sampling is shown below:

Figure 1: Passive Sampler

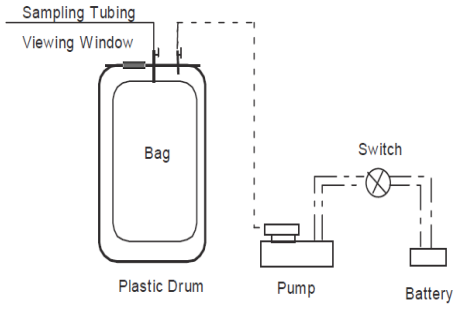


Figure 2: A Schematic Diagram of Sampling Device

5.1.2. Air samples in Nalophane bags shall be kept in cool condition not under direct sunlight exposure during the collection. If any condensate is observed on the inner surface of the sampled bag, the sample shall be discarded.

5.1.3. All samples collected during the sampling day shall be returned to laboratory at the same day. All olfactometry testing shall be conducted and finished within 24 hours after sampling.

5.1.4. The selected laboratory is the local laboratory for the measurement of odour concentration following the European Standard Method BS EN13725:2003 (by dynamic olfactometry). The Reporting Limit for the Olfactometry Analysis is 11 OUE/m^3.

- Odour concentration of the sample is determined by Forced-choice Dynamic Olfactometer in accordance to European Standard Method: BS EN13725:2003.
- Testing should be performed by five qualified panellists who have been trained and complied with the requirement of the European Standard Method: BS EN13725:2003 in the range of 20 to 80 ppb/v and a standard deviation of R < 2.3.
- Testing shall be started immediately after sample receipt and all testing to be completed with 24 hours after sampling.

5.1.5. The odour concentration is measured by determining the dilution factor required to reach the detection threshold. The odour concentration at the detection threshold is by definition 1 OUE/m^3. The odour concentration is then expressed in terms of multiples of the detection threshold.

Figure 3: Olfactory Laboratory with Scentroid™ SS600 Olfactometer

5.1.6. During each odour sampling day, one blank sample should be collected for quality control. The sample will be taken by purging pure nitrogen gas into the odour bag directly on site as a blank sample.

5.1.7. All equipment for odour measurement and analysis are maintained and calibrated in according to the requirement of the European Standard Method EN13725.

5.2. Monitoring Frequency

5.2.1. Odour measurement shall be conducted every three months for the first year of operation for the expanded SCISTW. The first odour measurement shall be conducted within one month after operation of the expanded SCISTW.

Subsequent odour measurement shall be conducted at the 4th, 7th and 10th month.

5.3. Monitoring Location

5.3.1. According to section 2.36 of the EM&A Manual, odour measurement will be conducted at 15 exhaust stacks of the deodorization system at SCISTW. The odour measurement locations are listed in **Table 5.1**. As suggested by the contractor, the location ID is renamed to better identify the deodorization unit which is different from that on the detailed reporting requirement of odour monitoring report.

5.3.2. The layout of odour monitoring locations for odour measurement is shown in **Appendix E**.

Table 5.1 Odour Monitoring Locations for Odour Measurement

Location Point
DOU 1-R(1)
DOU 1-PS(2)
DOU 1B-1
DOU 1B-2
DOU 2-PS(3)
DOU 3
DOU 4-PS(4)
DOU 5-PS(5)
DOU 6
DOU 6A
DOU 6B
DOU 8-1
DOU 8-2
DOU 9-1
DOU 9-2

Notes:

(1) Replace DOU 4-2 stated in Detailed Reporting Requirement of Odour Monitoring Report (Renaming to distinguish the source of odour is different from that of DOU4)

(2) Replace DOU 1 stated in Detailed Reporting Requirement of Odour Monitoring Report (A polishing stage (PS) is added after the treatment of DOU 1 to enhance odour treatment performance)

(3) Replace DOU 2 stated in Detailed Reporting Requirement of Odour Monitoring Report (A polishing stage (PS) is added after the treatment of DOU 2 to enhance odour treatment performance)

(4) Replace DOU 4 stated in Detailed Reporting Requirement (A polishing stage (PS) is added after the treatment of DOU 4 to enhance odour treatment performance)

(5) Replace DOU 5 stated in Detailed Reporting Requirement
(A polishing stage (PS) is added after the treatment of DOU 5 to enhance odour treatment performance)

5.4. Monitoring Parameter

5.4.1. During sampling, following items will be recorded:

- ambient temperature;
- relative humidity;
- wind speed; and
- wind direction
- photo showing the sampling locations relative to existing land features

6. Odour Measurement Result

6.1. Odour Concentration and Odour Emission Rate

6.1.1. The odour measurement was conducted on 21st October 2022. The detail of location photo is shown in **Appendix E**.

6.1.2. The odour emission rate is listed in **Table 6.1**. The total odour emission rate is calculated to be 9,300 ou/s. **Appendix F** shown the detail monitoring results for each monitoring location.

Table 6.1 Summary of Odour Emission Rate

Location ID	Odour Emission Rate (ou/s)
DOU 1-R	34
DOU 1-PS	592
DOU 1B-1	49
DOU 1B-2	38
DOU 2-PS	305
DOU 3	503
DOU 4-PS	3,489
DOU 5-PS	455
DOU 6	262
DOU 6A	1,659
DOU 6B	1,757
DOU 8-1	49
DOU 8-2	52

DOU 9-1	5
DOU 9-2	51

6.2. Odour Measurement Result Discussion

6.2.1. The total odour emission rate presented in EIA Report Table 3.14 are given in **Appendix G**, the design total mitigated odour emission rate is 11,506.21 ou/s for Option 2 – Decentralized Design.

6.2.2. Comparison between impact monitoring data and data obtained from EIA is shown in **Table 6.2**.

Table 6.2 Comparison between Impact Monitoring Data and Data Obtained from EIA

Total Odour Emission Rate (ou/s)	
Operation Phase Impact	**EIA**
9,300	11,506.21

6.2.3. According to Table 2.3 of EM&A Manual, the Action / Limit Level is shown in **Table 6.3.**

Table 6.3 Action / Limit Levels of the Odour Measurement

Parameter	Action	Limit
Odour Nuisance	- When two documented complaints are received; or - Measured total odour emission rate from exhaust stacks of deodorization system at SCSITW ≧ 0.9 x Total mitigated odour emission rate	- Five or more consecutive genuine documented complaints within a week; or - Measured total odour emission rate from exhaust stacks of deodorization system at SCISTW ≧ Total mitigated

	presented in EIA Report	odour emission rate presented in EIA Report

7. Summary of Odour Measurement

7.1. Conclusion

7.1.1. The impact total odour emission rate is smaller than the 90% of total mitigated odour emission rate presented in the EIA report (10355.59 ou/s). The odour measurement is acceptable and no exceedance is recorded.

7.2. Recommendation

7.2.1. The operator is reminded to maintain the plants and deodorization units are in good condition and to keep a close monitoring on the in-house H2S sensors to ensure that no odour nuisance is induced by SCSITW.

7.3. Correlation between Odour and H2S Concentration

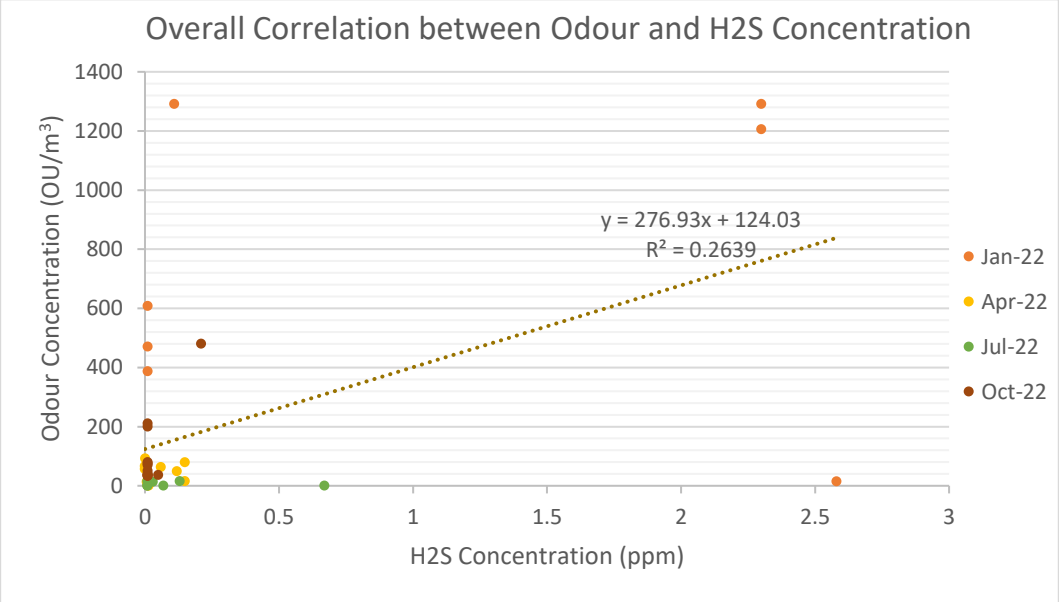
7.3.1. To further understand the gas composition, the overall correlation between H2S concentrations and odour units of available DOUs was plotted in **Graph 1**. In-house H2S concentration from sensors and odour concentration from odour measurement for October 2022 was listed in **Table 7.1**.

Table 7.1 In-house H2S Concentration from Sensors and Odour Concentration from Odour Measurement for October 2022

Location ID	In-house H2S Concentration (ppm)	Odour Concentration (OU/m^3)
DOU 1-R	<0.01	38
DOU 1-PS	<0.01	79
DOU 1B-1	<0.01	50
DOU 1B-2	<0.01	39
DOU 2-PS	<0.01	34
DOU 3	0.05	36
DOU 4-PS	0.21	480
DOU 5-PS	<0.01	34
DOU 6	<0.01	33
DOU 6A	<0.01	200
DOU 6B	<0.01	210

DOU 8-1	<0.01	70
DOU 8-2	<0.01	75
DOU 9-1	N/A	27
DOU 9-2	N/A	510

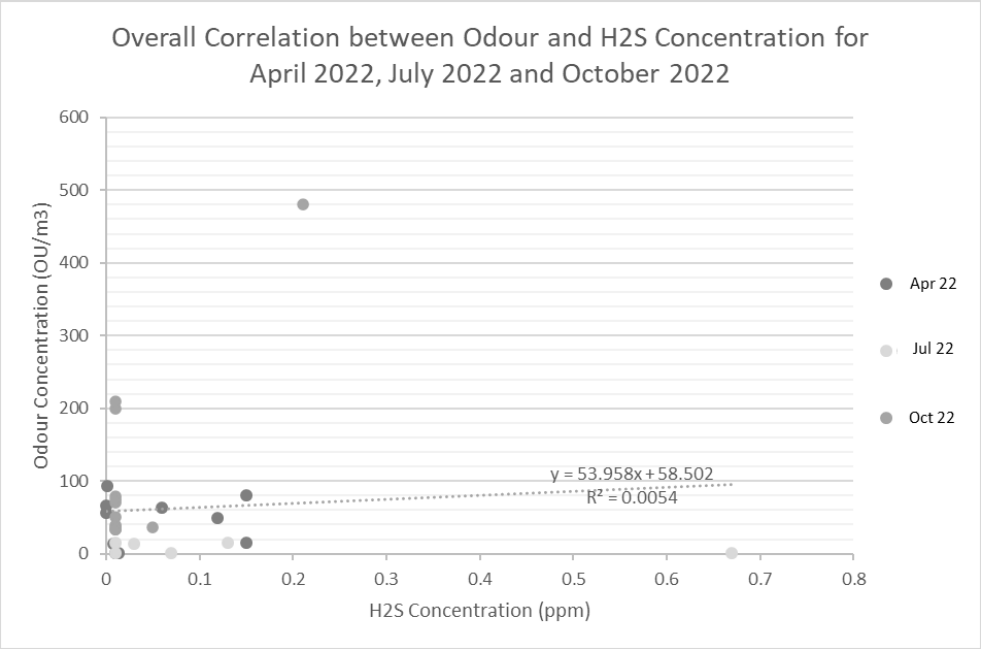
Graph 1 Overall Correlation between Odour and H2S Concentration



Remark:
1. Data smaller than detection limit would be plotted as zero for graph presentation

7.3.2. According to **Graph 1**, no correlation can be established generally. With the above-mentioned observation, the monitoring results in April 2022, July 2022 and October 2022 was similar. It is believed that the fine-tuned operating mode including change of quantities of chemical used at the wet chemical scrubbers and replacement of activated carbon at the activated carbon filters after odour measurement exceedance in January 2022 can effectively minimize the odour nuisance. To confirm the correlation between H2S concentrations and odour units, a graph without exceedance data (data from January 2022) should be established. **Graph 2** shown the correlation between Odour and H2S Concentration for April 2022, July 2022 and October 2022.

Graph 2 Correlation between Odour and H2S Concentration for April 2022 and July 2022



Remark:
1. Data smaller than detection limit would be plotted as zero for graph presentation

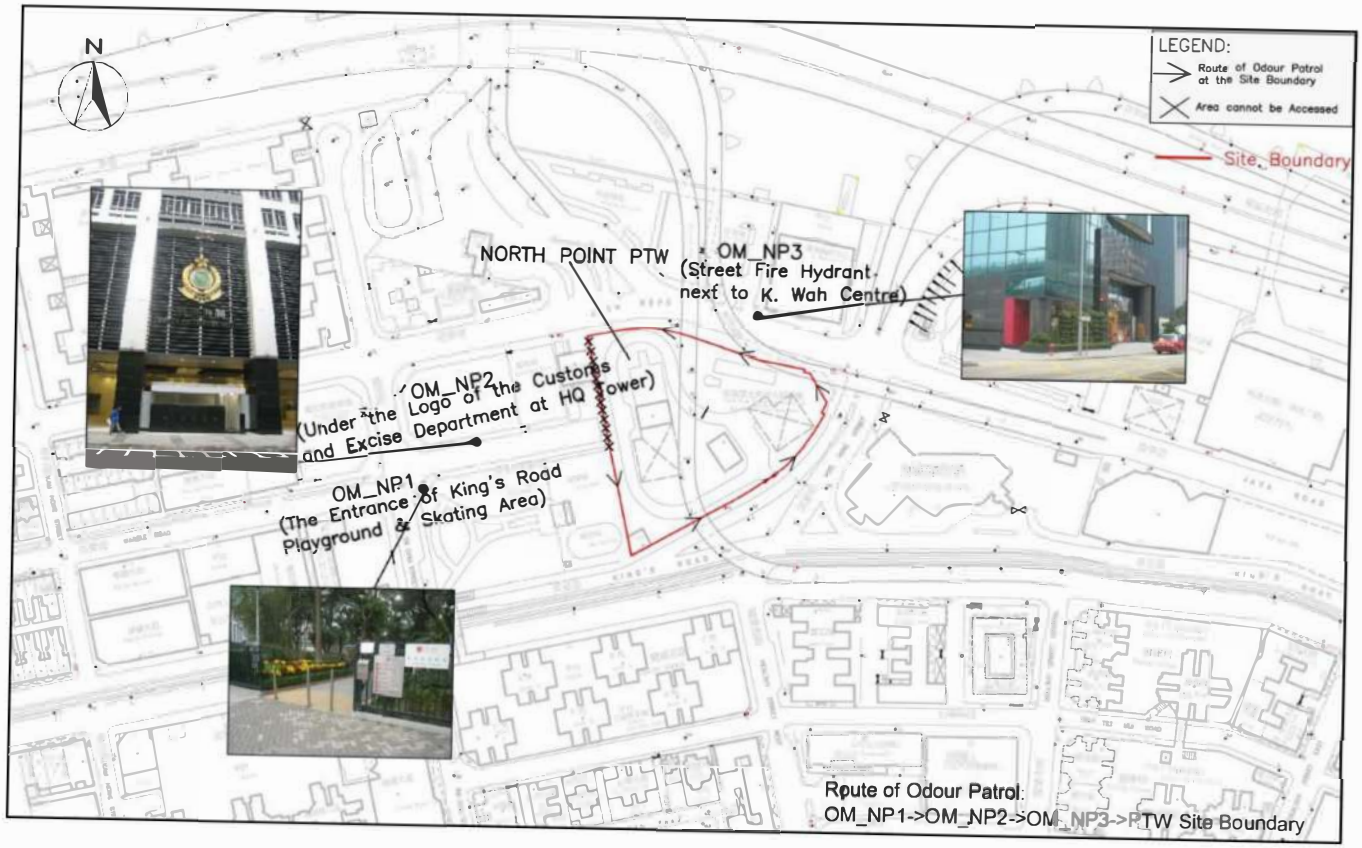
7.3.3. Although the data from April 2022, July 2022 and October 2022 were seemed to be concentrated near the origin from **Graph 1**, there was also no obvious correlation between these three months from **Graph 2**. As the sample size is still small, more data should be collected to establish the correlation between H2S concentration and odour concentration.

7.3.4. To conclude, the operators are reminded to maintain the equipment and plants in good condition and have a close monitoring on the performance of the deodorization units.

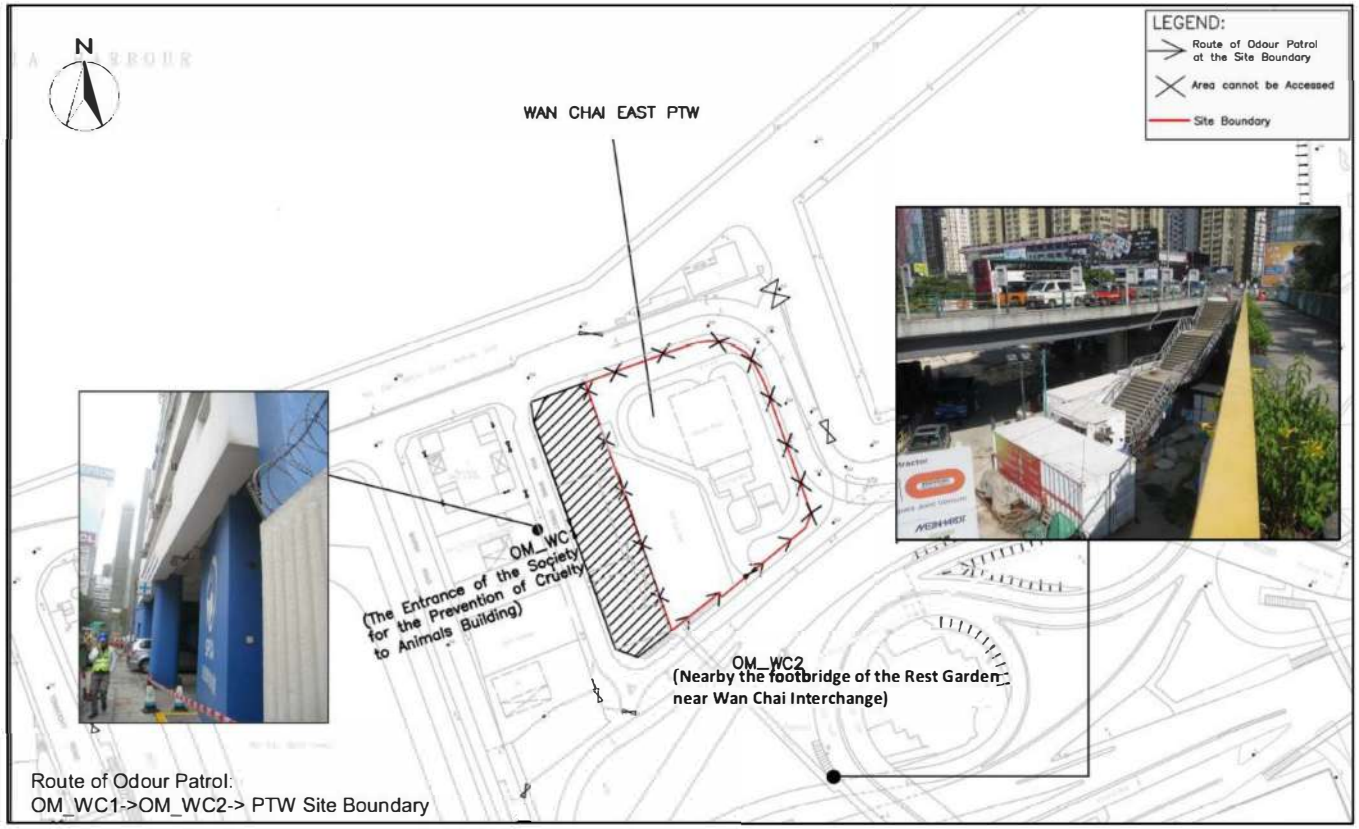
- **End of Report -**

Appendix A

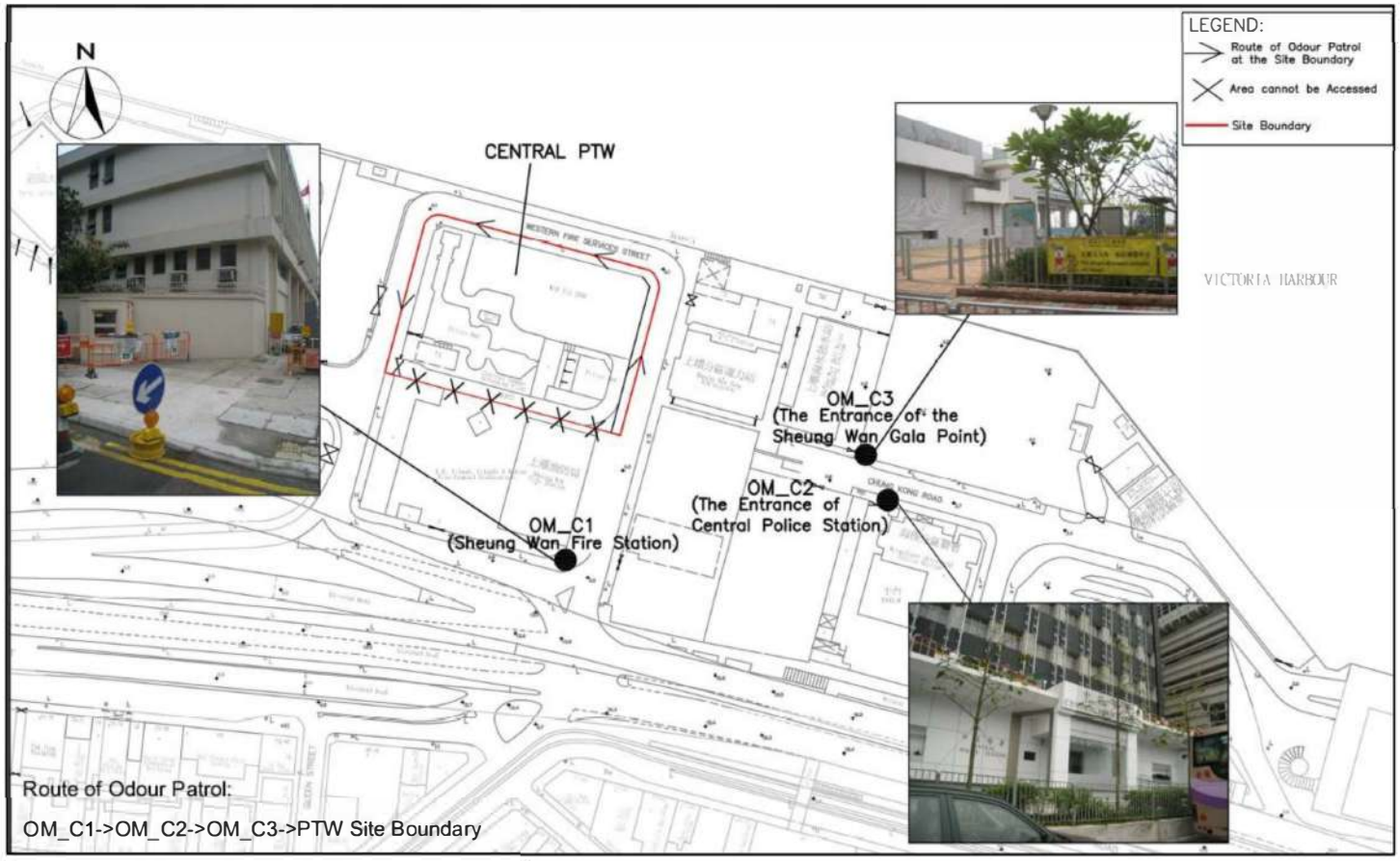
Odour Patrol Monitoring Locations



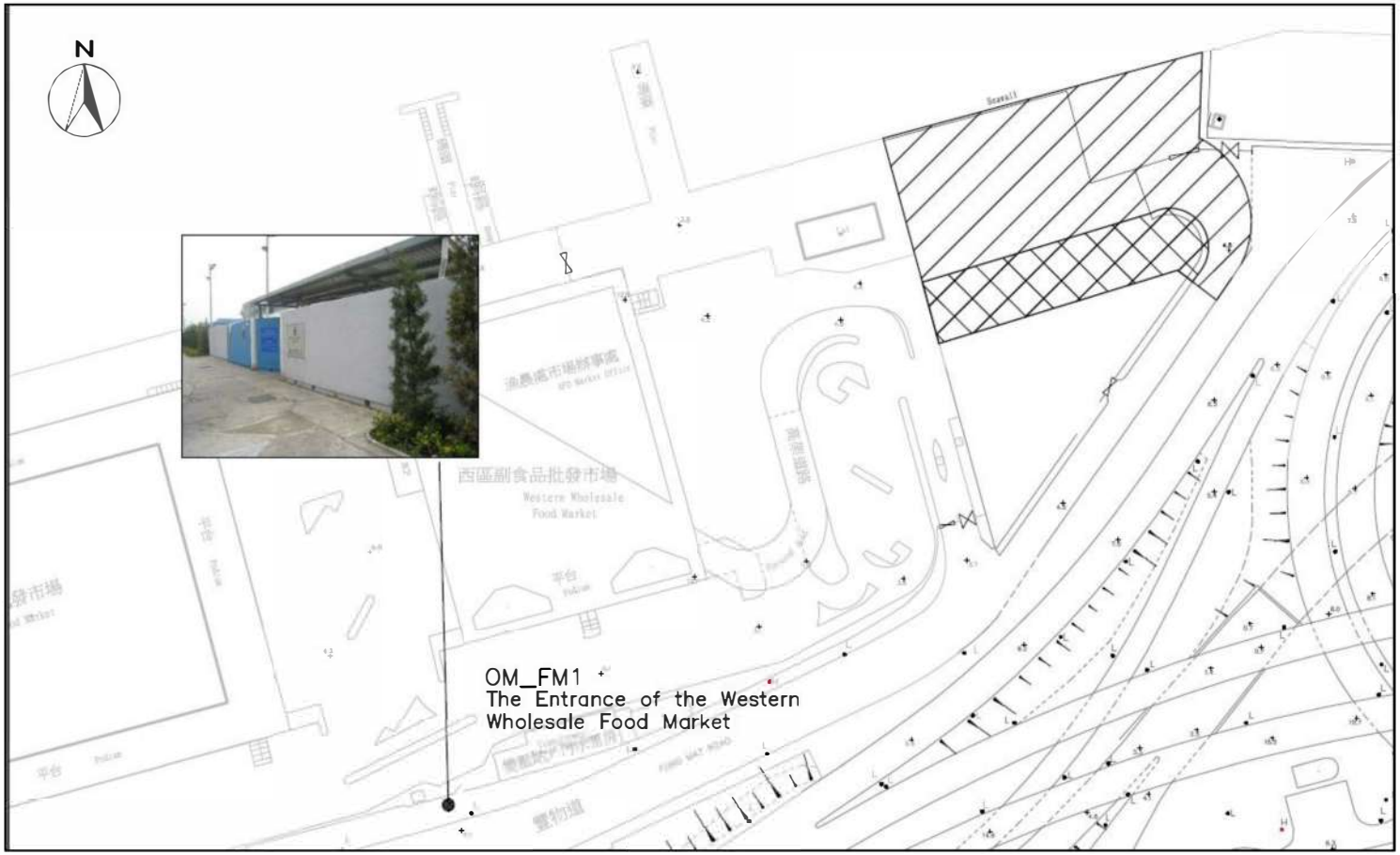
North Point PTW



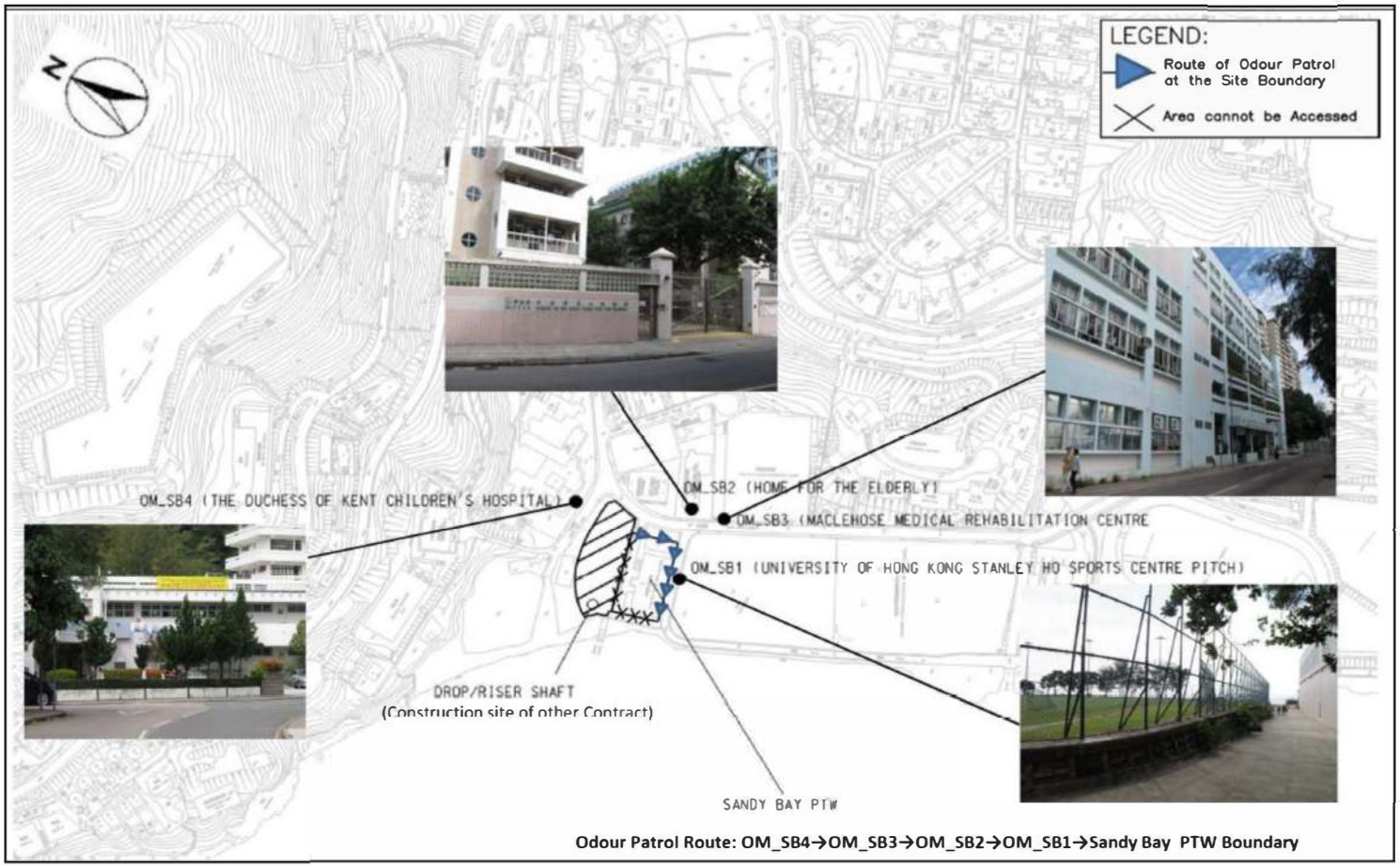
Wan Chai East PTW


N
LEGEND:
Route of Odour Patrol at the Site Boundary
Area cannot be Accessed
Site Boundary
CENTRAL PTW
VICTORIA HARBOUR
OM_C3
(The Entrance of the Sheung Wan Gala Point)
OM_C2
(The Entrance of Central Police Station)
OM_C1
(Sheung Wan Fire Station)
Route of Odour Patrol:
OM_C1->OM_C2->OM_C3->PTW Site Boundary

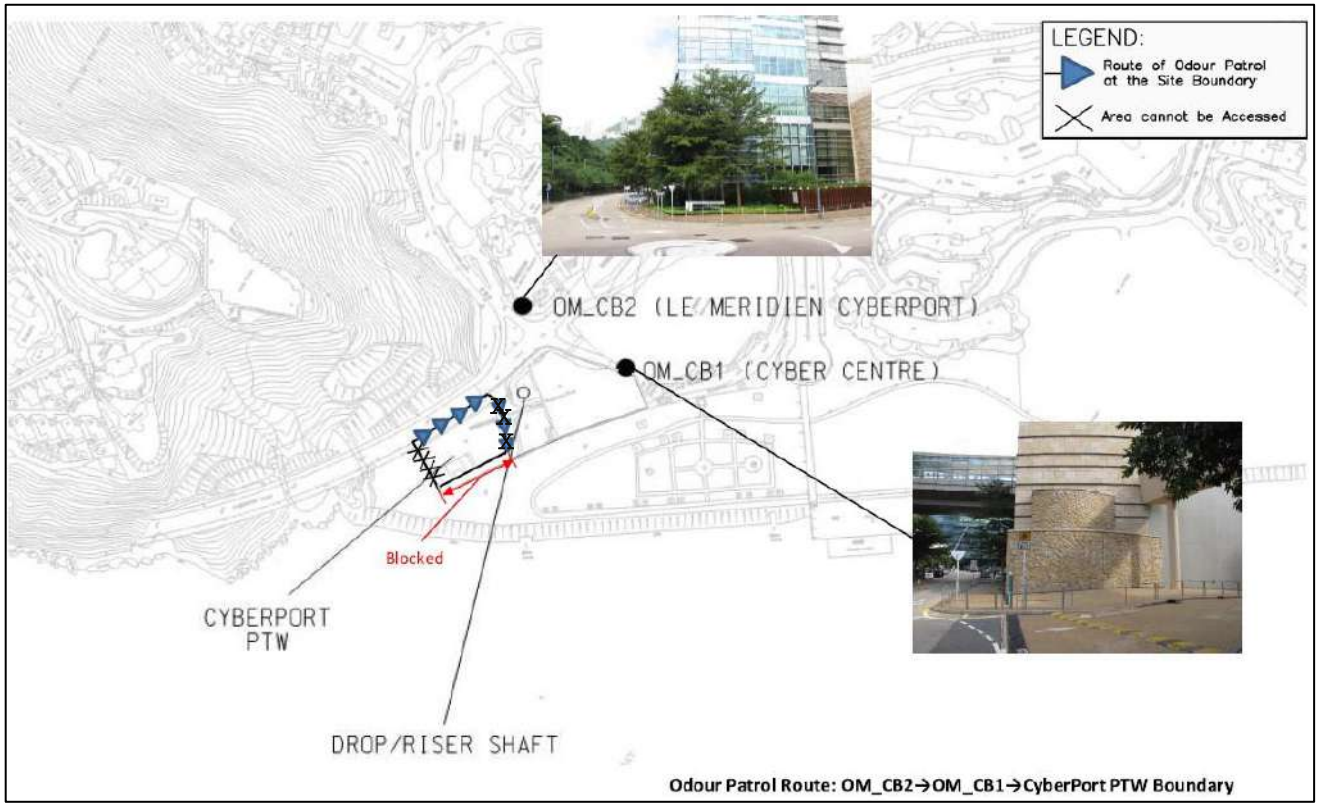
Central PTW



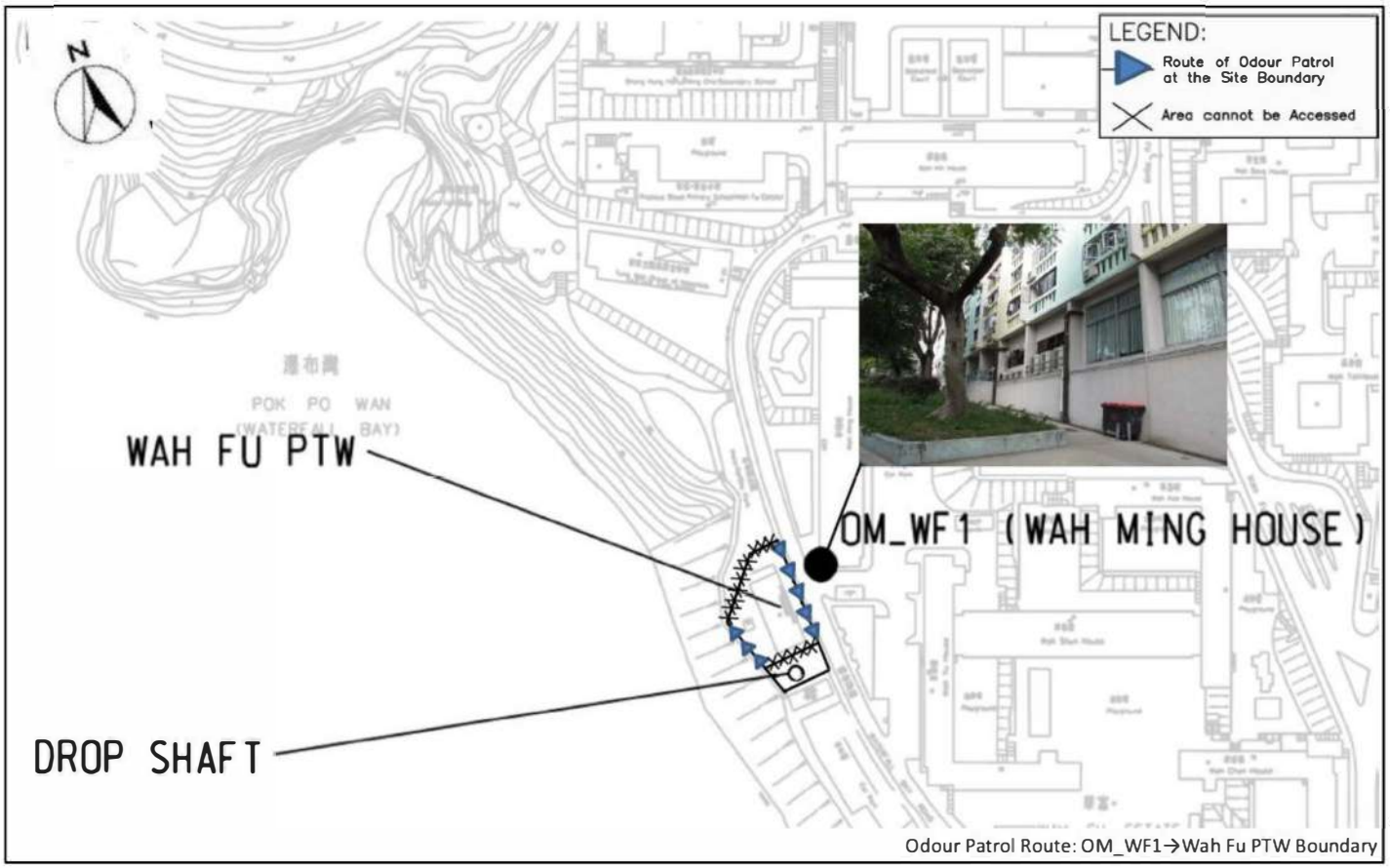
Western Wholesale Food Market



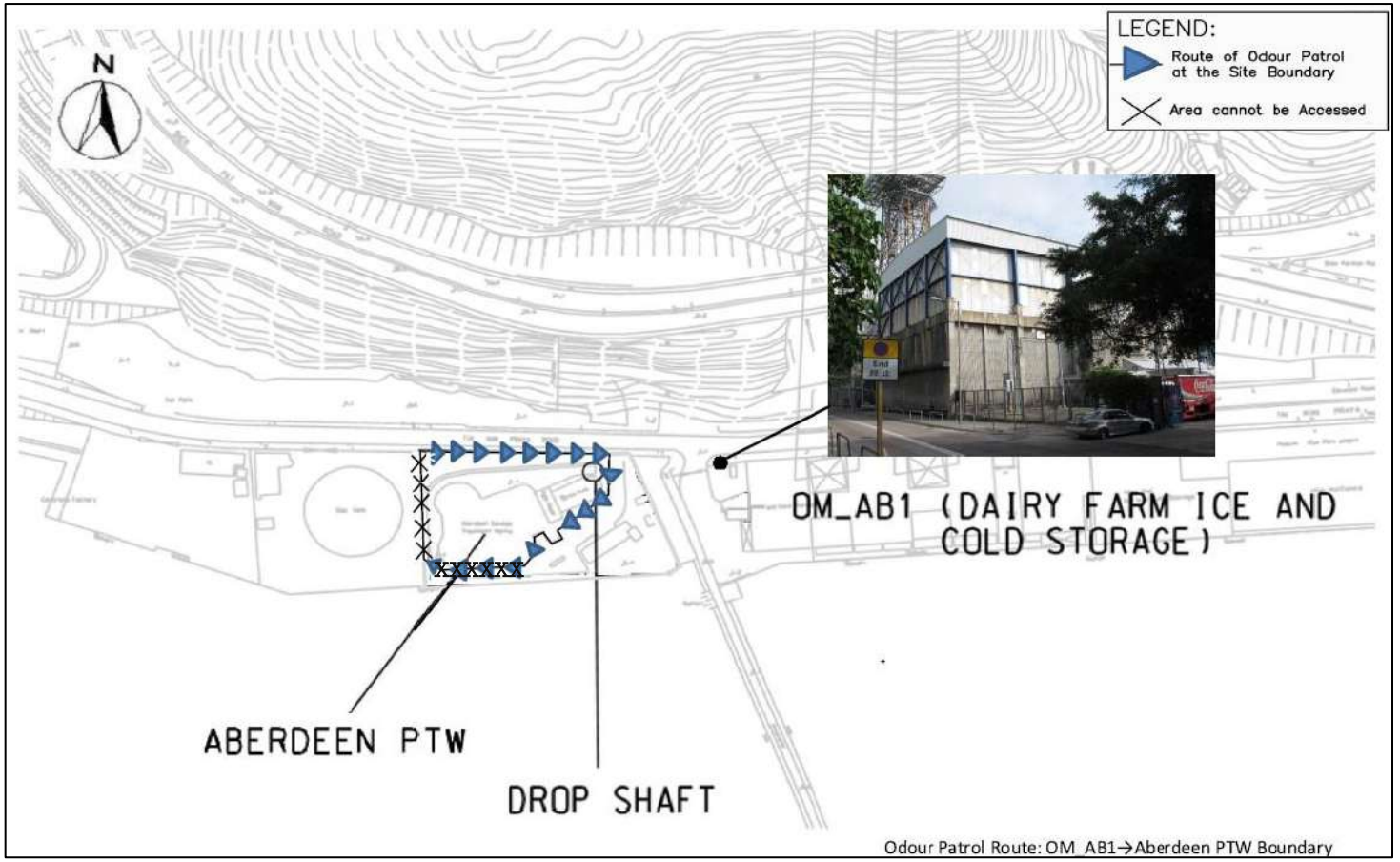
Sandy Bay PTW



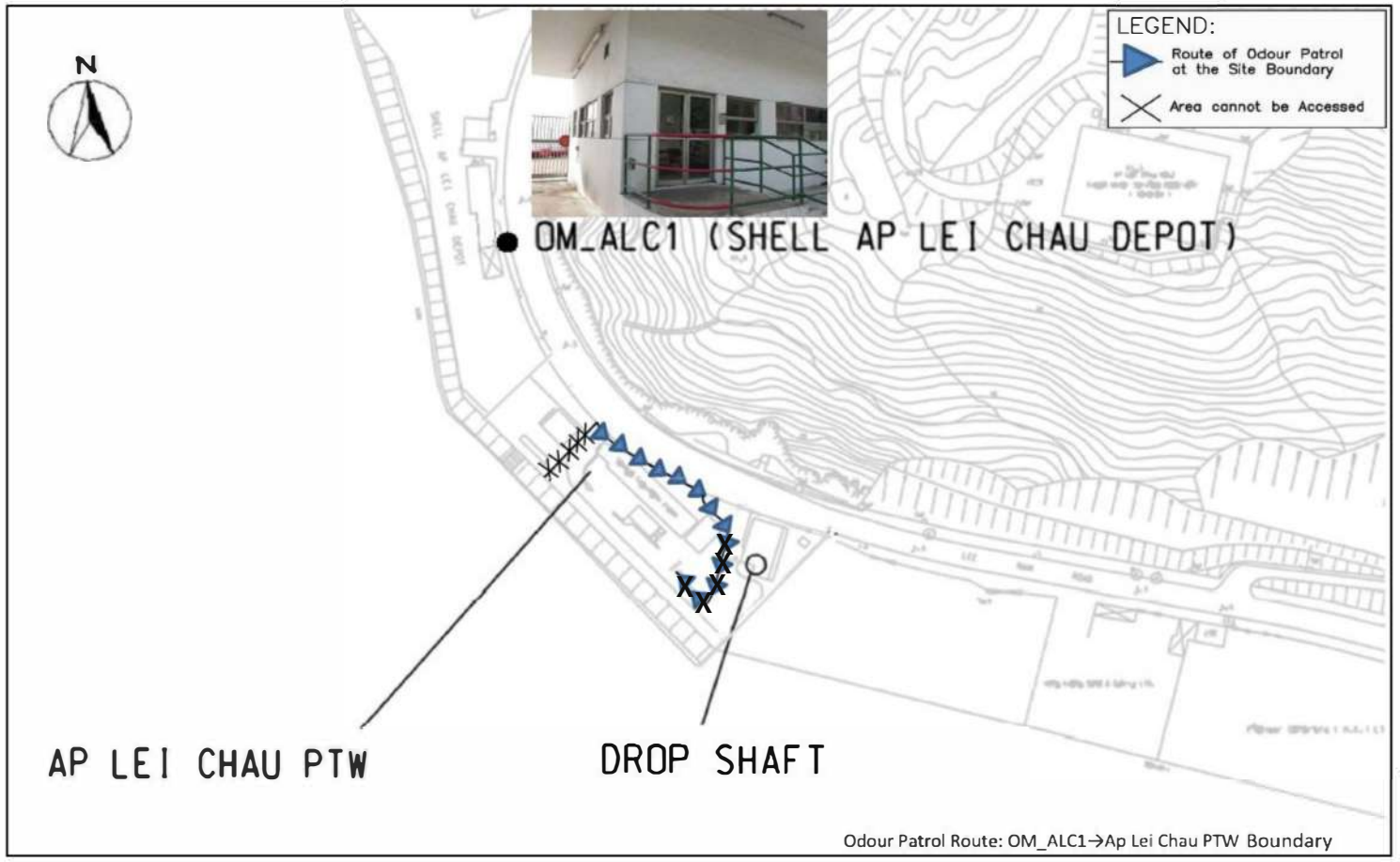
Cyberport PTW


LEGEND:
Route of Odour Patrol at the Site Boundary
Area cannot be Accessed
N
WAH FU PTW
OM_WF1 (WAH MING HOUSE)
DROP SHAFT
Odour Patrol Route: OM_WF1→Wah Fu PTW Boundary

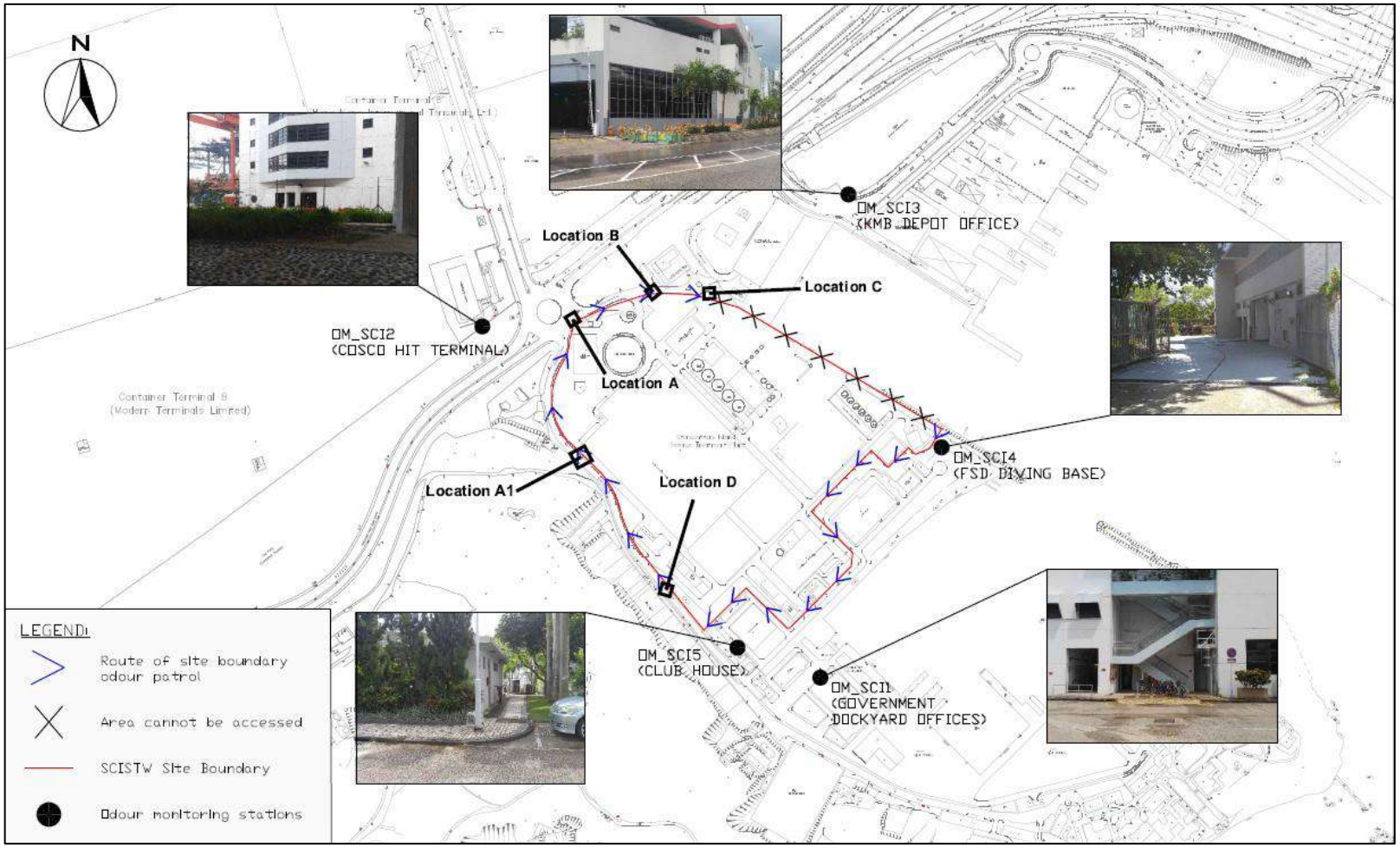
Wah Fu PTW



Aberdeen PTW



Ap Lei Chau PTW


N
Location A
Location A1
Location B
Location C
Location D
OM_SCI1
(GOVERNMENT DOCKYARD OFFICES)
OM_SCI2
(COSCO HIT TERMINAL)
OM_SCI3
(KMB DEPOT OFFICE)
OM_SCI4
(FSD DIVING BASE)
OM_SCI5
(CLUB HOUSE)
LEGEND:
Route of site boundary odour patrol
Area cannot be accessed
SCISTW Site Boundary
Odour monitoring stations

SCISTW

Appendix B

Odour Certificates

ALS Life Sciences | Environmental

Certificate No:: C22001

Certificate for a Qualified Odour Panellist

This is to certify that

LO TING YI

has participated in Ten (10) sets of individual N-Butanol Screening Test
during 18 March 2022 - 24 March 2022

with Individual Threshold: 36 ppb/v

and

fulfill the Requirement of the European Standard Method of Air Quality -
Determination of Odour Concentration by Dynamic Olfactometry (EN13725:2003) -

The Requirement of the Odour Threshold of n-Butanol in Nitrogen Gas in the Range of 20 - 80 ppb/v
with at least 10 sets of individual threshold estimates and standard deviation less than 2.3

24 March 2022	24 March 2023	
Issue Date	**Valid Until**	**Fung Lim Chee, Richard**

Certificate for a Qualified Odour Panel Member

Serial No.	:	**P-047**
Odour Panel Member	:	**Andrew Yuen**
Date of Screening Test	:	**08 Aug 2022** **10 Aug 2022** **12 Aug 2022**
Valid Until	:	**11 Feb 2023**

This is to certify that Mr. Andrew Yuen participated in a set of n-butanol screening tests in our laboratory between 08 Aug 2022 and 12 Aug 2022.

The odour threshold test results of n-butnaol in nitrogen gas was found to be in the range of 20 – 80 ppb/v and a standard deviation of $R < 2.3$, which comply with the requirement of the European Standard Method of Air Quality – Determination of Odour Concentration by Dynamic Olfactometry (EN 13725).

The participant is Approved and Authorized as Qualified Odour Panel Member for odour patrol and olfactometry analysis.

Signed for and on behalf of
CMA Industrial Development Foundation Limited

Wu Chun Fai
Assistant Manager – Environmental Division

Date: 12 Aug 2022

Certificate for a Qualified Odour Panel Member

Serial No.	:	**P-054**
Odour Panel Member	:	**Michael Lee**
Date of Screening Test	:	**08 Aug 2022** **10 Aug 2022** **12 Aug 2022**
Valid Until	:	**11 Feb 2023**

This is to certify that Mr. Michael Lee participated in a set of n-butanol screening tests in our laboratory between 08 Aug 2022 and 12 Aug 2022.

The odour threshold test results of n-butnaol in nitrogen gas was found to be in the range of 20 – 80 ppb/v and a standard deviation of $R < 2.3$, which comply with the requirement of the European Standard Method of Air Quality – Determination of Odour Concentration by Dynamic Olfactometry (EN 13725).

The participant is Approved and Authorized as Qualified Odour Panel Member for odour patrol and olfactometry analysis.

Signed for and on behalf of
CMA Industrial Development Foundation Limited

Wu Chun Fai
Assistant Manager – Environmental Division

Date: 12 Aug 2022

Appendix C

Field Record and Photo Record

Location ID	Panellist	Weather	Time	Temparature (℃)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction	Odour Intensity	Duration of Odour	Direction from Source	On-Site Observation	
											Odour Characteristics	Potential Odour Source
OM_NP1	1	Sunny	1121	30.6	68	0.0	NA	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_NP2	1	Sunny	1120	30.2	68	0.2	NE	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_NP3	1	Sunny	1114	30.5	68	0.4	NW	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_NP Boundary	1	Sunny	1124	30.5	68	0.6	NE	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_WC1	1	Sunny	1503	30.4	68	0.0	NA	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_WC2	1	Sunny	1507	29.8	68	0.2	NE	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_WC Boundary	1	Sunny	1459	32.2	68	0.2	NW	1	Occasional	Side Wind	Sewage	Wan Chai East PTW
	2							1				
	3							1				

Location ID	Panellist	Weather	Time	Temparature (℃)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction	Odour Intensity	Duration of Odour	Direction from Source	On-Site Observation	
											Odour Characteristics	Potential Odour Source
OM_C1	1	Sunny	1443	28.8	68	1.5	N	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_C2	1	Sunny	1439	28.6	68	0.0	NA	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_C3	1	Sunny	1437	32.3	68	0.7	SE	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_C Boundary	1	Sunny	1433	32	68	0.0	NA	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_FM	1	Sunny	1421	32	68	0.6	SE	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_SB1	1	Sunny	1408	33.0	68	0.4	NW	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_SB2	1	Sunny	1403	31.8	68	0.8	SE	0	NA	NA	NA	NA
	2							0				
	3							0				

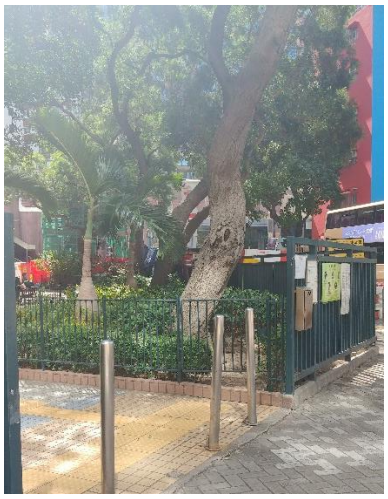
Location ID	Panellist	Weather	Time	Temparature (℃)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction	Odour Intensity	Duration of Odour	Direction from Source	On-Site Observation	
											Odour Characteristics	Potential Odour Source
OM_SB3	1	Sunny	1401	31.1	68	1.2	SW	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_SB4	1	Sunny	1405	33.4	68	0.0	NA	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_SB Boundary	1	Sunny	1406	32	68	0.0	NA	1	Continuous	Side Wind	Sewage	Sandy Bay PTW
	2							1				
	3							1				
OM_CB1	1	Sunny	1348	30.5	68	1.2	NE	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_CB2	1	Sunny	1349	30.6	68	0.0	NA	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_CB Boundary	1	Sunny	1351	31.4	68	0.7	W	1	Occasional	Side Wind	Sewage	Cyberport PTW
	2							1				
	3							0				
OM_WF Boundary	1	Sunny	1327	31	68	1.5	SE	0	NA	NA	NA	NA
	2							0				
	3							0				

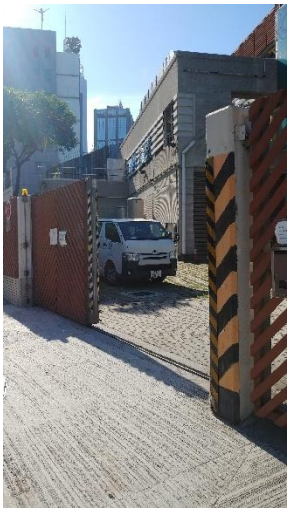
Odour Monitoring Report for Harbour Area Treatment Scheme Stage 2A (Operational Phase) (October 2022)

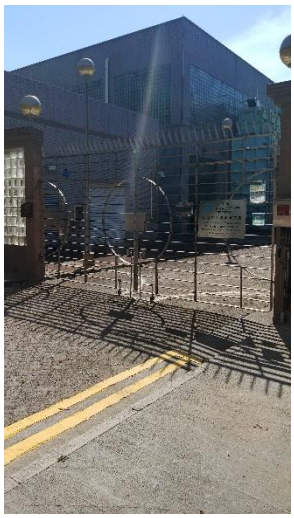
Location ID	Panellist	Weather	Time	Temparature (℃)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction	Odour Intensity	Duration of Odour	Direction from Source	On-Site Observation	
											Odour Characteristics	Potential Odour Source
OM_WF1	1	Sunny	1325	30.9	68	1.2	SE	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_AB1	1	Sunny	1315	30.2	68	0.5	E	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_AB Boundary	1	Sunny	1316	30.5	68	2.0	E	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_ALC1	1	Sunny	1303	28.6	68	0.2	S	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_ALC Boundary	1	Sunny	1306	28.6	68	0.2	SW	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_SCI1	1	Sunny	0941	27.7	68	0.0	NA	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_SCI2	1	Sunny	1029	28.6	68	0.2	SE	1	Occasional	Side Wind	Garbage	Refuse Collection Vehicles
	2							1				
	3							1				

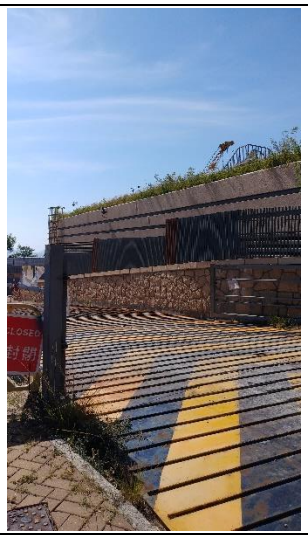
Location ID	Panellist	Weather	Time	Temparature (℃)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction	Odour Intensity	Duration of Odour	Direction from Source	On-Site Observation	
											Odour Characteristics	Potential Odour Source
OM_SCI3	1	Sunny	1016	30.2	68	0.6	E	1	Occasional	Downwind	Seawater	Water shore
	2							1				
	3							1				
OM_SCI4	1	Sunny	0944	30.0	68	0.2	E	0	NA	NA	NA	NA
	2							0				
	3							0				
OM_SCI5	1	Sunny	0951	30.4	68	0.2	SE	0	NA	NA	NA	NA
	2							0				
	3							0				
SCISTW-Location A	1	Sunny	1002	30.0	68	1.0	NE	1	Continuous	Side Wind	Garbage	Refuse Collection Vehicles
	2							1				
	3							1				
SCISTW-Location A1	1	Sunny	0959	31.5	68	0.1	SE	1	Continuous	Downwind	Sewage	SCISTW
	2							1				
	3							1				
SCISTW-Location B	1	Sunny	1004	30.9	68	0.1	SE	1	Continuous	Downwind	Garbage	Refuse Collection Vehicles
	2							1				
	3							1				
SCISTW-Location C	1	Sunny	1007	30.5	68	0.6	SE	2	Continuous	Side Wind	Garbage	West Kowloon Refuse Transfer Station
	2							2				
	3							2				

Location ID	Panellist	Weather	Time	Temparature (℃)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction	Odour Intensity	Duration of Odour	Direction from Source	On-Site Observation	
											Odour Characteristics	Potential Odour Source
SCISTW-Location D	1	Sunny	0955	30.5	68	0.0	NA	0	NA	NA	NA	NA
	2							0				
	3							0				

	
OM_NP1	OM_NP2
	
OM_NP3	North Point PTW Boundary
	
OM_WC1	OM_WC2

	
Wan Chai East PTW Boundary	OM_C1
	
OM_C2	OM_C3
	
Central PTW Boundary	OM_FM1

	
OM_SB1	OM_SB2
	
OM_SB3	OM_SB4
	
Sandy Bay PTW Boundary	OM_CB1

	
OM_CB2	Cyberport PTW Boundary
	
OM_WF1	Wah Fu PTW Boundary
	
OM_AB1	Aberdeen PTW Boundary

	
OM_ALC1	OM_ALC1
	
OM_SCI1	OM_SCI2
	
OM_SCI3	OM_SCI4

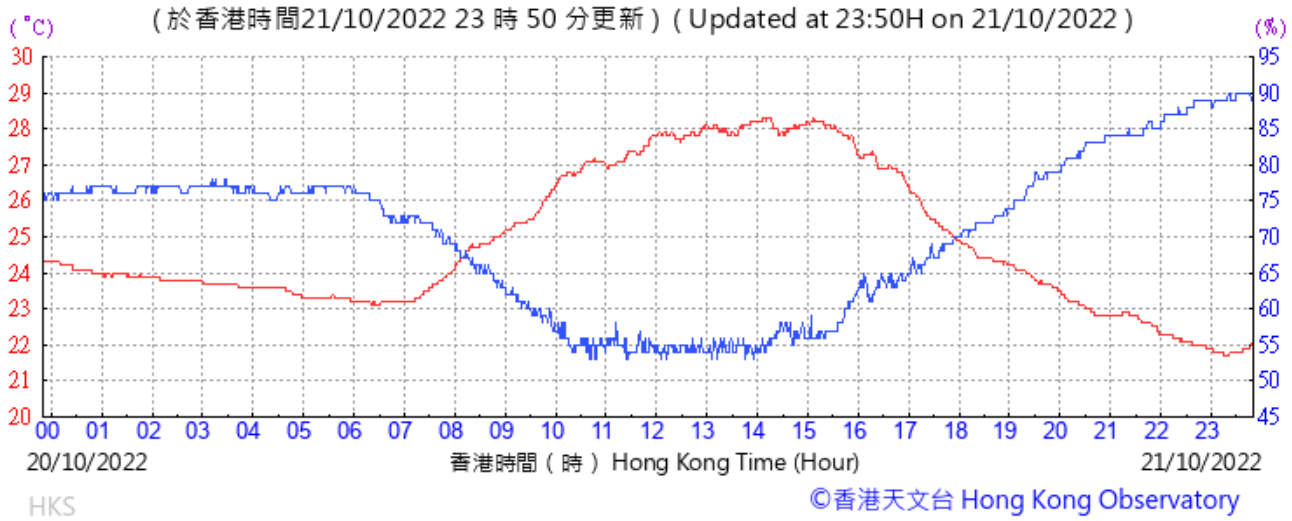
	
OM_SCI5	Location A
	
Location A1	Location B
	
Location C	Location D

Appendix D

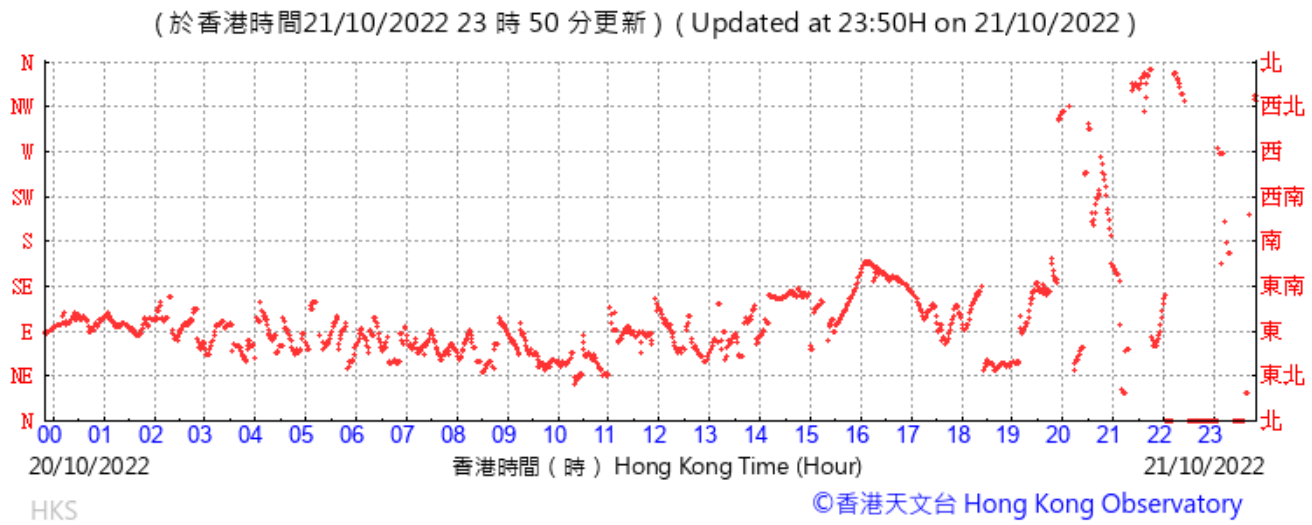
Meteorological Information from the Hong Kong Observatory Station

Meteorological Information from the Hong Kong Observatory Station

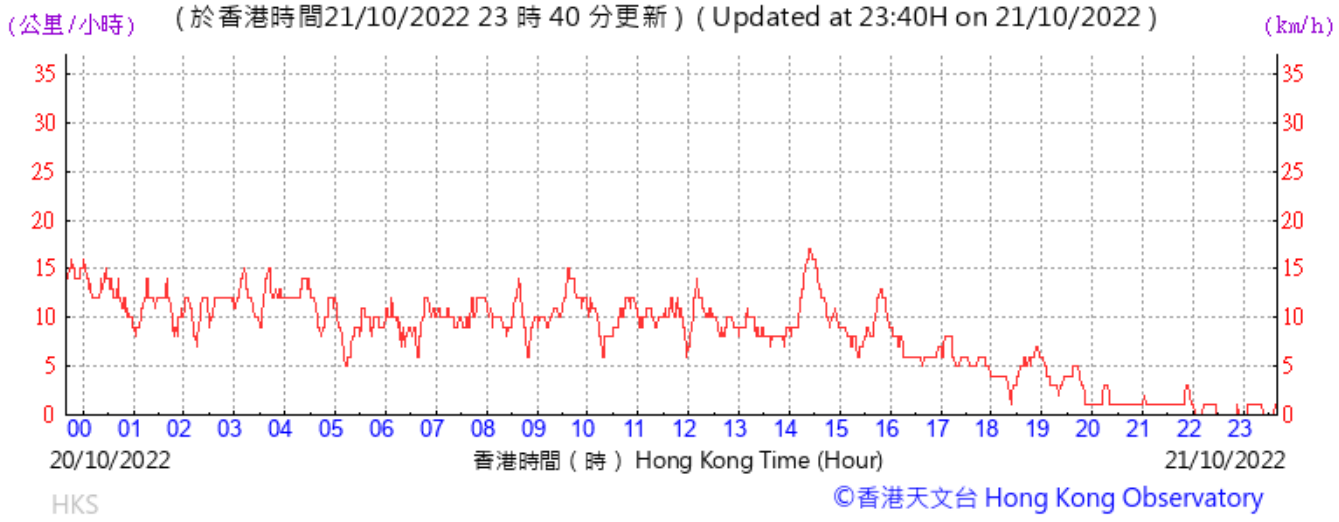
Temperature/Humidity:



Wind Direction:

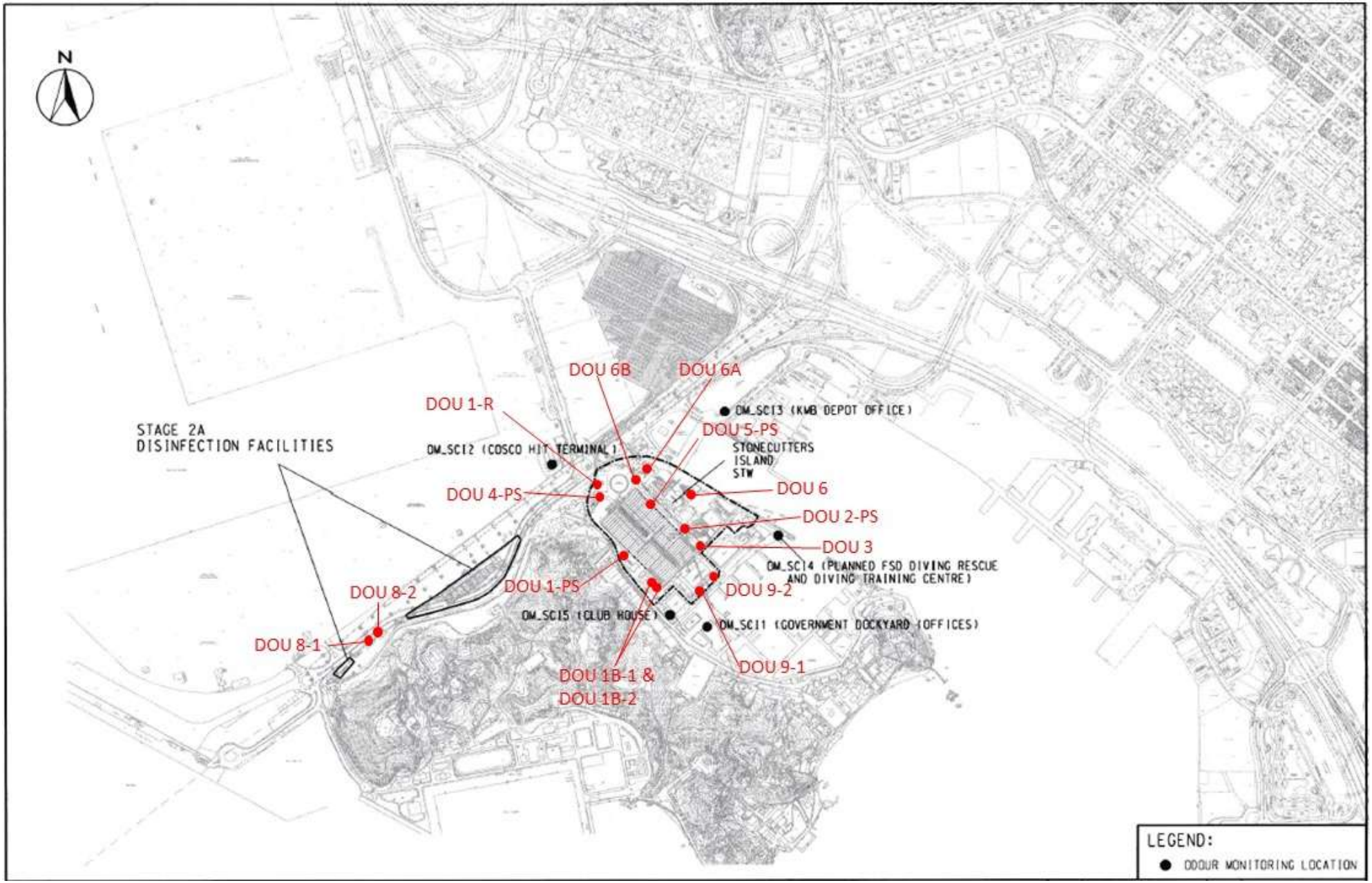


Wind Speed:



Appendix E

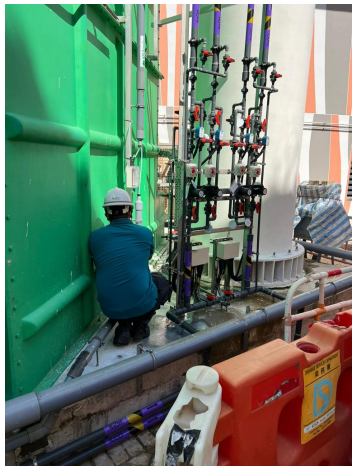
Layout of Odour Monitoring Locations for Odour Measurement


N
STAGE 2A
DISINFECTION FACILITIES
DOU 6B
DOU 6A
DOU 1-R
OM_SC13 (KMB DEPOT OFFICE)
DOU 5-PS
OM_SC12 (COSCO HIT TERMINAL)
STONECUTTERS ISLAND STW
DOU 4-PS
DOU 6
DOU 2-PS
DOU 3
OM_SC14 (PLANNED FSD DIVING RESCUE AND DIVING TRAINING CENTRE)
DOU 1-PS
DOU 8-2
DOU 9-2
OM_SC15 (CLUB HOUSE)
OM_SC11 (GOVERNMENT DOCKYARD (OFFICES)
DOU 8-1
DOU 9-1
DOU 1B-1 &
DOU 1B-2
LEGEND:
ODOUR MONITORING LOCATION

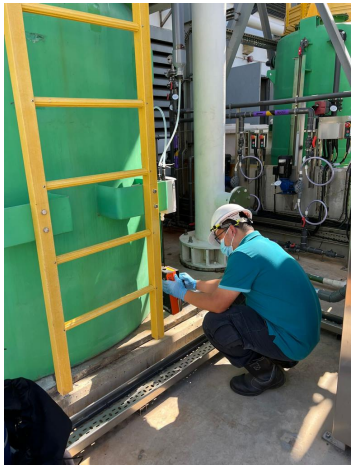
Sampling Locations Photos

DOU 1B-1

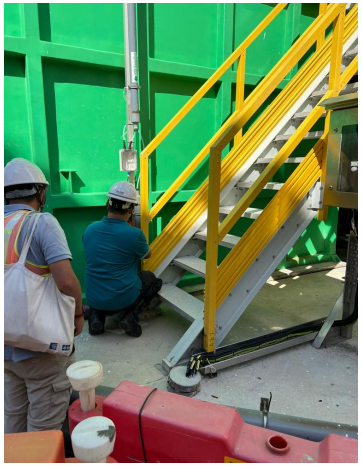
DOU 1B-2



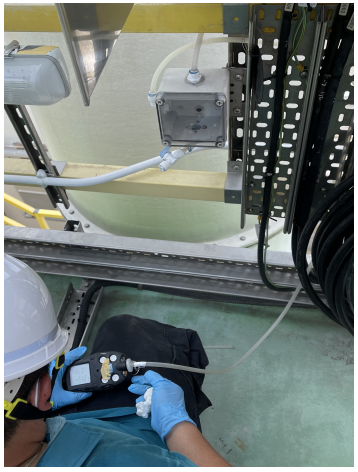
DOU 1-PS



DOU 1-R



DOU 2-PS



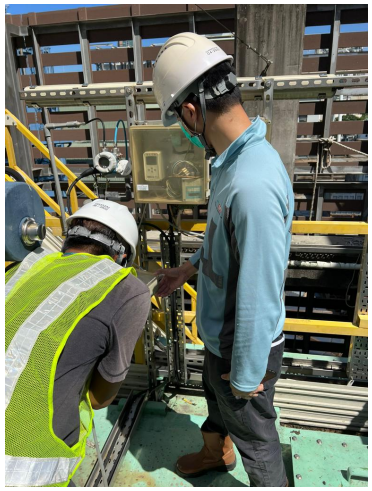
DOU 3

DOU 4-PS

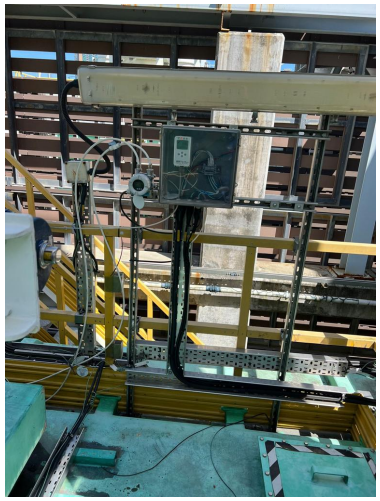
DOU 5-PS

Sampling Location Photos

DOU 6



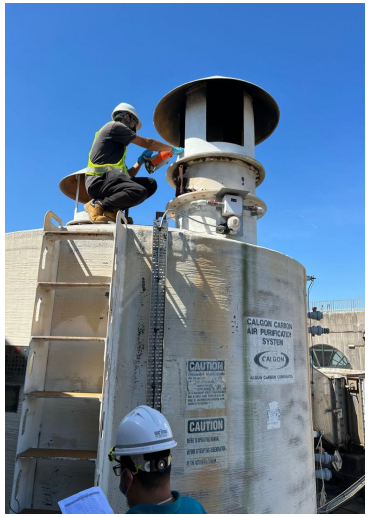
DOU 6A



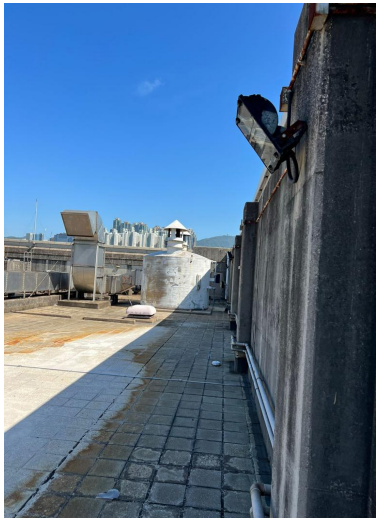
DOU 6B

DOU 8-1

DOU 8-2



DOU 9-1



DOU 9-2

Appendix F

Odour Measurement Result

Sample ID	Location ID	Sampling Date	Sampling Time	Analysis Date	Analysis Time	LOR [Note 1] (ou_E/m^3)	Odour Concentration (ou_E/m^3)	Duct Volumetric Flow Rate [Note 2] (m^3/hr)	Odour Emission Rate (ou_E/s)
LB030640-9	DOU 1B-1	21-Oct-22	11:40	21-Oct-22	16:30 – 17:30	< 11	50	3,555	49
LB030640-10	DOU 1B-2	21-Oct-22	12:00	21-Oct-22		< 11	39	3,530	38
LB030640-3	DOU 1-PS	21-Oct-22	11:20	21-Oct-22		< 11	79	26,985	592
LB030640-1	DOU 1-R	21-Oct-22	09:45	21-Oct-22		< 11	38	3,178	34
LB030640-4	DOU 2-PS	21-Oct-22	11:00	21-Oct-22		< 11	34	32,331	305
LB030640-13	DOU 3	21-Oct-22	10:40	21-Oct-22		< 11	36	50,264	503
LB030640-2	DOU 4-PS	21-Oct-22	10:00	21-Oct-22		< 11	480	26,165	3,489
LB030640-5	DOU 5-PS	21-Oct-22	10:15	21-Oct-22		< 11	34	48,200	455
LB030640-8	DOU 6	21-Oct-22	13:00	21-Oct-22		< 11	33	28,601	262
LB030640-6	DOU 6A	21-Oct-22	13:15	21-Oct-22		< 11	200	29,861	1659
LB030640-7	DOU 6B	21-Oct-22	13:30	21-Oct-22		< 11	210	30,121	1757
LB030640-11	DOU 8-1	21-Oct-22	13:45	21-Oct-22		< 11	70	2,498	49
LB030640-12	DOU 8-2	21-Oct-22	14:00	21-Oct-22		< 11	75	2,498	52
LB030640-14	DOU 9-1	21-Oct-22	12:20	21-Oct-22		< 11	27	720	5
LB030640-15	DOU 9-2	21-Oct-22	12:40	21-Oct-22		< 11	510	360	51
Blank	Field Blank		--			--	< 11	--	--
								Total Emissions [Note 3]	9,300

Note:

1. LOR denotes limit of reporting.
2. The volumetric flow rate data were provided by the client.
3. If calculated odour emission rate are lower than a certain value, integer will be used for calculating the total emissions.
4. All the collected sample volume of the gas bags was sufficient for olfactometry analysis.
5. Field Blank containing pure and odourous nitrogen gas was filled by CMA staff.

Sample ID	Location ID	Sampling Date	Measured Time	Weather Condition	Ambient Temperature (°C)	Relative Humidity (%)	Wind Speed (m/s)	Wind Direction	Barometric Pressure (hPa)
LB030640--9	DOU 1B-1	26-Jul-22	11:40	Fine	34.0	40	0.9	S	1011
LB030640-10	DOU 1B-2	26-Jul-22	12:00	Fine	34.0	43	0.6	S	1011
LB030640-3	DOU 1-PS	26-Jul-22	11:20	Fine	31.0	43	0.7	SE	1011
LB030640-1	DOU 1-R	26-Jul-22	09:45	Fine	27.0	52	0.4	SE	1011
LB030640-4	DOU 2-PS	26-Jul-22	11:00	Fine	29.0	46	0.9	E	1011
LB030640-13	DOU 3	26-Jul-22	10:40	Fine	29.0	46	0.7	E	1011
LB030640-2	DOU 4-PS	26-Jul-22	10:00	Fine	31.0	43	0.6	S	1011
LB030640-5	DOU 5-PS	26-Jul-22	10:15	Fine	32.0	40	0.9	SW	1011
LB030640-8	DOU 6	26-Jul-22	13:00	Fine	32.0	45	0.4	NE	1011
LB030640-6	DOU 6A	26-Jul-22	13:15	Fine	32.0	45	0.6	NE	1011
LB030640-7	DOU 6B	26-Jul-22	13:30	Fine	29.0	57	0.5	N	1011
LB030640-11	DOU 8-1	26-Jul-22	13:45	Fine	33.0	38	0.3	NE	1011
LB030640-12	DOU 8-2	26-Jul-22	14:00	Fine	40.0	33	0.7	NE	1011
LB030640-14	DOU 9-1	26-Jul-22	12:20	Fine	33.0	40	0.4	SW	1011
LB030640-15	DOU 9-2	26-Jul-22	12:40	Fine	32.0	49	0.7	SW	1011

Appendix G

Total Odour Emission Rate Extracted from EIA report

Option 2 - Decentralized Design							
CEPT Facilities (Odd No. Units) & Flow Distribution Channel)	146162.21	S-O2-DO1	12	1.86	20	1	4384.87
CEPT Facilities (Even No. Units) & NWKPS + NWKPS O/F chamber	136086.21	S-O2-DO2	12	1.86	20	1	4082.59
Sludge Treatment Facilities (include Sludge Storage Tanks, Sludge Dewatering Building 1 & 2, Existing and New Sludge Cake Silos)	19057.82	S-O2-DO3	6	2.40	12.58	3	571.73
Stage 1 MPS & Riser Shaft	6518.89	S-O2-DO4	18	1.13	12.28	4	195.57
Stage 2A MPS & Riser Shaft	6518.89	S-O2-DO5	18	1.13	12.28	4	195.57
NWKPTW	19963.88	S-O2-DO6	13	2.26	12.28	8	598.92
Flow Distribution Chambers	2688.01	S-O2-DO7	4.5	0.32	10.48	2	80.64
New Flow Distribution Chamber							
Chlorination Contact Tank	37776.64	S-C-DO1	11	1.13	7.2	4	1133.30
Drop Shaft and Chamber 15A	2630.22	S-C-DO2	4	0.57	8.84	2	263.02

Total: 11,506.21

Note: (1) CEPT facilities include Influent upflow structure, distribution channel, flocculation tanks, sedimentation tanks & effluent weirs, drop shafts, scum pit and rapid mixing tank of sedimentation tanks
(2) MPS is Main Pumping Station
(3) NWKPTW, NWKPS & NWKO/F chambers are North West Kowloon PTW, NWKPTW Pumping Station & NWKPTW Overflow Chamber, respectively
(4) The emission rate included a 1.31 ambient temperature correction factor.

Appendix H

Investigation Report

Report No. **005**
Monitoring Date **21 October 2022**

According to Table 2.3 of EM&A Manual, the Action and Limit Levels of Odour Patrol are shown below:

Parameter	Action Level (AL)	Limit Level (LL)
Odour Nuisance	Odour Intensity of 2 is measured from odour patrol	Odour Intensity of 3 or above is measured from odour patrol

Odour Patrol Results

Monitoring Location	Odour Patrol Member			Level Exceedance
	O-1	O-2	O-3	
	Odour Intensity (0 to 4)			
SCISTW Boundary Location C	2	2	2	Action

Investigation Results:

a) Causes of exceedances

- With reference to on-site observation, the odour characteristics and potential odour source of SCISTW Boundary Location C are listed below:

Location ID	On-Site Observation	
	Odour Characteristics	Potential Odour Source
SCISTW Boundary Location C	Garbage	Refuse Transfer Station / Refuse Vehicles

<u>SCISTW Boundary Location C</u>

- SCISTW Boundary Location C are located near the West Kowloon Refuse Transfer Station. The potential odour source is mainly related to the station and the refuse collection vehicles. The action level exceedance at SCISTW Boundary Location C are non-project related.
- Investigation was conducted by DSD to identify the reason / source of exceedance. It was noted that West Kowloon Refuse Transfer Station is located next to the SCISTW. In Hong Kong, a total of seven Refuse Transfer Stations (RTS) is currently in operation. Throughput of West Kowloon Transfer Station is about 2,700 tonnes per day which has

the largest throughput among the seven RTS and resulted in high frequency of refuse vehicles going in and out Ngong Shung Road.

- SCISTW Boundary Location C is a monitoring point in front of the West Kowloon Refuse Transfer Station. Therefore, the odour was largely related to the West Kowloon Refuse Transfer Station.
- For SCISTW Boundary Location C, the odour patrol conducted on 28th January 2022, 29th April 2022, 26th July 2022 also shown that the potential odour source was refuse transfer station / refuse vehicles. The odour characteristics were both considered to be garbage. With the consistency of results, odour nuisance of SCISTW Boundary Location C can be confirmed to be non-project related.

b) Action required under the Event/Action plan

Refer to Table 4.1.

c) Action taken under the Event/Action plan

Person-in-charge of Odour Monitoring	DSD
1. After considered the above-mentioned investigation results, the exceedances are non-project related.	1.&2. Investigation had been carried out within 2 weeks as shown above.
2. The odour source is identified to be due to the refuse transfer station rather than the operation of SCISTW, no repeat odour patrol is considered necessary.	3. Specific mitigation measures will be implemented if the exceedance is determined to be project-related

d) Conclusions and Recommendations for mitigation

- All plants and deodorization units were checked to be in normal condition. It is reminded to maintain the plants and deodorization units are in good condition and to keep a close monitoring on the in-house H2S sensors to ensure that no odour nuisance is induced by SCSITW