

Drainage Services Department**Quotation No. DEMP/2021/33****Phase II Odour Impact Monitoring of Tuen Mun Area 54 Sewage Pumping Station for Operation Phase****Third Phase II Odour Impact Monitoring Report**

Castco LIMS no.: 220715-2003

Report Issue Date: 25 July 2022

Prepared by:



Mr. Kung Man Chun
Inspector

Certified by:



Ms. Leong Mio Teng
Environmental Team LeaderThe report shall only be reproduced in FULL unless prior written approval is obtained from CTCL.

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Date: 12 August 2022

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Attn.: Ms. Leong Mio Teng (Environmental Team Leader)

Dear Madam

Re: Quotation No. DEMP/2021/33
Phase II Odour Impact Monitoring of Tuen Mun Area 54 Sewage
Pumping Station for Operation Phase
- Third Phase II Odour Impact Monitoring Report

With reference to the Third Phase II Odour Impact Monitoring Report received on 8 August 2022 submitted by the Environmental Team. I hereby verify the Third Phase II Odour Impact Monitoring Report under the captioned Project pursuant to Section 2.53 of the EM&A Manual.

Yours faithfully
MEINHARDT INFRASTRUCTURE AND ENVIRONMENT LTD



Joyce WONG
Independent Environmental Checker

c.c. : DSD – Mr. Adrian Leung (By Post)

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Executive Summary

1. This is the 3rd Phase II Odour Impact Monitoring report which summaries the results of Phase II Odour Impact Monitoring conducted from 16 to 17 July 2022 under the operation of Tuen Mun Area 54 Sewage Pumping Station ("TMA54SPS").
2. Hydrogen Sulphine ("H₂S") monitoring was conducted at A3 and A4. No Action / Limit Level exceedance was recorded.
3. No odour compliant was received during the monitoring period.

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1. Introduction

Introduction

- 1.1 The construction of Tuen Mun Area 54 Sewage Pump Station (“TMA54SPS”) including civil and electrical & mechanical works were implemented under Contract No. CV/2012/02 (by Civil Engineering and Development Department (“CEDD”) and Contract No. DE/2013/10 (by Drainage Services Department (“DSD”), respectively). The Project comprises the Environmental Monitoring and Audit Manual (“EM&A Manual”) EIA Register Nos. AEIAR-122/2008 and Environmental Permit (“EP”) Nos. FEP- 181/2018.
- 1.2 Pursuant to the Environmental Impact Assessment Ordinance (“EIAO”), TMA54SPS Project is a “Designated Project”. The EP stipulates that an EM&A programme is required to endure mitigation measures recommended in the Environmental Impact Assessment Report (“EIA Report”) and the EM&A Manual are implemented during the construction and operation of the Project.
- 1.3 In accordance with the approved EIA Report, Environmental Monitoring and Audit (“EM&A”) programme are recommended to ensure compliance with the EIA study recommendations. DSD is the Engineers’ Representative (“ER”) while Meinhardt Infrastructure and Environment Limited (“Meinhardt”) was commissioned as the Independent Environmental Checker (“IEC”).
- 1.4 Castco Testing Centre Limited (“CTCL”) was commissioned by DSD under Quotation No. DEMP/2021/33 to undertake the duties of Environmental Team (“ET”) as specified in the EM&A Manual and the EP for the odour impact monitoring at two selected ASRs for 12-month operation of the TMA54SPS.

Background

- 1.5 TMA54SPS was substantially completed in March 2018. Regarding the EM&A programme for the operation phase of TMA54SPS, an odour impact monitoring, H₂S monitoring, is required prior to and during the initial operation of TMA54SPS. Total five Air Sensitive Receivers (“ASRs”) (A1 to A5) was specified in the EM&A Manual and illustrated in Figure 1.
- 1.6 The odour baseline monitoring was carried out in April 2018 and established the Action Levels for operation phase odour impact monitoring.
- 1.7 For the odour impact monitoring, it is carried out in two phases as agreed with Environmental Protection Department (“EPD”) due to the private land resumption programme in Tuen Mun Area 54. The Phase I odour impact monitoring for A1, A2 and A5 has been completed and the associated final report is being finalized. The Phase II odour impact monitoring for A3 and A4 will be conducted accordingly.
- 1.8 ET conducted site visit on 9 November 2021 with DSD representative. A3 and A4 are located within the project site boundary of CEDD Site formation and infrastructure works near Tsz Tin Road and Hing Fu Street in Area 54, Tuen Mun Project (Contract No. CV/2019/04) with contract period from December 2020 to June 2024. The project mainly comprises the formation of land, construction of road, vertical noise barriers, footpaths, slopes, retaining walls, drainage works, waterworks, landscaping works and improvement to existing Lam Tei Interchange.

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Land formation works will be kept in process during the 12-month odour impact monitoring at A3 and A4.

- 1.9 The odour impact monitoring shall be conducted at a height of 10m above ground level on a truck mounted aerial working platform to simulate the worst level of predicted results of the receivers in the EIA report. As the construction site was undergone formation with depositing fill materials to rise the ground level, the elevated level of the aerial working platform was adjusted accordingly to keep 10m above original level before backfilling.

Project Organization

- 1.10 The project organization chart and with respect to the EM&A programme is shown in Appendix A Project Organization. Information of key personnel contact names and telephone numbers are summarized in Table 1.1.

Table 1.1 Contact Information of Key Personnel

Company / Department	Position	Contact Person	Telephone No.
Drainage Services Department	Engineers' Representative (ER)	Mr. Adrian Leung	2594 7306
Meinhardt Infrastructure and Environment Limited	Independent Environmental Checker (IEC)	Ms. Joyce Wong	2859 0138
Castco Testing Centre Limited	Environmental Team Leader (ETL)	Ms. Leong Mio Teng	2597 8162

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2. Odour Impact Monitoring

Monitoring Requirements

- 2.1 H₂S is one of the main components of odour emissions. Since ambient H₂S concentration can be readily monitor at the ASRs, it can serve as a surrogate indicator for sewage odours.
- 2.2 In accordance with the EM&A Manual, the odour impact monitoring shall be conducted by ET at the same monitoring stations as in the baseline period, using portable H₂S analyser. In case the odour impact monitoring cannot be carried out at the proposed monitoring locations, ET will carry out the monitoring at alternative locations which can represent the baseline conditions at the impact monitoring locations. The alternative odour impact monitoring locations shall be approved by ER and agreed with IEC.

Monitoring Parameters, Frequency and Duration

- 2.3 A 15-minute integrated sample were collected every 3 hours for duration of 24 hours at the monitoring stations. Hourly meteorological conditions (temperature, wind speed & direction) were obtained from the nearest Hong Kong Observatory's Tuen Mun Weather Station through the monitoring period. No odour monitoring was conducted on rainy day.
- 2.4 The Phase I odour impact monitoring for A1, A2 and A5 has been completed and the associated final report is being finalized. The Phase II odour impact monitoring for A3 and A4 will be conducted in coming 12-month.
- 2.5 If all monitoring results are below the Limit Levels, the impact monitoring would be ceased. If the monitoring results of detected odour monitoring concentration at any ASR is higher than the limit levels due to the operation of the TMA54SPS, the odour monitoring shall be extended until the odour concentration at the ASR in consecutive 2 times are below the Limit Levels (once for 3 months). The Phase II H₂S monitoring programme is summarized in Table 2.1.

Table 2.1 Phase II Odour Impact Monitoring Programme

Sampling Duration	Frequency	Tentative Phase II Odour Impact Monitoring Schedule	
24 hours	- Once every three months for first year after operation of TMA54SPS. - Due to the private land resumption programme, odour impact monitoring is carried in two phases (Phase I and Phase II) as agreed with EPD. - If the results of any detected odour concentration at any ASR is higher than the Limit Level due to operation of TMA54SPS, the odour monitoring programme shall be extended until the odour concentration at the ASR in consecutive 2 times are below the Limit Levels (once for 3 months).	Monitoring Event	Monitoring Date
		1 st	January 2022
		2 nd	April 2022
		3 rd	July 2022
		4 th	October 2022

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Monitoring Locations

2.6 H₂S monitoring was conducted at A3 and A4 for the Phase II odour impact monitoring as shown in Table 2.2.

Table 2.2 Odour Monitoring Station of Phase II Odour Impact Monitoring

Monitoring Station	Location	Description
A3	Planned Secondary School	ASR
A4	Planned Primary School	ASR

Monitoring Equipment

2.7 H₂S concentrations was measured by portable H₂S analyzer, type Jerome 631-X H₂S Aanlyzer. The detection range of the H₂S analyzer is 0.001 ppm to 50 ppm in four graduated ranges with resolution of 0.001 ppm. The analyzer operates within a temperature range of 0 to 40°C, at an air flowrate of 0.15 L/min. Grab air sampler is drawn by built-in suction pump of the analyzer and passed through a gold film sensor. The electrical resistance of the fold film changes according to the change in mass of H₂S in the gas sample. Table 2.3 summarizes the equipment to be used in the odour monitoring.

Table 2.3 H₂S Monitoring Equipment

Equipment	Model	Quantity
Portable H ₂ S analyzer	Jerome 631-X H ₂ S Aanlyzer	1

2.8 Calibration certificates of equipment are given in Appendix B Calibration Certificate of Equipment.

Monitoring Methodology

- 2.9 A 15-minute integrated sample were collected every 3 hours for duration of 24 hours at the monitoring stations at a height of 10m above the same ground level as TMA54SPS on a truck mounted aerial working platform by portable H₂S analyzer. Photographic records of the impact monitoring setup are shown in Appendix C Photographic Records.
- 2.10 Hourly meteorological conditions (temperature, wind speed and direction) were obtained from the nearest Hong Kong Observatory's Tuen Mun Weather Station through the monitoring period.

QA/QC Procedure

2.11 Regeneration and zero adjustment (if necessary) were conducted before odour sampling.

Action and Limit Levels

2.12 The Action and Limit Levels for odour impact monitoring are defined in Table 2.4.

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Table 2.4 Action and Limit Levels for Air Quality in Operation Phase

Parameter	ASR	Location	Action Level (ppb)	Limit Level (ppb)
H ₂ S	A3	Planned Secondary School	2.5	2.5
	A4	Planned Primary School	2.5	2.5
Incidents of odour complaints			Any incidence of odour complaint received through the Odour Complaint Register.	Two or more complaints through the Odour Complaint Register within three months.

2.13 The Action and Limit Level of Phase I Odour Impact monitoring, i.e. 24-hour average H₂S concentration to compare against the Action and Limit Level, are adapted in Phase II Odour Impact monitoring.

2.14 If non-compliance of the Action and Limit Levels occur, action in accordance with Event and Action Plan for Air Quality Monitoring (Operational Phase) in EM&A Manual shall be carried out. The Event and Action Plan is provided in Appendix D Event and Action Plan.

Online Monitoring

2.15 IP camera with network for continuous online monitoring on odour monitoring exercise was setup to enhance the safety of on-site operation. The ET utilized online monitoring to ensure safety measures are in place during operation on working platform.

3. Odour Impact Monitoring Results

Odour Impact Monitoring

- 3.1 The odour impact monitoring were conducted with monitoring results are summarized in Table 3.1.

Table 3.1 Summary of H₂S Monitoring Results

Monitoring Station	Location	Monitoring Period	24-hour average H ₂ S concentration (ppb)
A3	Planned Secondary School	16 – 17 July 2022	0.93
A4	Planned Primary School	16 – 17 July 2022	0.98

- 3.2 There was no Action and Limit Level exceedance of 24-hour average H₂S concentration recorded.
- 3.3 Detailed monitoring results are shown in Appendix E 24-hour H₂S Monitoring Results.

Meteorological Data and Other Factors

- 3.4 The weather conditions during the monitoring period were generally fine.
- 3.5 Hourly meteorological conditions (temperature, wind speed and direction) were obtained from the nearest Hong Kong Observatory's Tuen Mun Weather Station through the monitoring period.
- 3.6 Details of weather information during the monitoring period are shown in Appendix F Meteorological Conditions.
- 3.7 No significant odour sources from the TMA54SPS were observed during the odour impact monitoring.

4. Summary of Complaint

4.1 No odour complaint was received during the monitoring period.

5. Conclusions

5.1 The Phase II odour impact monitoring was conducted.

5.2 24-hour average H₂S concentrations were recorded. No Action / Limit Level exceedance was recorded.

5.3 No odour complaint was received during the monitoring period.

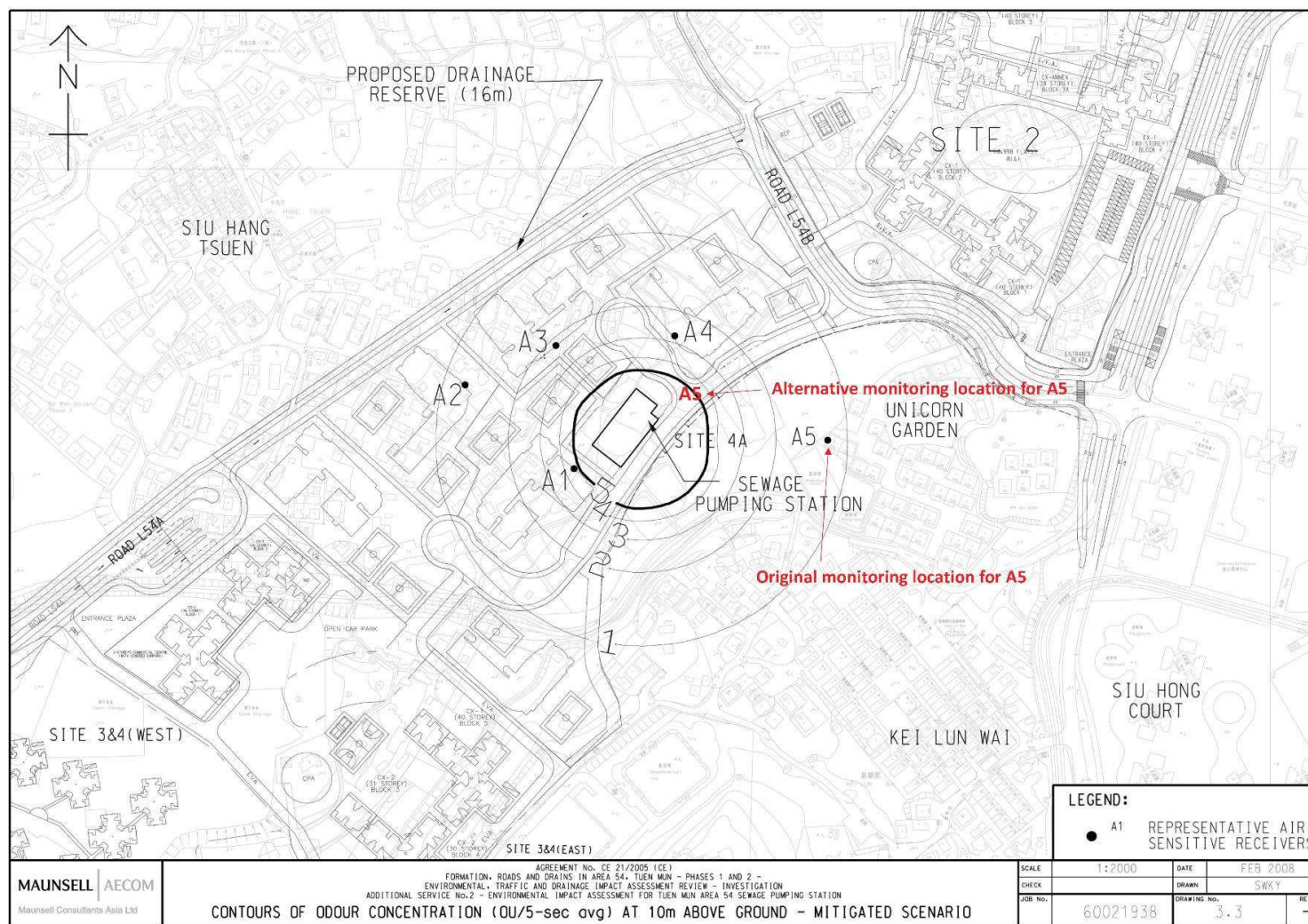


Figure 1 Locations for Odour Impact Monitoring

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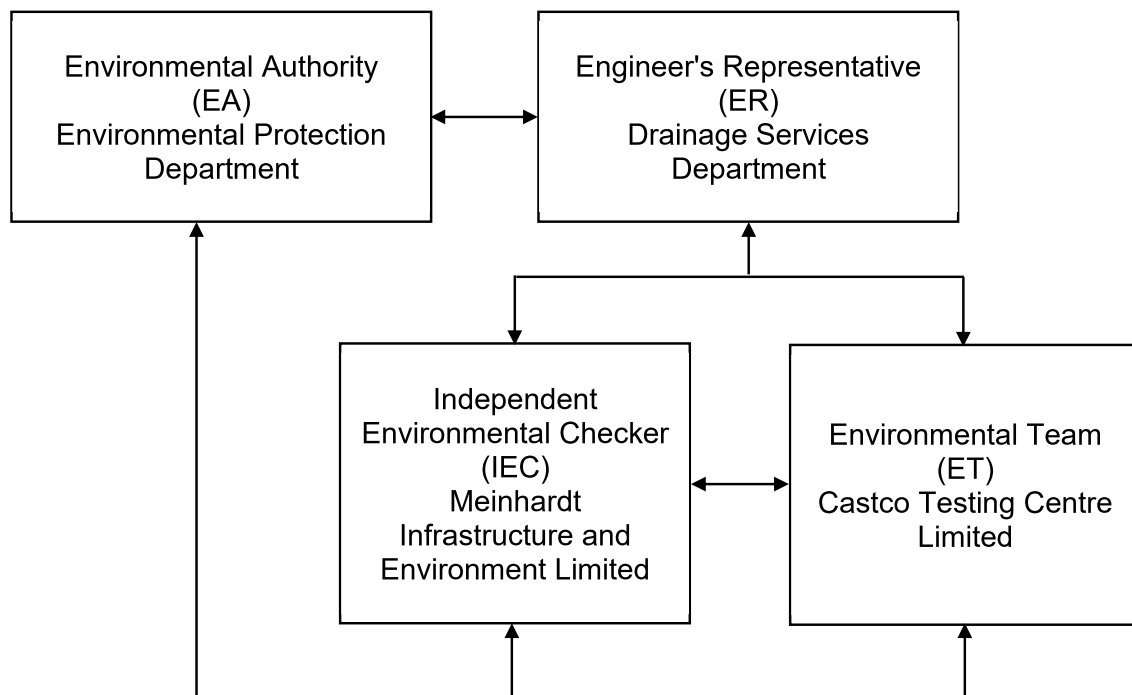
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Appendix A - Project Organization



Appendix B - Calibration Certificate of Equipment

Portable H₂S analyzer



Calibration Certificate

Certificate No.: CC0092107

1. Description

Calibration item :	a) Hydrogen Sulfide (H ₂ S)
Equipment description :	Gold Film Hydrogen Sulfide Analyzer
Manufacturer :	ARIZONA INSTRUMENT LLC
Type / Model No. :	Jerome® 631-X
Serial No. :	3067
Assigned equipment no. :	AAST-H2SA-03
Adjustment :	N/A
Remark :	Received with good condition

2. Customer information

Customer :	Castco Testing Centre Limited
Address :	33, On Kui Street, Fanling, N.T.
Date of receipt :	19 July 2021

3. Date of performance of the calibration

Date of calibration :	22 July 2021
-----------------------	--------------

Approved Signatory
WM Ling

Company Chop:
Certificate issue date: 28 July 2021

CT-BEG-02
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4. Result of Calibration

a) Hydrogen Sulfide (H₂S)

Reference Setting ; ppm	Measured reading ; ppm	Error of indication ; %
0.0	0.000	N/A
0.5	0.48	-4.0
10.0	10	0.0
20.0	21	5.0

Estimated expanded uncertainty: 8.0 % FS

Technical Requirement: ± 5 ppm

Hydrogen Sulfide (H₂S) - Repeatability

Reference reading ; ppm	RSD ; %
20.0	0.0

Technical Requirement: ± 2 %

Hydrogen Sulfide (H₂S) - Response Time

Reference reading ; ppm	Response time ; second
20.0	13

Technical Requirement:

≤ 30 seconds (Pump)

Note: The technical requirement is refer to JJG 695-2003

CT-006-04

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Portable H₂S analyzer



5. Reference method for calibration

Hydrogen Sulfide	JJG 695-2003
------------------	--------------

6. Environment condition of calibration

Temperature	24.1 °C
Relative humidity	48 %RH

7. Reference equipment used in the calibration

Item	Model	Serial No.	Expiry date	Traceable to
Hydrogen sulfide	PGM-6208	M01C022401	12 Oct 2021	BJIM

- Note1: The estimated expanded uncertainties have been calculated in "Evaluation and expression of uncertainty in measurement" and give an internal estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.
- Note2: The standard (s) and instrument used in the calibration are traceable to national or international recognized standard and are calibrated on a schedule to maintain the accuracy and good condition.
- Note3: The result reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long term stability of the instrument.
- Note4: The result shows in this calibration certificate relate only to the item calibrated, and the results only applies to the calibration item as received.

Calibrated by: *[Signature]*

Date: 22 July 2021

Checked by: *[Signature]*

Date: 22 July 2021

*** End of Certificate ***

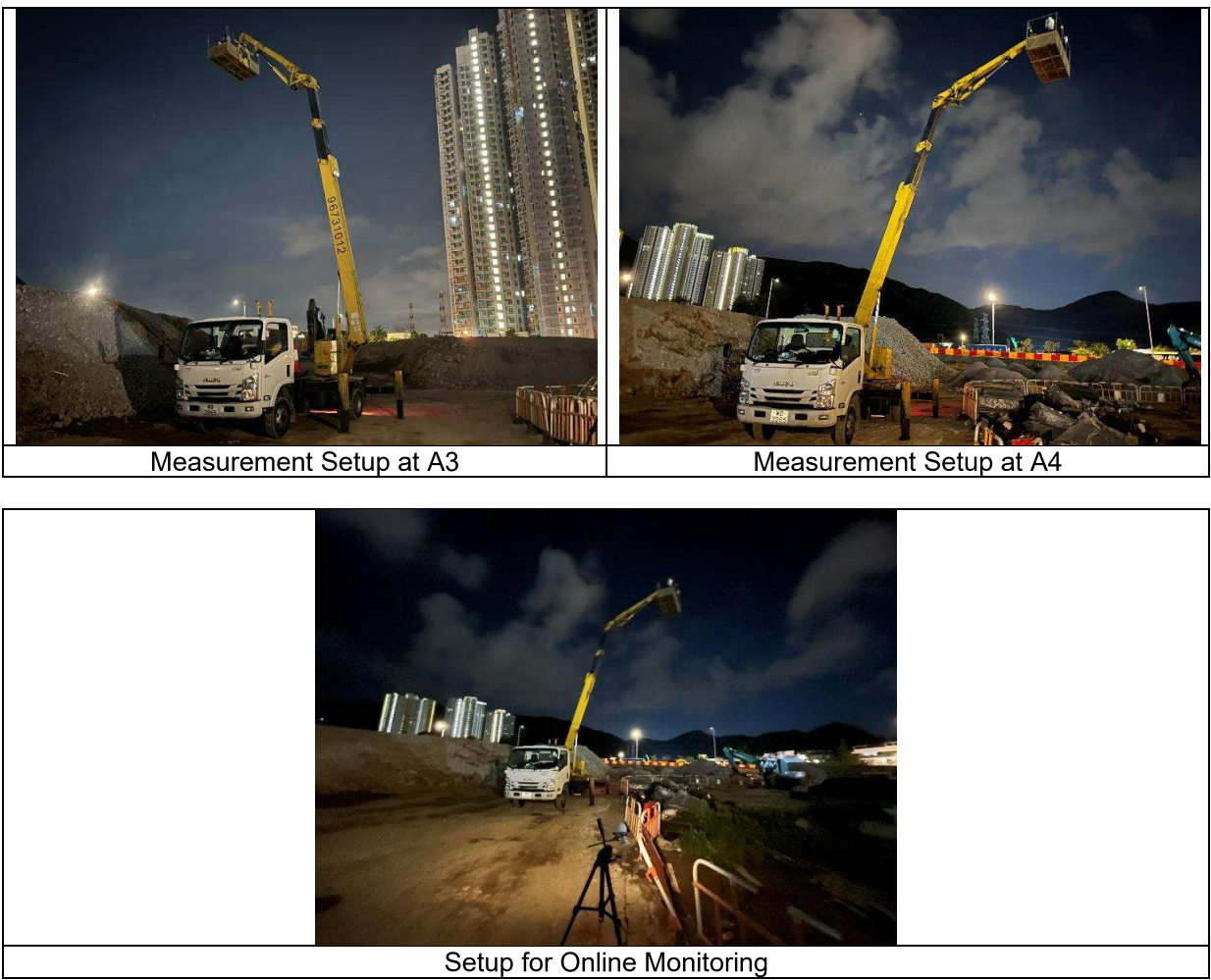
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Appendix C - Photographic Records



Appendix D - Event and Action Plan

Event	Action		
	ET	IEC	ER (DSD)
Exceedance of Action Level	1. Identify source / reason of exceedance; 2. Inform IEC and ER (DSD); 3. Carry out investigation to identify the source / reason of exceedance or complaints. Investigation shall be completed within 1 week and advise the findings to IEC and ER (DSD); 4. Repeat measurement to confirm finding after rectification work.	1. Check with ET and ER (DSD) on the operating activities and implementation of odour mitigation measures; 2. Discuss with ER (DSD) on the possible remedial actions; 3. Advise the ER (DSD) on the effectiveness of the proposed remedial measures; 4. Supervise implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing; 2. Rectify any unacceptable practice; 3. Amend working methods as required; 4. Implement amended working methods.
Exceedance of Limit Level	1. Notify IEC, ER (DSD) and EPD; 2. Identify source of odour; 3. Increase monitoring frequency; 4. Carry out investigation to identify the source / reason of exceedance. Investigation shall be completed within 1 week and advise the findings to IEC and ER (DSD); 5. Arrange meeting with IEC and ER (DSD) to discuss the remedial actions to be taken; 6. Assess effectiveness of the remedial actions and keep IEC, EPD and ER (DSD) informed to the results.	1. Check with ET and ER (DS) on the operating activities and implementation of odour mitigation measures; 2. Review the proposed remedial actions whenever necessary to assure their effectiveness and advise the ER (DSD) accordingly; 3. Supervise implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing; 2. Rectify any unacceptable practice and amend working methods as required; 3. Formulate remedial actions and inform ET and IEC; 4. Ensure amended working methods and remedial actions properly implemented; 5. If exceedance continues, consider what portion of the work is responsible and stop that portion of work unit the exceedance is abated.

Appendix E - 24-hour H₂S Monitoring Results

Monitoring Station: A3		
Measurement Period	15-minute H ₂ S Concentration (ppb)	24-hour average H ₂ S Concentration (ppb)
16 Jul 2022, 10:45-10:59	1.7	0.93
16 Jul 2022, 15:08-15:22	1.9	
16 Jul 2022, 16:59-17:13	0.5	
16 Jul 2022, 19:41-19:55	0.5	
16 Jul 2022, 22:59-23:13	0.5	
17 Jul 2022, 03:15-03:29	0.5	
17 Jul 2022, 04:54-05:08	0.5	
17 Jul 2022, 07:41-07:55	1.3	
Maximum	1.9	
Minimum	0.5	
Action Level	2.5	
Limit Level	2.5	

Monitoring Station: A4		
Measurement Period	15-minute H ₂ S Concentration (ppb)	24-hour average H ₂ S Concentration (ppb)
16 Jul 2022, 11:42-11:56	1.8	0.98
16 Jul 2022, 15:43-15:57	1.5	
16 Jul 2022, 16:18-16:32	0.8	
16 Jul 2022, 20:18-20:32	0.6	
16 Jul 2022, 22:16-22:30	0.6	
17 Jul 2022, 03:43-03:57	0.5	
17 Jul 2022, 04:17-04:31	0.5	
17 Jul 2022, 08:16-08:30	1.5	
Maximum	1.8	
Minimum	0.5	
Action Level	2.5	
Limit Level	2.5	

Appendix F - Meteorological Conditions

Hong Kong Observatory's Tuen Mun Weather Station Hourly Meteorological Conditions

Date	Time	Temperature (°C)	Wind Speed (km/hour)	Wind Direction
16 July 2022	10:00	30.3	9.00	Southwest
	11:00	31.2	10.33	Southwest
	12:00	31.7	12.00	Southwest
	13:00	32.0	11.67	Southwest
	14:00	32.6	10.67	Southwest
	15:00	32.8	13.00	South
	16:00	32.4	10.67	South
	17:00	31.5	10.83	South
	18:00	30.8	11.17	South
	19:00	30.3	8.50	South
	20:00	29.9	7.50	South
	21:00	29.5	10.17	Southeast
	22:00	29.5	10.50	Southeast
	23:00	29.2	9.00	Southeast
17 July 2022	0:00	29.4	9.33	South
	1:00	29.4	7.50	South
	2:00	29.1	7.67	Southwest
	3:00	29.2	6.17	Variable
	4:00	29.1	7.50	South
	5:00	29.1	8.50	South
	6:00	29.1	6.33	South
	7:00	29.5	9.83	South
	8:00	30.0	8.17	Variable
	9:00	30.6	10.00	Southwest
	10:00	31.2	12.83	Southwest

Source:

<https://data.gov.hk/en-data/dataset/hk-hko-rss-latest-one-minute-mean-air-temp><https://data.gov.hk/en-data/dataset/hk-hko-rss-latest-ten-minute-wind-info>