

3 AIR QUALITY

3.1 Air Quality Parameters

3.1.1 Monitoring and audit of the Total Suspended Particulates (TSP) levels shall be carried out by the ET during construction to ensure that any deteriorating air quality can be readily detected and timely action taken to rectify the situation.

3.1.2 1-hour and 24-hour TSP levels should be measured to indicate the impacts of construction dust on air quality. The TSP levels shall 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.

3.1.3 Upon approval of the ER/IEC, 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.

3.1.4 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 other special phenomena and work progress of the concerned site etc. shall be recorded in detail. A sample data sheet is shown in Appendix B2.

3.2 Monitoring Equipment

3.2.1 The following equipment shall be used when carrying out the construction phase, air quality monitoring:

- High volume sampler (HVS) in compliance with the following specifications shall be used for carrying out the 1-hr and 24-hr TSP monitoring:
 - (a) 0.6-1.7 m³/min (20-60 SCFM) adjustable flow range;
 - (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 cm² (63 in²);
 - (e) flow control accuracy: +/- 2.5% deviation over 24-hr 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 position;

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- (l) easy to change the filter; and
(m) capable of operating continuously for 24-hr period.
- 3.2.2 The Contractor / ET shall be responsible for provision of the monitoring equipment. He shall ensure that a sufficient number of High Volume Samplers (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 be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. shall be clearly labelled.
- 3.2.3 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 recognised primary standard and be calibrated annually. The calibration data shall be properly documented for future reference. All the data should be converted into standard temperature and pressure conditions.
- 3.2.4 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 the data sheet as stated in Section 3.1.
- 3.2.5 If the ET Leader proposes to use a direct-reading dust meter to measure 1-hr TSP levels, he shall submit sufficient information to the ER/IEC to prove that the instrument is capable of achieving a comparable result with that of the HVS to confirm that it may be used for the 1-hr sampling. The instrument should also be calibrated regularly, and the 1-hr sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by a direct reading method.
- 3.2.6 Wind data monitoring equipment shall also be provided and set up at strategic locations for logging wind speed and wind direction near the dust monitoring locations. The equipment installation location shall be proposed by the ET Leader and agreed with the ER/IEC. For installation and operation of wind data monitoring equipment, the following points shall be observed:
- (a) the wind sensors should be installed on masts at an elevated level 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;
 - (b) the wind data should be captured by a data logger and to be downloaded for processing 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.
- 3.2.7 In exceptional situations, the ET Leader may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from EPD.

3.3 Laboratory Measurement / Analysis

- 3.3.1 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.
- 3.3.2 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analyses, the laboratory equipment shall be approved by the IEC/ER and the measurement procedures shall be witnessed by the IEC/ER. The ET Leader shall provide the ER with one copy of Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for his reference.
- 3.3.3 Filter paper of size 8"x10" shall be labelled before sampling. It shall be a clean filter paper with no pin holes, and shall be conditioned in a humidity controlled chamber for over 24-hr and be pre-weighed before use for the sampling.
- 3.3.4 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 a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.
- 3.3.5 All the collected samples shall be kept in a good condition for 6 months before disposal.

3.4 Monitoring Locations

- 3.4.1 The dust monitoring locations are shown in Figure 2.1. The status and locations of dust sensitive receivers may change after issuing this manual. In this event, the ET Leader shall propose updated monitoring locations and seek approval from ER/IEC and agreement from EPD on the proposal.
- 3.4.2 The following criteria, as far as practicable, should be followed when alternative monitoring locations are proposed, in that the position should be:
- at the site boundary or such locations close to the major dust emission source;
 - close to the sensitive receptors; and
 - take into account the prevailing meteorological conditions.
- 3.4.3 The ET Leader shall agree with the ER/IEC on the position of the HVS for installation of the monitoring equipment. The following points shall be considered when positioning the samplers:
- 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 meter 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 metres of separation from walls, parapets and penthouses is required for rooftop samplers;
- (e) a minimum of 2 metre 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 metres from the dripline;
- (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.

3.5 Baseline Monitoring

- 3.5.1 The ET Leader shall carry out baseline monitoring at all of the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hr TSP samples. 1-hr sampling shall also be done at least 3 times per day while the highest dust impact is expected.
- 3.5.2 During the baseline monitoring, there should not be any construction or dust generation activities in the vicinity of the monitoring stations.
- 3.5.3 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 which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations shall be approved by the ER/IEC and agreed with EPD.
- 3.5.4 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with EPD to agree on an appropriate set of data to be used as a baseline reference and submit to ER/IEC for approval.
- 3.5.5 Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. 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 EPD.

3.6 Impact Monitoring

- 3.6.1 The ET Leader shall carry out impact monitoring during the course of the Works. 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-hr TSP monitoring. For 1-hr TSP monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs.
- 3.6.2 The specific time to start and stop the 24-hr TSP monitoring shall be clearly defined for each location and be strictly followed by the operator.
- 3.6.3 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Action Plan in Section 2.7, 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 air quality is rectified.

3.7 Event and Action Plan for Air Quality

- 3.7.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET Leader shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. Table 3.1 shows the air quality criteria, namely Action and Limit levels to be used. Should non-compliance of the air quality criteria occurs, the ET, the E/IEC and the Contractor shall undertake the relevant action in accordance with the Action Plan in Table 3.2.

Table 3.1 Action and Limit Levels for Air Quality

Parameters	Action	Limit
24 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $< 108 \mu\text{g}/\text{m}^3$, Action level = average of baseline level plus 30% and Limit level For baseline level $> 108 \mu\text{g}/\text{m}^3$ and baseline level $< 154 \mu\text{g}/\text{m}^3$, Action level = $200 \mu\text{g}/\text{m}^3$ For baseline level $> 154 \mu\text{g}/\text{m}^3$, Action level = 130% of baseline level	260
1 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $< 154 \mu\text{g}/\text{m}^3$, Action level = average of baseline level plus 30% and Limit level For baseline level $> 154 \mu\text{g}/\text{m}^3$ and baseline level $< 269 \mu\text{g}/\text{m}^3$, Action level = $350 \mu\text{g}/\text{m}^3$ For baseline level $> 269 \mu\text{g}/\text{m}^3$, Action level = 130% of baseline level	500



Table 3.2 Event / Action Plan for Air Quality

EVENT	ACTION		
	ACTION LEVEL	ET	ER/IEC
1. Exceedance for one sample	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 	<ol style="list-style-type: none"> 1. Notify Contractor 2. Check monitoring data and Contractor's working methods 	<ol style="list-style-type: none"> 1. Rectify any unacceptable practice 2. Amend working methods if appropriate
2. Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER 3. Repeat measurements to confirm findings 4. Increase monitoring frequency to daily 5. Discuss with ER for remedial actions required 6. If exceedance continues, arrange meeting with ER 7. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Check monitoring data and Contractor's working methods 4. Discuss with Environmental Supervisor and Contractor on potential remedial actions 5. Ensure remedial actions properly implemented 	<ol style="list-style-type: none"> 1. Submit proposals for remedial actions to ER within 3 working days of notification 2. Implement the agreed proposals 3. Amend proposal if appropriate

Table 3.2: Event / Action Plan for Air Quality (continued)

EVENT		ACTION	
LIMIT LEVEL	ET	ER/IEC	CONTRACTOR
1. Exceedance for one sample	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER and EPD 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 5. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Check monitoring data and Contractor's working methods 4. Discuss with Environmental Team Leader and Contractor potential remedial actions 5. Ensure remedial actions properly implemented 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to ER within 3 working days of notification 3. Implement the agreed proposals 4. Amend proposal if appropriate
2. Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER and EPD the causes & actions taken for the exceedances 3. Repeat measurement to confirm findings 4. Increase monitoring frequency to daily 5. Investigate the causes of exceedance 6. Arrange meeting with EPD and ER to discuss the remedial actions to be taken 7. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 4. Discuss amongst Environmental Team Leader and the Contractor potential remedial actions 5. Review Contractor's remedial actions whenever necessary to assure their effectiveness 6. 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 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to ER within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated

3.8 Dust Mitigation Measures

3.8.1 The EIA report has specified dust control and mitigation measures in accordance with the Air Pollution Control (Construction Dust) Regulation. The Contractor shall be responsible for the design and implementation of measures to control dust, these include:

- The Contractor shall undertake at all times to prevent dust nuisance as a result of his activities. Dust suppression measures such as water spraying are necessary and should be installed to ensure that the air quality at the boundary of the site and at any sensitive receivers complies with the Hong Kong Air Quality Objectives.
- The Contractor shall notify any specific construction work as stated in the Air Pollution Control (Construction Dust) Regulation to the Authority before the commencement of such work.
- The Contractor shall apply for a licence or permit under the requirements of the relevant legislation (e.g., Air Pollution Control Ordinance and its subsidiary regulations) wherever applicable.
- Watering of unpaved areas, access roads, construction areas and dusty stockpiles shall be undertaken at least eight times daily during dry and windy weather. Watering of the haul road shall be undertaken four to eight times daily during dry or windy weather. Water sprays may be either fixed or mobile to follow individual areas to be wetted as and when required. Application of suitable wetting agents, such as dust suppression chemicals, shall be used in addition to water, especially during the dry season (October to December).
- Effective water sprays shall be used during the delivery and handling of all raw sand and aggregate, and other similar materials, wet dust is likely to be created and to dampen all stored materials during dry and windy weather.
- Stockpiles of sand, aggregate or any other dusty materials greater than 20m³ shall be enclosed on three sides, with walls extending above the pile and 1 metre beyond the front of the pile.
- Suitable chemical wetting agent such as dust suppression chemical shall be used on completed cuts and fills to reduce wind erosion.
- Areas within the construction site where there is a regular movement of vehicles shall have a paved surface and be kept clear of loose surface material.
- The Contractor shall restrict all motorized vehicles within the construction site, excluding those on public roads, to maximum speed of 20 km per hour and confine haulage and delivery vehicles to designated roadways inside the Site.

- Construction working areas will be restricted to a minimum practicable size.
 - The Contractor shall ensure that no earth, rock or debris is deposited on public or private rights of way as result of his activities, including any deposits arising from the movement of plant or vehicles.
 - The Contractor shall provide a wheel washing facility at the exits from work areas to the satisfaction of the Engineer and to the requirements of the Commissioner of Police. Water in wheel washing facilities and sediment shall be changed and removed respectively at least once a month.
 - The Contractor shall submit details of the wheel washing facilities; such shall be usable prior to any earthworks excavation activity on the construction site. The Contractor shall also provide a hard-surfaced road between any washing facility and the public road.
 - In the event of any spoil or debris from construction works being deposited on adjacent land, or streams, or any silt being washed down to any area, then all such spoil, debris or material and silt shall be immediately removed and the affected land and areas restored to their natural state by the Contractor to the satisfaction of the Engineer.
 - If spoil cannot be immediately transported out of the Site, stockpiles should be stored in sheltered areas.
 - Plant and vehicles shall be inspected annually to ensure that they are operating efficiently and that exhaust emissions are not causing a nuisance. All Site vehicle exhausts should be directed vertically upwards or directed away from ground.
 - Dust monitoring will be included in the EM&A Manual at the most affected ASRs. In general, 24-hour total suspended particulates and 1-hour total suspended particulates are required to be measured at the most affected ASRs which were listed in the Chapter 2 Table2.1.
 - Path for complaints and handling procedures should be set up and implement.
- 3.8.2 If the above measures are not sufficient to restore the air quality to acceptable levels, upon the advice of ET Team Leader, the Contractor shall liaise with the IEC on other mitigation measures, propose such measures to the ER/IEC for approval, and implement the mitigation measures