

Section 2

AIR QUALITY

2 AIR QUALITY

2.1 Introduction

2.1.1 In this Section, the methodology, equipment, monitoring locations, criteria and protocols for the EM&A of dust during Project construction.

2.1.2 The impact of fugitive dust on ambient air pollution will depend on the quantity, as well as the drift potential of the dust particles released into the atmosphere. Large dust particles will settle out near the source and particles that are 30 - 100 μm in diameter are likely to undergo impended settling. These particles, depending on the extent of atmospheric turbulence, are likely to settle within a distance of 100 m from the source. The main dust impact will arise from the fine particles of a diameter less than 30 μm , measured as TSP, dispersed over greater distance from the sources. Total Suspended Particulates (TSP) levels shall, therefore, be monitored to evaluate the dust impact during the construction of the WCR.

2.1.3 The objectives of TSP monitoring are to:

- (a) Identify the extent of construction dust impacts on sensitive receiver;
- (b) Determine the effectiveness of mitigation measures to control dust from construction activities;
- (c) Recommend further mitigation measures if found to be necessary;
- (d) Verify the prediction of the dust impacts in the EIA during each phase of the construction works; and
- (e) Comply with Action and Limit Levels for air quality as defined in this Manual.

2.2 Air Quality Parameters

2.2.1 Monitoring and audit of the TSP levels shall be carried out by the ET to ensure that any deteriorating air quality will be quickly detected and that timely action will be taken to rectify the situation.

2.2.2 1-hour and 24-hour TSP levels shall 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 *USEPA Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B*. With the approval of the ER, 1-hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as obtained by the high volume sampling method, to indicate short event impacts.

2.2.3 All relevant data relating to the dust monitoring (including: temperature, pressure, weather conditions, elapsed-time meter readings for the start and stop of the sampler, the identification and weight of the filter paper, details of the work being undertaken at the time of sampling and any other relevant information) shall be recorded in detail. A sample data sheet is shown in *Annex A*.

2.3 Monitoring Equipment

2.3.1 High volume samplers (HVS) in compliance with the following specification shall be used for carrying out the 1-hr and 24-hr TSP monitoring:

- (a) HVS with 0.6-1.7 m^3/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;
- (l) Easy to change the filter; and
- (m) Capable of operating continuously for 24-hr period.

- 2.3.2 The ET Leader is responsible for provision of the monitoring equipment. The ET Leader shall ensure that a sufficient number of HVSs with appropriate calibration kits 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 kits, filter papers, etc. shall be clearly labelled.
- 2.3.3 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 by the concerned parties such as the IC(E). All the data should be converted into standard temperature and pressure condition.
- 2.3.4 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 down in the data sheet as mentioned in *Annex A*.
- 2.3.5 If the ET Leader proposes to use a direct reading dust meter to measure 1-hr TSP levels, the ET Leader shall submit sufficient information to the IC(E) to prove that the instrument is capable of achieving 1-hr sampling result comparable to those obtained by the HVS. The instrument should also be calibrated regularly, and the 1-hr sampling shall be determined periodically to check the validity and accuracy of the results measured by direct reading method.
- 2.3.6 Wind data monitoring equipment shall also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET Leader and agreed with the ER in consultation with IC(E). 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 10 m 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.
- 2.3.7 In exceptional situations, the ET Leader may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from IC(E).

2.4 Laboratory Measurement / Analysis

- 2.4.1 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments for handling the collected dust samples, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory shall be an HOKLAS accredited, or maintain other internationally accredited status acceptable to EPD.
- 2.4.2 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) and EPD. Measurements performed by the laboratory shall be demonstrated to the satisfaction of the ER and the IC(E). The IC(E) shall conduct regular audits of the measurements performed by the laboratory to ensure the accuracy of measurement results. The ET Leader shall provide the ER with one copy of the *USEPA Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B* for reference.
- 2.4.3 Filter paper of size 8"x 10" 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 being used for the sampling.
- 2.4.4 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.
- 2.4.5 All the collected samples shall be kept in a good condition for 6 months before disposal.

2.5 Monitoring Locations

- 2.5.1 The dust monitoring locations are shown in *Figure 2.5a* and summarised in *Table 2.5a*. The status and locations of dust sensitive receivers may change after issuing this manual. If such a case arises, the ET Leader shall propose alternative monitoring locations and seek approval from ER and agreement from the IC(E).

Table 2.5a *Dust Monitoring Stations*

Dust Monitoring Stations	Monitoring Location
AM1	Ma Shan Tsuen (West)
AM2	Ma Shan Tsuen (East)
AM3	Lei Yue Mun Village
AM4	Sam Ka Tsuen Recreational Ground

- 2.5.2 If alternative monitoring locations are proposed (other than those identified above), they shall, as far as practicable, meet the following criteria:
- Be located at the site boundary or other similar location close to the major dust emitting source(s);
 - Be close to the sensitive receptors; and
 - Take into account the prevailing meteorological conditions.

2.5.3 The ET Leader shall agree with the ER, in consultation with the IC(E), the position of the HVS for installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:

- (a) A horizontal platform with appropriate support to secure the samplers against gusty wind shall be provided;
- (b) No two samplers should be placed less than 2 m apart;
- (c) The distance between the sampler and any intervening obstacle, such as a building, shall be at least twice the height that the obstacle protrudes above the sampler;
- (d) A minimum of 2 m separation from walls, parapets and penthouses is required for rooftop samplers;
- (e) A minimum of 2 m separation from any supporting structure, measured horizontally is required;
- (f) No furnace or incinerator flues shall be located nearby;
- (g) Airflow around the sampler shall be unrestricted;
- (h) The sampler shall be more than 20 m from any disciplines;
- (i) Any wire fence and gate, to protect the sampler, shall 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 shall be obtained to operate the samplers.

2.6 **Baseline Monitoring**

2.6.1 The ET Leader shall carry out baseline monitoring at all of the designated dust monitoring locations for at least 14 consecutive days prior to the commencement of the construction works. The baseline monitoring will consist of daily 24-hr TSP samples. 1-hr sampling shall also be undertaken at least 3 times per day while the highest dust impact is expected (eg. during major construction works). Before commencing the baseline monitoring, the ET leader shall inform the IC(E) of the baseline monitoring programme such that the IC(E) can conduct on-site audits to ensure the accuracy of the baseline monitoring results.

2.6.2 During the baseline monitoring, there should not be any construction or dust generating activities in the vicinity of the monitoring stations.

2.6.3 In cases when 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 and agreed with the IC(E) prior to being used.

2.6.4 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with the IC(E) and EPD to agree on an appropriate set of data for use as a baseline reference. This baseline reference data shall be submitted to ER for approval.

2.6.5 Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. If the ET Leader considers that the ambient conditions have changed and that repeat baseline monitoring is required to obtain updated baseline levels, then repeat baseline monitoring shall be undertaken at times when the Contractor's activities are not generating dust, at least in the proximity of the monitoring stations. If the revised baseline monitoring identifies changes in ambient conditions, then the baseline levels and, in turn, the air quality criteria, shall be revised. The revised baseline levels and air quality criteria shall be agreed with the IC(E) and EPD.

2.7 Impact Monitoring

- 2.7.1 The ET Leader shall carry out impact monitoring during the course of the Project works. The regular 24-hr TSP impact monitoring shall be undertaken at least once every six-days at each of the monitoring stations. 1-hr TSP monitoring shall be undertaken at least three times in every six-days when the highest dust impact is predicted to occur. Before commencing the baseline monitoring, the ET leader shall inform the IC(E) of the impact monitoring programme such that the IC(E) can conduct on-site audits to ensure the accuracy of the impact monitoring results.
- 2.7.2 The specific start and stop times of the 24-hr TSP monitoring shall be clearly defined for each location and be strictly followed by the operator.
- 2.7.3 In case of non-compliance with the dust criteria, more frequent monitoring exercises, as specified in the Action Plan in *Section 2.8*, shall be conducted within 24 hours after the non-compliant result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

2.8 Event and Action Plan for Dust

- 2.8.1 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 2.8a* shows the dust criteria, namely the Action and Limit (A/L) Levels to be used. Should non-compliance of the dust criteria occur, actions in accordance with the Action Plan in *Table 2.8b* shall be carried out.

Table 2.8a Action and Limit Levels for Dust

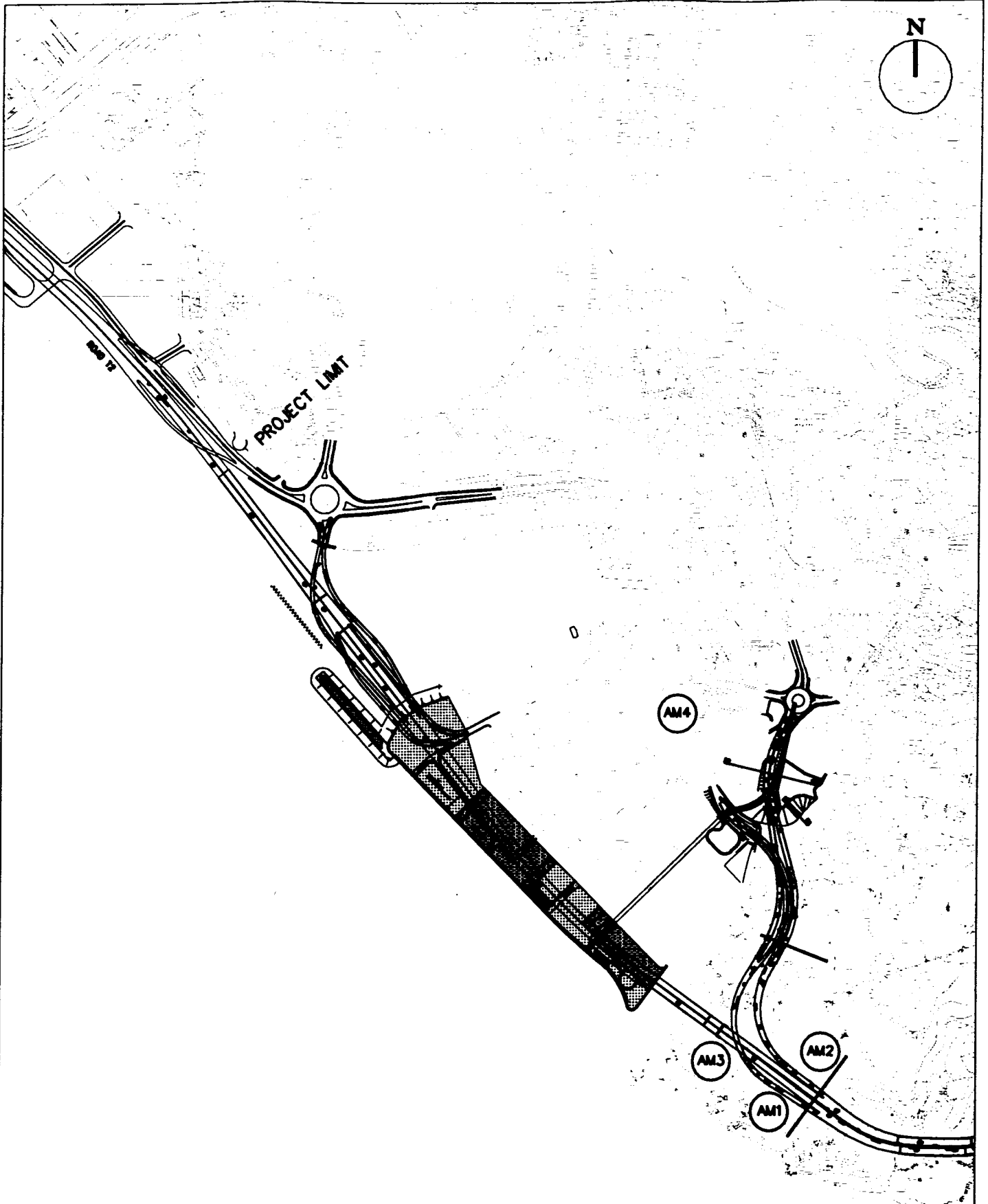
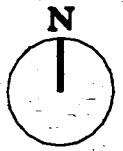
Parameters	Action	Limit
24 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level < 108 $\mu\text{g}/\text{m}^3$, Action level = average of baseline level plus 30% and Limit level For baseline level > 108 $\mu\text{g}/\text{m}^3$, and baseline level < 154 $\mu\text{g}/\text{m}^3$, Action level = 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 2.8b Event/Action Plan for Dust

EVENT	ACTION				Contractor
	ET Leader	IC(E)	ER	ER	
ACTION LEVEL					
1. Exceedance for one sample	<ol style="list-style-type: none"> 1. Identify source 2. Inform IC(E) and ER 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET 	<ol style="list-style-type: none"> 1. Notify Contractor 2. Check Contractor's working method 	<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 IC(E) and ER 3. Repeat measurements to confirm findings 4. Increase monitoring frequency to daily 5. Discuss with IC(E) and ER on remedial actions required 6. If exceedance continues, arrange meeting with IC(E) and ER 7. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Checking monitoring data submitted by ET 2. Advise the ER on the effectiveness of the proposed remedial measures 3. Supervise the implementation of the remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Check Contractor's working method 4. Discuss possible remedial measures with ET, Contractor and IC(E) 5. Ensure remedial measures are 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 	
LIMIT LEVEL					
1. Exceedance for one sample	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER, IC(E) 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 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET 2. Advise the ER on the effectiveness of the proposed remedial measures 3. Supervise the implementation of the remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Check Contractor's working method 4. Discuss possible remedial measures with ET, Contractor and IC(E) 5. Ensure remedial measures are 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. 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 implemented 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 	<ol style="list-style-type: none"> 1. Review Contractor's remedial actions to assure their effectiveness and advise the ER accordingly 2. Supervise the implementation of the remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Discuss potential remedial actions with IC(E), ET, and Contractor and agree remedial measures to be implemented with the Contractor 4. Ensure remedial measures are properly implemented 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 	<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 	

The EIA Study recommends appropriate dust control and mitigation measures. These measures are to be included in the contract documents. The Contractor shall be responsible for the implementation of the following measures.

1. The construction work is likely cause high dust impact at some ASRs. The dust control measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* shall be incorporated in the Contract Specification and implemented to reduce dust impact to within the acceptable dust criteria of $500 \mu\text{g}\text{m}^{-3}$ arising from the works. Mitigation measures include:
 - (a) The heights from which excavated materials are dropped shall be controlled to a minimum practical height to limit fugitive dust generation from unloading;
 - (b) All dusty materials shall be sprayed with water immediately prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet;
 - (c) The haul road shall be located away from sensitive receivers and 20 kph of vehicle speed and water spray of roads are shall be undertaken for the cut and fill section work;
 - (d) Every vehicle shall be washed to remove any dusty materials from its body and wheels before leaving a construction site;
 - (e) The load on the vehicles shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle; and
 - (f) The working area of any excavation shall be sprayed with water before, during and immediately after the operation so as to maintain the entire surface wet.
2. Through the implementation of the above mitigation measures, dust emissions from materials handling and bulldozing will be reduced by 50% and dust from vehicle movement on unpaved haul roads will be reduced by 60%. Moreover, the vehicle speed shall be limited to 20 kph within the worksite.
3. If the above measures are not sufficient to restore the air quality to acceptable levels upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on the development of alternative mitigation measures, which shall be proposed to ER for approval, prior to implementation.



KEY

- AM1 - Ma Shan Tsuen West
- AM2 - Ma Shan Tsuen East
- AM3 - Lei Yue Mun Village
- AM4 - Sam Ka Tsuen Recreational Ground

WCR, TKO YAU TONG RECLAMATION AREA
- LOCATION OF DUST MONITORING STATIONS

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	DATE: MAR 99	FIGURE No. 2.5a
SCALE: 1 : 11000		

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