

3. NOISE

3.1 Construction Noise Monitoring

3.1.1 Noise Parameters

3.1.1.1 Monitoring and audit of noise levels should be carried out by the ENPOs to ensure that any unacceptable noise impacts could be readily detected and timely and appropriate action be undertaken to rectify the situation.

3.1.1.2 The construction noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq(30 min) should be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, Leq(5 min) should be employed for comparison with the NCO criteria.

3.1.1.3 As supplementary information for data auditing, statistical results such as L₁₀ and L₉₀ should also be obtained for reference. A sample data record sheet is shown in **Appendix B** for reference.

3.1.2 Monitoring Equipment

3.1.2.1 As referred in the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter should be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0dB.

3.1.2.2 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5m/s or wind with gusts exceeding 10m/s. The wind speed should be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

3.1.2.3 The EMT should be responsible for the provision of the monitoring equipment. The EMT Leader should ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation should be clearly labelled. The equipment installation location should be proposed by the EMT Leader and agreed with the ENPO Manager/EAT Leader, the ER and EPD.

3.1.3 Monitoring Locations

3.1.3.1 Sufficient number of noise monitoring locations should be selected among those potentially affected NSRs during the construction of different works packages to monitor the potential noise impacts. A group of monitoring stations can serve to monitor the noise impacts from a number of concurrent works packages. The status and locations of NSRs may change after issuing this Manual. The EMT Leader should propose and alter monitoring locations and seek approval from ER and agreement from ENPO/EAT and EPD during the construction phase of the project.

3.1.3.2 When noise monitoring locations are proposed, the monitoring locations should be chosen based on the following criteria:

- (a) at locations close to the major site activities which are likely to have noise impacts, with proper position/siting and orientation of the monitoring equipment ensured;
- (b) close to the noise sensitive receivers (N.B. For the purposes of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre should be considered as noise sensitive receiver); and
- (c) for monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

3.1.3.3 The monitoring station should normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 1.2m above the ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements should be made. For reference, a correction of +3dB(A) should be made to the free field measurements. The EMT Leader should agree with the ER on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring should be carried out at the same positions.

3.1.4 Baseline Monitoring

3.1.4.1 The EMT Leader should carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring should be carried out daily for a period of at least two weeks. A schedule on the baseline monitoring should be submitted to the ER for approval before the monitoring starts.

3.1.4.2 Before the commencement of baseline monitoring, the EMT Leader should inform the EAT of the baseline monitoring programme such that the EAT can conduct on-site audit to ensure accuracy of the baseline monitoring results. During the baseline monitoring, there should not be any construction activities in the vicinity of the monitoring stations.

3.1.4.3 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the EMT Leader should liaise with EPD and in consultation with ER to agree on an appropriate set of data to be used as a baseline reference.

3.1.5 Impact Monitoring

3.1.5.1 Noise monitoring should be carried out at all the designated monitoring station. The monitoring frequency should depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a per week basis when noise generating activities are underway:

- (a) one set of measurements between 0700-1900 hours on normal weekdays;
- (b) one set of measurements between 1900-2300 hours;
- (c) one set of measurements between 2300-0700 hours of next day; and
- (d) one set of measurements between 0700-1900 hours on holidays.

3.1.5.2 For the measurements (b), (c) and (d) above, one set of measurements should at least include 3 consecutive Leq(5 min) results.

3.1.5.3 Noise monitoring should also be carried out at school site during the examination periods. The EMT Leader should liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

3.1.5.4 Before commencing the impact monitoring, the EMT Leader should inform the EAT of the impact monitoring programme such that the EAT can conduct on-site audit to ensure accuracy of the impact monitoring results.

3.1.5.5 In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in Section 3.1.6 should be carried out. This additional monitoring should be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

3.1.6 **Event and Action Plan for Construction Noise**

3.1.6.1 The Action and Limit levels for construction noise are defined in **Table 3.1**. Should non-compliance of the criteria occurred, action in accordance with the Action Plan in **Table 3.2** should be carried out.

Table 3.1 Action and Limit Levels for Construction Noise

Time Period	Action	Limit
0700-1900 hrs on normal weekdays	When one documented complaint is received	75* dB(A)
0700-2300 hrs on holidays; and 1900-2300 hrs on all other days		60/65/70** dB(A)
2300-0700 hrs of next day		45/50/55** dB(A)

* reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.

** to be selected based on Area Sensitivity Rating.

3.1.6.2 Attention is drawn to the fact that the above action and limit levels are applied to the cumulative noise levels i.e. all relevant construction work of SEKDFS.

Table 3.2 Event/Action Plan for Construction Noise

Event	EMT	EAT	ER	Contractor
Action level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform EAT, ER; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with ER and Contractor; 6. Repeat measurement on next day of exceedance. 	<ol style="list-style-type: none"> 1. Discuss with Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Remind the Contractor of his contractual obligations and discuss remedial actions to be implemented 	<ol style="list-style-type: none"> 1. Inform the ER and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ENPO and propose mitigation measures to EAT and ER; 6. Implement the agreed mitigation measures.
Action level being exceeded by more than two consecutive sampling days	<ol style="list-style-type: none"> 1. Repeat measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform EAT, ER; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with ER and Contractor; 6. Increase monitoring frequency to daily to assess effectiveness of remedial measures 	<ol style="list-style-type: none"> 1. Discuss with Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; 3. Ensure agreed mitigation measures are fully implemented; 4. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with Environmental Supervisor and Contractor on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures; 4. Ensure mitigation measures are implemented. 	<ol style="list-style-type: none"> 1. Inform the ER and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. consider changes of working methods; 5. Discuss with ENPO and propose mitigation measures to ER and EAT within 3 working days; 6. Implement the agreed mitigation measures.

Table 3.2 Event/Action Plan for Construction Noise (Continued)

Event	EMT	EAT	ER	Contractor
Limit level being exceeded by one sampling day	<ol style="list-style-type: none"> Repeat measurement to confirm findings; Identify source(s) of impact; Inform EAT, ER and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level. 	<ol style="list-style-type: none"> Checking monitoring data submitted by EMT and Contractor's method; Discuss with Contractor on the possible mitigation measures; Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly. 	<ol style="list-style-type: none"> Discuss with ENPO and Contractor on the proposed mitigation measures; Request Contractor to critically review the working methods; Make agreement on the mitigation measures to be implemented; Ensure mitigation measures are properly implemented; Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; consider changes of working methods; Discuss with ENPO and ER and propose mitigation measures to ER within 3 working days; Implement the agreed mitigation measures.
Limit level being exceeded by more than two consecutive sampling days	<ol style="list-style-type: none"> Repeat measurement to confirm findings; Identify source(s) of impact; Inform EAT, ER and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with ER and Contractor; Ensure mitigation measures are implemented; and Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days. 	<ol style="list-style-type: none"> Checking monitoring data submitted by EMT and Contractor's method; Discuss with Contractor on the possible mitigation measures; Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; and Supervise the implementation of mitigation measures 	<ol style="list-style-type: none"> Discuss with ENPO and Contractor on the proposed mitigation measures; Request Contractor to critically review the working methods; Make agreement on the mitigation measures to be implemented; Ensure mitigation measures are properly implemented; Assess the effectiveness of the implemented mitigation measures; and Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of construction works until no exceedance of Limit level. 	<ol style="list-style-type: none"> Undertake immediate action to avoid further exceedance; Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Discuss with ENPO and ER and propose mitigation measures to ER within 3 working days; Implement remedial actions immediately upon instruction from the ER; Resubmit proposals of mitigation measures if problem could not be rectified; Stop the relevant portion of works as determined by ER, until the exceedance is abated.

3.1.7 Monitoring Approach for the Whole SEKD Project

- 3.1.7.1 Considering that the noise limits applied to all construction works of SEKD as a whole, it is necessary to formulate a monitoring approach to deal with the numerous works packages in different time frame.
- 3.1.7.2 One of the possible approach is to adopt the concept of noise quota. The noise quota is based on the noise limits to surrounding NSRs and the construction plant lists. The construction plant lists from different works packages should be submitted to the EAT and ER for review in two weeks' intervals
- 3.1.7.3 One alternative approach is to adopt several permanent monitoring stations for the whole SEKD projects. Each monitoring station will represent a monitoring area with a radius of 300 m. This approach allows monitoring of the whole SEKD into areas. Deferential management and control could be applied to suit individual area. Some areas far away from NSRs could have less stringent standard.
- 3.1.7.4 As the above approaches would impose constraints on the construction works and require much management efforts, the need to implement these approaches has to be reviewed after the construction noise assessments have been finalised. Details of approach will be given to the preferred approach.

3.1.8 Noise Mitigation Measures

- 3.1.8.1 The EIA report has recommended construction noise control and mitigation measures. The Contractor should be responsible for the design and implementation of these measures. It is predominantly important for this large-scale construction work to derive an environmentally sound work programme to reduce the likely impacts.
- 3.1.8.2 Noise emissions from construction sites during construction phase could be minimised by adopting good site practice, selecting silenced plant, using quiet working methods and installing temporary barriers. Recommended noise mitigation measures are detailed in the following:

Implementation of Good Site Practices

- The contractor should locate noisy equipment and activities as far from sensitive receivers as practicable. Also, temporary site offices (and other similar structures) should be located, as far as is possible, such that sensitive receivers could be screened by these structures from the line of sight of the construction areas;
- Intermittent noisy activities should be scheduled to minimise exposure of nearby NSRs to high levels of construction noise. For example, noisy activities could be scheduled at times coinciding with periods when the schools are likely to be unoccupied. Prolonged operation of noisy equipment close to the schools should be avoided;
- Idle equipment should be turned off or throttled down. Noisy equipment should be maintained properly and used no more often than is necessary;
- Construction activities should be planned so that parallel operation of several sets of equipment close to a given receiver is avoided;
- Where possible, the numbers of concurrently operating items of plant should be reduced through sensitive programming; and
- Construction plant should be properly maintained and operated. Construction equipment often has silencing measures built in or added on, e.g. compressor panels, and mufflers. Silencing measures should be properly maintained and utilised.

Use of Quiet Plant and Working Methods

The use of quiet plant was identified to be a feasible solution to tackle adverse construction noise impacts. The Contractor should obtain particular models of plant that are quieter than standard types given in the GW-TM. The benefits achievable in this way would depend on the details of the Contractors' chosen methods of working, and it would be too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. Quiet PME is defined as PME whose actual SWL is less than the value specified in the GW-TM for the same item of plant. Reference can be made to the British Standard BS5228: Part 1:1997 Control on Construction and Open Sites.

Using Temporary and Movable Noise Barriers

Locating movable barriers close to noisy plant could be very effective in screening NSRs from particular items of plant or noisy operations. Erecting movable barriers of 3 to 5 m height with a small cantilevered upper portion and skid footing within a few metres of stationary plant and within about 5 m or more of a mobile equipment such as an excavator and mobile crane etc. could block the line of sight of these plant items to the NSR. It would be possible for the Contractor to provide purpose-built noise barriers or screens constructed of appropriate material (minimum superficial density of 15 kg/m²) located close to operating PME, in order to reduce the noise impact to the surrounding sensitive uses. Certain types of PME, such as generators and compressors, could be completely screened by portable barriers giving a total noise reduction of 10 dB(A) or more.

Reducing the Numbers of Plant Operating in Critical Areas Close to NSRs

It would be appropriate to restrict the number of operating PME within certain parts of the site that are very close to the NSRs in order to reduce the level of noise impacts. This method could be more effective for activities associated with foundation work, pile construction and excavation activities in which a large number of PME are anticipated, but not all of them would be utilised at the same time. A noise reduction of up to 6 dB(A) could be achieved if the number of PME used on site is reduced to one, as estimated from the predicted values.

Using Noise Screening Structures or Purpose-built Noise Barriers along the Site Boundary

Considering the medium-rise nature of surrounding NSRs, it would be effective to have noise screening structures along the site boundary to protect NSRs close to the construction site boundary. The following measures could be applied to reduce the construction noise:

- Site buildings such as office and stores could be grouped together to form a substantial barrier separating site operations and nearby noise sensitive premises;
- Stacks of certain materials such as bricks, aggregate, timber or topsoil could be strategically placed to form a barrier;
- Earth bunds could be built to provide screening for major earthmoving operations; and
- For adverse cases, purpose-built noise barriers or screens could be placed along the site boundary.

3.1.8.3 If the above measures are not sufficient to restore the construction noise quality to an acceptable levels upon the advice of EMT Leader, the Contractor should liaise with the ENPO on some other mitigation measures, propose to ER for approval, and carry out the mitigation measures.