

## 2 AIR QUALITY MONITORING

### Introduction

- 2.1 The requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of air quality impacts during the construction phase of the Project are presented in this Section. As construction dust is the prime concern, TSP levels shall be monitored to evaluate the dust impact during the construction phase.
- 2.2 The objectives of the air quality monitoring shall be:
- (a) To identify the extent of construction dust impacts on sensitive receivers during construction phases;
  - (b) To determine the effectiveness of mitigation measures to control fugitive dust emission from activities during construction phases;
  - (c) To audit the compliance of the Contractor with regard to dust control, contract conditions and the relevant dust impact criteria;
  - (d) To recommend further mitigation measures if found to be necessary; and
  - (e) To comply with Action and Limit (AL) Levels for air quality as defined in this Manual.

### Air Quality Parameters

- 2.3 Monitoring and audit of the TSP levels shall be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely action taken to rectify the situation.
- 2.4 1-hour and 24-hour our TSP levels should be measured to indicate the impacts of construction dust on air quality. The 24-hour TSP levels should be measured by following the standard high volume sampling method as set out in the Title 40 of the Code of Federal Regulations, Chapter 1(part 50), Appendix B. Upon approval of the ER, 1 hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts.
- 2.5 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and any other local atmospheric factors affecting or affected by site conditions, etc., shall be recorded down in detail. A sample data sheet is shown in **Appendix B**.
- 2.6 The locations of air sensitive receivers (ASRs) within the assessment area of the Peng Chau STW Upgrade are shown in **Figure 2-1**.

## Monitoring Equipment

- 2.7 High volume samplers (HVS) in compliance with the following specifications shall be used for carrying out the 1-hour and 24 -hour TSP monitoring:
- (a) Adjustable flow ranges of 0.6-1.7m<sup>3</sup> per minute;
  - (b) Equipped with a timing /control device with +/- 5 minutes accuracy for 24 hours operation;
  - (c) installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;
  - (d) Capable of providing a minimum exposed area of 406 cm<sup>2</sup>;
  - (e) Flow control accuracy: +/- 2.5% deviation over 24- hour sampling period;
  - (f) Equipped with a shelter to protect the filter and sampler;
  - (g) Incorporated with an electronic mass flow rate controller or other equivalent devices;
  - (h) Equipped with a flow recorder for continuous monitoring;
  - (i) Provided with a peaked roof inlet;
  - (j) Incorporated with a manometer;
  - (k) Able to hold and seal the filter paper to the sampler housing at horizontal positions;
  - (l) Easily changeable filter; and
  - (m) Capable of operating continuously for a 24-hour period.
- 2.8 The ET is responsible for provision of the monitoring equipment. They shall ensure that sufficient number of HVSs with an appropriate calibration kit are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. The HVSs shall be equipped with an electronic mass flow controller and the calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc., shall be clearly labelled.
- 2.9 Initial calibration of dust monitoring equipment shall be conducted upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognized primary standard and be calibrated annually. The concern parties such as IC(E) shall properly document the calibration data for future reference. All the data should be converted into standards temperature and pressure condition.

- 2.10 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded in data sheet as mentioned in Appendix B.
- 2.11 If the ET proposes to use a direct reading dust meter to measure 1-hour TSP levels, he shall submit sufficient information to the IC(E) to prove that the instrument is capable of achieving a comparable results to the HVS. The instrument should also be calibrated regularly, and the 1-hour sampling shall be determined periodically by the HVS to check the validity and accuracy of the results measured by direct reading method.
- 2.12 Wind data monitoring equipment shall also be provided and set up for logging wind speed and wind direction near the dust monitoring locations. The equipment installation location shall be proposed by the ET and agreed with the IC(E). For installation and operation of wind data monitoring equipment, the following points shall be observed:
- (a) The wind sensors should be installed 10 m above ground so that they are clear of obstructions or turbulence caused by buildings;
  - (b) The wind data should be captured by a data logger. The data shall be downloaded for analysis at least once a month;
  - (c) The wind data monitoring equipment should be re-calibrated at least once every six months; and
  - (d) Wind direction should be divided into 16 sectors of 22.5 degrees each.
- 2.13 In exceptional situations, the ET may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from the IC(E).

#### **Laboratory Measurement/Analysis**

- 2.14 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory should be HOKLAS accredited or another internationally accredited laboratory.
- 2.15 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the ER in consultation with the IC(E). Any measurement performed by the laboratory shall be demonstrated to the satisfaction of the ER and IC(E). IC(E) shall regularly audit to the measurement performed by the laboratory to ensure the accuracy of measurements results. The ET leader shall provide the ER with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1(Part 50), Appendix B for his reference.

- 2.16 Filter paper of size 8"×10" shall be labelled before sampling. It shall be a clean filter paper with no pinholes, and shall be conditioned in a humidity controlled chamber for over 24-hours and be pre-weighted before use for the sampling.
- 2.17 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper shall then be returned to the laboratory for reconditioning in the humidity-controlled chamber followed by accurate weighing by an electronic balance with readout down to 0.1mg. The balance shall be regularly calibrated against a traceable standard.
- 2.18 All the collected samples shall be kept in a good condition for 6 months before disposal.

### Monitoring Locations

- 2.19 Based on the EIA report, the worst affected location is Sea Crest Villa Block A. This location is selected for construction dust monitoring (**Figure 2-2**). The status and location of dust sensitive receivers may change after issuing this Manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER and agreement from the IC(E) and EPD.
- 2.20 When alternative monitoring locations are proposed, the proposed site should, as far as practicable:
- (a) be at the site boundary or such locations close to the major dust emission source;
  - (b) be close to the sensitive receptors; and
  - (c) take into account the prevailing meteorological conditions.
- 2.21 The ET shall agree with ER in consultation with the IC(E) on the position of the HVS for the installation of the monitoring equipment. When positioning the sampler, the following points shall be noted.
- (a) A horizontal platform with appropriate support to secure the samplers against gusty wind should be provided.
  - (b) No two samplers should be placed less than 2 meters apart;
  - (c) The distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;
  - (d) A minimum of 2 meters of separation from walls, parapets and penthouses is required for rooftop samplers;
  - (e) A minimum of 12 meters separation from any supporting structure, measured horizontally is required;
  - (f) No furnace or incinerator flue is nearby;

- (g) Airflow around the sampler is unrestricted;
- (h) The sampler is more than 20 meters from the drip-line;
- (i) Any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;
- (j) Permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- (k) A secured supply of electricity is needed to operate the samplers.

### **Baseline Monitoring**

- 2.22 Baseline monitoring shall be carried out at all the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hour TSP samples. The selected baseline monitoring stations should reflect baseline conditions at the impact stations. One-hour sampling should also be done at least 3 times per day while the highest dust impact is expected. General meteorological conditions (wind speed, direction and precipitation) and notes regarding any significant adjacent dust producing sources shall also be recorded throughout the baseline monitoring period.
- 2.23 The baseline monitoring will provide data for the determination of the appropriate action levels with the limit levels set against statutory or otherwise agreed limit.
- 2.24 During the baseline monitoring, there should not be any construction or dust generation activities in the vicinity of the monitoring stations. Before commencing baseline monitoring the ET shall inform the IC(E) of the baseline monitoring programme such that the IC(E) can conduct on-site audit to ensure accuracy of the baseline monitoring results.
- 2.25 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET Leader shall carry out the monitoring at alternative locations that can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations shall be approved by the ER and agreed with the IC(E) and EPD.
- 2.26 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET shall liaise with the IC(E) and EPD to agree on an appropriate set of data to be used as a baseline reference and submit to ER for approval.
- 2.27 Ambient conditions may vary seasonally and shall be reviewed once every three months. If the ET leader considers that the ambient conditions have been changed and a repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring should be at times when the Contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should change in ambient conditions be determined, the

baseline levels and, in turn, the air quality criteria, should be revised. The revised baseline levels and air quality criteria should be agreed with the IC(E) and EPD.

### Impact Monitoring

- 2.28 The ET shall carry out impact monitoring during the course of the Project. For regular impact monitoring, the sampling frequency of at least once in every six-days, shall be strictly observed at all the monitoring stations for 24-hour TSP monitoring. For 1-hour TSP monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs. Before commencing baseline monitoring, the ET shall inform the IC(E) of the impact monitoring programme such that the IC(E) can conduct on-site audit to ensure accuracy of the impact monitoring results.
- 2.29 The specific time to start and stop the 24-hour TSP monitoring shall be clearly defined for each location and be strictly followed by the operator.
- 2.30 In case of non-compliance with the air quality criteria, more frequent monitoring, as specified in the Action Plan in the following section, shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in the air quality is rectified.

### Environmental Quality Performance Limits

- 2.31 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. **Table 2-1** shows the air quality criteria, namely Action and Limit levels to be used.

**Table 2-1 Action/Limit Levels for Air Quality**

Parameters	Action	Limit
24-hour TSP Level in $\mu\text{g m}^{-3}$	For baseline level $\leq 200 \mu\text{g m}^{-3}$ , Action level = (baseline level * 1.3 + Limit level)/2; For baseline level $> 200 \mu\text{g m}^{-3}$ , Action level = Limit level	$260 \mu\text{g m}^{-3}$
1-hour TSP Level in $\mu\text{g m}^{-3}$	For baseline level $\leq 384 \mu\text{g m}^{-3}$ , Action level = (baseline level * 1.3 + Limit level)/2; For baseline level $> 384 \mu\text{g m}^{-3}$ , Action level = Limit level	$500 \mu\text{g m}^{-3}$

### Event and Action Plan for Air Quality

- 2.32 Should non-compliance of air quality criteria occur, actions in accordance with the Action Plan in **Table 2-2** shall be carried out.

**Table 2-2 Event/Action Plan for Air Quality**

Event	Action			
	ET	IC(E)	ER	Contractor
<b>Action Level</b>				
Exceedance for one sample	<ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures;</li> <li>2. Inform IC(E) and ER;</li> <li>3. Repeat measurement to confirm findings;</li> <li>4. Increase monitoring frequency to daily.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET;</li> <li>2. Check Contractor's working method.</li> </ol>	<ol style="list-style-type: none"> <li>1. Notify Contractor.</li> </ol>	<ol style="list-style-type: none"> <li>1. Rectify any unacceptable practice;</li> <li>2. Amend working methods if appropriate.</li> </ol>
Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> <li>1. Identify source;</li> <li>2. Inform IC(E) and ER;</li> <li>3. Advise the ER on the effectiveness of the proposed remedial measures;</li> <li>4. Repeat measurement to confirm findings;</li> <li>5. Increase monitoring frequency to daily;</li> <li>6. Discuss with IC(E) and Contractor on remedial actions required;</li> <li>7. If exceedance continues, arrange meeting with IC(E) and ER;</li> <li>8. If exceedance stops, cease additional monitoring.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check Contractor's working method;</li> <li>2. Discuss with ET and Contractor on possible remedial measures;</li> <li>3. Advise the ET on the effectiveness of the proposed remedial measures;</li> <li>4. Supervise Implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. Ensure remedial measures properly implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Submit proposals for remedial to ER within 3 working days of notification;</li> <li>2. Implement the agreed proposals;</li> <li>3. Amend proposal if appropriate.</li> </ol>

Event	Action			
	ET	IC(E)	ER	Contractor
Limit Level				
Exceedance for one sample	<ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures;</li> <li>2. Inform ER, Contractor and EPD;</li> <li>3. Repeat measurement to confirm findings;</li> <li>4. Increase monitoring frequency to daily;</li> <li>5. Assess effectiveness of Contractor's remedial actions and keep IC(E), EPD and ER informed of the results.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET;</li> <li>2. Check Contractor's working method;</li> <li>3. Discuss with ET and Contractor on possible remedial measures;</li> <li>4. Advise the ER on the effectiveness of the proposed remedial measures;</li> <li>5. Supervise Implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. Ensure remedial measures properly implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance;</li> <li>2. Submit proposals for remedial actions to IC(E) within 3 working days of notification;</li> <li>3. Implement the agreed proposals;</li> <li>4. Amend proposal if appropriate.</li> </ol>
Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> <li>1. Notify IC(E), ER, Contractor and EPD;</li> <li>2. Identify source;</li> <li>3. Repeat measurement to confirm findings;</li> <li>4. Increase monitoring frequency to daily;</li> <li>5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented;</li> <li>6. Arrange meeting with IC(E) and ER to discuss the remedial actions to be taken;</li> <li>7. Assess effectiveness of Contractor's remedial actions and keep IC(E), EPD and ER informed of the results;</li> <li>8. If exceedance stops, cease additional monitoring.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss amongst ER, ET, and Contractor on the potential remedial actions;</li> <li>2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly;</li> <li>3. Supervise the implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. In consolidation with the IC(E), agree with the Contractor on the remedial measures to be implemented.</li> <li>4. Ensure remedial measures properly implemented;</li> <li>5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.</li> </ol>	<ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance;</li> <li>2. Submit proposals for remedial actions to IC(E) within 3 working days of notification;</li> <li>3. Implement the agreed proposals;</li> <li>4. Resubmit proposals if problem still not under control;</li> <li>5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.</li> </ol>



## Mitigation Measures

2.33 The EIA Report has recommended air quality control and mitigation measures during the construction and operational phases of the Project. The mitigation measures recommend in the EIA report are summarised below:

### Construction Phase

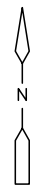
2.34 Implementation of the requirements stipulated in the Air Pollution Control (Construction Dust) Regulation and the following good site practices are recommended to control dust emission from the site:

- (a) Stockpiles of imported material kept on site should be contained within hoardings, dampened and/or covered during dry and windy weather;
- (b) Material stockpiled alongside trenches should be covered with tarpaulins whenever works are close to village houses;
- (c) Water sprays should be used during the delivery and handling of cement, sands, aggregates and the like;
- (d) Any vehicle used for moving cement, sands, aggregates and construction waste shall have properly fitting side and tail boards. Materials should not be loaded to a level higher than the side and tail boards, and should be covered by a clean tarpaulin.

### Operational Phase

2.35 All the major odour sources such as inlet works, grit chamber, equalization tank, SBR, sludge thickener, sludge digester, screening and grits storage area, return liquor pumping station and sludge drying bed (if it serves as duty unit) would be enclosed by air-tight covers. The odourous gas would then be collected and treated by deodorization unit with hydrogen sulphide removal efficiency of more than 99.5%. With the implementation of these mitigation measures, the impact to the identified ASRs would become insignificant.

2.36 The implementation schedule for the recommended air quality mitigation measures is presented in Appendix A.



PROPOSED PENG CHAU STW  
UPGRADE

PROPOSED EMERGENCY  
OVERFLOW OUTFALL

TAI LEI ISLAND

ASR1

PROPOSED DN250  
PUMPING MAINS

STUDY AREA BOUNDARY

PROPOSED SUBMARINE  
OUTFALL

ASR2

ASR3

ASR4

ASR5

ASR10

ASR9

ASR11

ASR6

ASR7

ASR8

LEGEND:

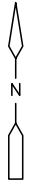
- ASR 1: PENG CHAU REFUSE TRANSFER STATION
- ASR 2: SEA CREST VILLA BLOCK D
- ASR 3: SEA CREST VILLA BLOCK C
- ASR 4: SEA CREST VILLA BLOCK B
- ASR 5: SEA CREST VILLA BLOCK A
- ASR 6: TEMPORARY STRUCTURE IN THE NORTH OF KAM PENG ESTATE
- ASR 7: KAM PENG ESTATE
- ASR 8: PENG LAI COURT
- ASR 9: FUTURE EDUCATIONAL AREA
- ASR 10: FUTURE RESIDENTIAL AREA
- ASR 11: FUTURE RESIDENTIAL AND COMMERCIAL AREA

500m

40 0 40 Meter



**Figure 2-1**  
**Locations of Air Sensitive Receivers**



PROPOSED PENG CHAU STW UPGRADE

TAI LEI ISLAND

PROPOSED DN250 PUMPING MAINS

PENG CHAU

PROPOSED EMERGENCY OVERFLOW OUTFALL

SEA CREST VILLA BLOCK A

PROPOSED SUBMARINE OUTFALL

LEGEND:

● TSP MONITORING LOCATION

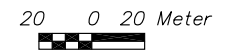


Figure 2-2  
TSP Monitoring Location