2. AIR QUALITY MONITORING

Introduction

2.1 This section presents 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. The requirements for baseline and impact monitoring and the action and limit levels are applicable to both the designated project and non-designated project elements.

2.2 The objectives of the air quality monitoring shall be:

- to identify the extent of construction dust impacts on sensitive receivers;
- to determine the effectiveness of mitigation measures to control fugitive dust emission from activities during construction phase;
- to audit the compliance of the Contractor with regard to dust control, contract conditions and the relevant dust impact criteria;
- to recommend further mitigation measures if found to be necessary;
- to comply with Action and Limit (A/L) Levels for air quality as defined in this Manual.

Air Quality Parameters

2.3 The criteria against which ambient air quality monitoring shall be assessed are:

- The Hong Kong Air Quality Objectives (AQOs) for TSP, 24-hour TSP levels of 260 µg m\(^{-3}\); and
- The statutory 1-hour TSP limit of 500 µg m\(^{-3}\).

2.4 These levels are not to be exceeded at Air Sensitive Receivers (ASRs).

Monitoring Equipment

2.5 The TSP levels shall be measured by following the standard method as set out in High Volume Method for Total Suspended Particulates, Part 50 Chapter 1 Appendix B, Title 40 of the Code of Federal Regulations of the USEPA.

2.6 Dust laden with air shall be drawn through a high volume sampler (HVS) fitted with a conditioned, pre-weighed filter paper, at a controlled rate. After sampling for 24-hours, the filter paper with retained particles is collected and returned to the laboratory for drying in a desiccator followed by accurate weighing. 24-hour average TSP levels are calculated from the ratio of the mass of particulates retained on the filter paper to the total volume of air sampled.

2.7 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of sampler, identification and weight of the filter paper, and
other special phenomena and work progress of the concerned site, etc, shall be recorded down in detail. A sample data sheet is shown in Appendix B.

2.8 HVS in compliance with the following specifications shall be used for carrying out the 1-hour and 24-hour monitoring:

- 0.6 - 1.7 m³ per minute (20 - 60 standard cubic feet per minute) adjustable flow range;
- equipped with a timing / control device with ± 5 minutes accuracy for 24 hours operation;
- installed with elapsed-time meter with ± 2 minutes accuracy for 24 hours operation;
- capable of providing a minimum exposed area of 406 cm² (63 in²);
- flow control accuracy: ± 2.5% deviation over 24-hour sampling period;
- incorporated with an electronic mass flow rate controller or other equivalent devices;
- equipped with a flow recorder for continuous monitoring;
- provided with a peaked roof inlet;
- incorporated with a manometer;
- able to hold and seal the filter paper to the sampler housing at horizontal position;
- easy to change the filter;
- capable of operating continuously for 24-hour period.

2.9 The ET shall be responsible for the provision of the monitoring equipment. He shall ensure that sufficient number of HVSs with appropriate calibration kit is available for carrying out the baseline, regular impacts monitoring and ad-hoc monitoring. The HVSs shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals, in accordance with requirements stated in the manufacturers operating manual and as described below. All the equipment, calibration kit, filter papers, etc, shall be clearly labelled.

2.10 The flow rate of each HVS with mass flow controller shall be calibrated using an orifice calibrator. Initial calibration of the dust monitoring equipment shall be conducted upon installation and prior to commissioning. One point flow rate calibration shall be carried out every two months. Five-point calibration shall be carried out every six months.

2.11 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 down on the data sheet as mentioned in Appendix B.

**Monitoring Locations**

2.12 Two worst affected locations at Pui O have been identified for TSP dust monitoring as shown in Table 2.1 and illustrated in Figure 2.1. One monitoring location at the Siu Ho Wan WTW is also identified to monitor dust impact at existing water treatment facilities. Prior to the commencement of the EM&A programme, the proposed air quality monitoring stations shall be discussed and agreed with the Engineer, the ET, IC(E) and EPD.
Table 2.1  Air Monitoring Stations during Construction Phase

<table>
<thead>
<tr>
<th>Project Classification</th>
<th>Identification No.</th>
<th>Air Monitoring Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-designated Project</td>
<td>LWT2</td>
<td>Pui O Lo Wai Tsuen facing South Lantau Road</td>
</tr>
<tr>
<td>Non-designated Project</td>
<td>PG1</td>
<td>Children’s Playground next to Chi Ma Wan Road</td>
</tr>
<tr>
<td>Designated Project</td>
<td>SHWAB</td>
<td>Siu Ho Wan WTW Administration Building</td>
</tr>
</tbody>
</table>

2.13 When alternative monitoring locations are proposed, the monitoring locations shall be chosen based on the following criteria:

- monitoring at sensitive receivers close to the major site activities which are likely to have air quality impacts;
- monitoring at the air sensitive receivers as defined in the Technical Memorandum;
- assurance of minimal disturbance to the occupants during monitoring.

2.14 When positioning the HVSs, the following points shall be noted:

- a horizontal platform with appropriate support to secure the samplers against gusty wind shall be provided;
- no two samplers shall be placed less than 2 m apart;
- 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;
- a minimum of 2 m separation from walls, parapets and penthouses is required for rooftops samplers;
- a minimum of 2 m separation from any supporting structure, measures horizontally is required;
- no furnace or incinerator flue is nearby;
- airflow around the sampler is unrestricted;
- the sampler is more than 20 m from the dripline;
- any wire fence and gate to protect the sampler, shall not cause any obstruction during monitoring;
- permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- a secured supply of electricity is needed to operate the samplers.
Baseline Monitoring

2.15 Baseline monitoring shall be carried out to determine the ambient 1-hour and 24-hour TSP levels at the monitoring locations prior to the commencement of the Project works. During the baseline monitoring, there shall not be any construction or dust generating activities in the vicinity of the monitoring stations.

2.16 TSP baseline monitoring shall be carried out for a continuous period of at least two weeks under typical weather conditions with the 24-hour and three 1-hour ambient measurements taken daily at each monitoring location. 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.

2.17 The baseline monitoring will provide data for the determination of the appropriate Action levels with the Limit levels set against statutory or otherwise agreed limits.

2.18 Baseline checking of ambient TSP levels shall be carried out every six months at each monitoring location, when no dusty works activities are in operation. If the ET considers that significant changes in the ambient conditions have arisen, a repeat of the baseline monitoring may be carried out to update the baseline levels and air quality criteria, after consultation and agreement with the ER, the IC(E) and the EPD.

Impact Monitoring for Construction Air Quality Impact

2.19 The monthly schedule of the compliance and impact monitoring programme shall be drawn up by the ET one month prior to the commencement of the scheduled construction period. For regular impact monitoring, a sampling frequency of at least once in every six days shall be strictly observed at all of the monitoring stations for 24-hour TSP monitoring. In case of complaints, 1-hour TSP monitoring shall be conducted at least three times in every six days when the highest dust impacts are likely to occur. The impact monitoring programme is summarised in Table 2.2.

<table>
<thead>
<tr>
<th>Sampling duration</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour</td>
<td>3 times every 6 days (as required in case of complaints)</td>
</tr>
<tr>
<td>24 hours</td>
<td>Once every 6 days</td>
</tr>
</tbody>
</table>

2.20 Before commencing the monitoring, the ET shall inform the IC(E) of the impact monitoring programme such that the IC(E) can conduct an on-site audit to ensure the accuracy of the impact monitoring results.

Compliance Assessment

2.21 Action and Limit levels that provide an appropriate framework for the interpretation of monitoring results have to be agreed between ET, IC(E), EPD and the Engineer before commencement of the air monitoring. The air quality monitoring data shall be checked against the agreed A/L levels. Recommended A/L levels are listed in Table 2.3.
Table 2.3  Proposed Action and Limit Levels for Impact Monitoring

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Action Level (1)</th>
<th>Limit Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSP (24 hour average)</td>
<td>• BL ≤ 200 µg m(^{-3}), AL = (BL * 1.3 + LL)/2</td>
<td>260 µg m(^{-3})</td>
</tr>
<tr>
<td></td>
<td>• BL &gt; 200 µg m(^{-3}), AL = LL</td>
<td></td>
</tr>
<tr>
<td>TSP (1 hour average)</td>
<td>• BL ≤ 384 µg m(^{-3}), AL = (BL * 1.3 + LL)/2</td>
<td>500 µg m(^{-3})</td>
</tr>
<tr>
<td></td>
<td>• BL &gt; 384 µg m(^{-3}), AL = LL</td>
<td></td>
</tr>
</tbody>
</table>

(1) BL = Baseline level, AL = Action level, LL = Limit level.

Event and Action Plan (EAP)

2.22 The principle upon which the EAP is based on the prescription of procedures and actions associated with the measurement of certain defined levels of air pollution recorded by the environmental monitoring process and the agreed A/L levels. In cases where exceedance of these A/L levels occurs, the ET, the IC(E), the Engineer and the Contractor shall strictly observe the relevant actions of the respective EAP listed in Table 2.4.
<table>
<thead>
<tr>
<th>EVENT</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACTION LEVEL</strong></td>
<td></td>
</tr>
<tr>
<td>1. Exceedance for one sample</td>
<td>1. Identify source, investigate the causes of complaint and propose remedial measures; 2. Inform IC(E) and ER; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily.</td>
</tr>
<tr>
<td>2. Exceedance for two or more consecutive samples</td>
<td>1. Identify source; 2. Inform IC(E) and ER; 3. Advise the ER on the effectiveness of the proposed remedial measures; 4. Repeat measurements to confirm findings; 5. Increase monitoring frequency to daily; 6. Discuss with IC(E) and Contractor on remedial actions required; 7. If exceedance continues, arrange meeting with IC(E) and ER; 8. If exceedance stops, cease additional monitoring.</td>
</tr>
<tr>
<td><strong>LIMIT LEVEL</strong></td>
<td></td>
</tr>
<tr>
<td>1. Exceedance for one sample</td>
<td>1. Identify source, investigate the causes of exceedance and propose remedial measures; 2. Inform IC(E), ER, Contractor and EPD; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily; 5. Assess effectiveness of Contractor’s remedial actions and keep IC(E), EPD and ER informed of the results.</td>
</tr>
<tr>
<td>2. Exceedance for two or more consecutive samples</td>
<td>1. Notify IC(E), ER, Contractor and EPD; 2. Identify source; 3. Repeat measurement to confirm findings; 4. Increase monitoring frequency to daily; 5. Carry out analysis of Contractor’s working procedures to determine possible mitigation to be taken; 6. Arrange meeting with IC(E) and ER to discuss the remedial actions to be taken; 7. Assess effectiveness of Contractor’s remedial actions and keep IC(E), EPD and ER informed of the results; 8. If exceedance stops, cease additional monitoring.</td>
</tr>
</tbody>
</table>
Mitigation Measures

2.23 The EIA Report recommended air quality control and mitigation measures during the construction phase of the Project. The mitigation measures are summarised below and are common to both the designated project and non-designated project elements.

2.24 Dust mitigation measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* should be incorporated to control dust emission from the sites at Siu Ho Wan and Pui O. Major control measures relevant to this Project are:

- watering on the work sites at Siu Ho Wan and Pui O twice a day;
- skip hoist for material transport should be totally enclosed by impervious sheeting;
- vehicle washing facilities should be provided at every vehicle exit point;
- the area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores;
- every main haul road should be scaled with concrete and kept clear of dusty materials or sprayed with water so as to maintain the entire road surface wet;
- every stock of more than 20 bags of cement should be covered entirely by impervious sheeting placed in an area sheltered on the top and the three sides;
- all dusty materials should be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet;
- every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites;
- the dusty materials stockpiled on site should be covered;
- the load of dusty materials carried by vehicle leaving a construction site should be covered entirely by clean impervious sheeting to ensure dust materials do not leak from the vehicle.

2.25 The implementation schedule for the recommended mitigation measures for the designated project of Siu Ho Wan WTW Extension is presented in Appendix A.