

Citybus Group Limited

**Citybus Permanent
Headquarters and
Bus Maintenance Depot
in Chai Wan**

Monthly Environmental
Monitoring and Audit
Report
April 2003

First Issue

Citybus Group Limited

Citybus Permanent Headquarters and
Bus Maintenance Depot in Chai Wan

Environmental Monitoring and Audit

Monthly Environmental Monitoring and Audit Report – April 2003

May 2003

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ABBREVIATIONS AND ACRONYMS

A/L Levels	Action and Limited Levels
AQO	Air Quality Objectives
Arup	Ove Arup & Partners Hong Kong Limited
ASR	Area Sensitive Rating
B&K	Brüel & Kjær
CNP	Construction Noise Permit
CR	Contractor
DA-TM	Technical Memorandum on Noise from Construction Work in Designated Areas
EA	Environmental Auditor
EM&A	Environmental Monitoring and Audit
EPD	Environmental Protection Department
ER	Engineer / Engineer' s Representative
ET	Environmental Team
GW-TM	Technical Memorandum on Noise from Construction Work other than Percussive Piling
HKSAR	Hong Kong Special Administrative Region
HOKLAS	The Hong Kong Laboratory Accreditation Scheme
HVS	High Volume Sampler
IC(E)	Independent Environmental Checker
IEC	International Electrotechnical Commission Publications
IVE - CW	Institution of Vocational Education (Chai Wan)
K	Degrees Kelvin
LCP	Ling Chan + Partners Limited
NAMAS	National Measurement Accreditation Service
NSR	Noise Sensitive Receiver
PSPS	Private Sector Participation Schemes
SR	Sensitive Receiver
TSP	Total Suspended Particulates

EXECUTIVE SUMMARY

This is the seventeenth monthly EM&A report presenting the site inspection findings, and the progress on air quality and noise impact monitoring for April 2003.

Daytime (0700 – 1900 hours) noise monitoring was conducted at 4 locations. The highest noise level was 69.9 dB(A) recorded at the Hong Kong IVE Choi Wan on 4 April 2003 and Tsuen Wan Estate (N4) on 14 April 2003 and the lowest was 65.5 dB(A) recorded at Heng Fa Chuen (N1) on 8 April 2003. There were no exceedances on the A/L Levels during the monitoring period.

The highest average 1-hour TSP was 167.7 $\mu\text{g}/\text{m}^3$ recorded at the Hong Kong IVE Choi Wan on 28 April 2003 and the lowest average 1-hour TSP was 120.6 $\mu\text{g}/\text{m}^3$ recorded at the Hong Kong IVE Choi Wan on 9 April 2003. There were no exceedances on the A/L Levels during the monitoring period.

The highest 24-hour TSP level was 81.3 $\mu\text{g}/\text{m}^3$ recorded at the Hong Kong IVE Choi Wan on 28 April 2003 and the lowest 24-hour TSP was 60.2 $\mu\text{g}/\text{m}^3$ recorded at the Hong Kong IVE Choi Wan on 9 April 2003. There were no exceedances on the A/L Levels during the monitoring period.

Site inspections were carried out weekly in April 2003. The findings are summarised as follows:

- No significant air quality impact was identified
- No significant noise impact was identified.
- No significant water impact was identified.
- Oil spillage from timber lubrication was observed behind site office. As instructed by ET, the Contractor agreed to place a sheet of tarpaulin on the ground as the temporary mitigation measure.
- No drip-tray was provided for the diesel drums at the site. As instructed by ET, the Contractor had provided drip-trays for diesel drums.

The major construction activity carried out by the Contractor in April 2003 was construction of ground level of the maintenance depot.

No inert material has been disposed of at Quarry Bay Public Filling Barging Point in April 2003.

1. INTRODUCTION

Ove Arup & Partners Hong Kong Limited (Arup) was appointed by Citybus Group Limited as the Environmental Team (ET) for Citybus Permanent Headquarters and Bus Depot in Chai Wan (hereafter called the "Project"). Environmental parameters including air quality and construction noise were selected for impact monitoring. The construction activities of the Project have commenced in December 2001 and is expected to last for about 18 months.

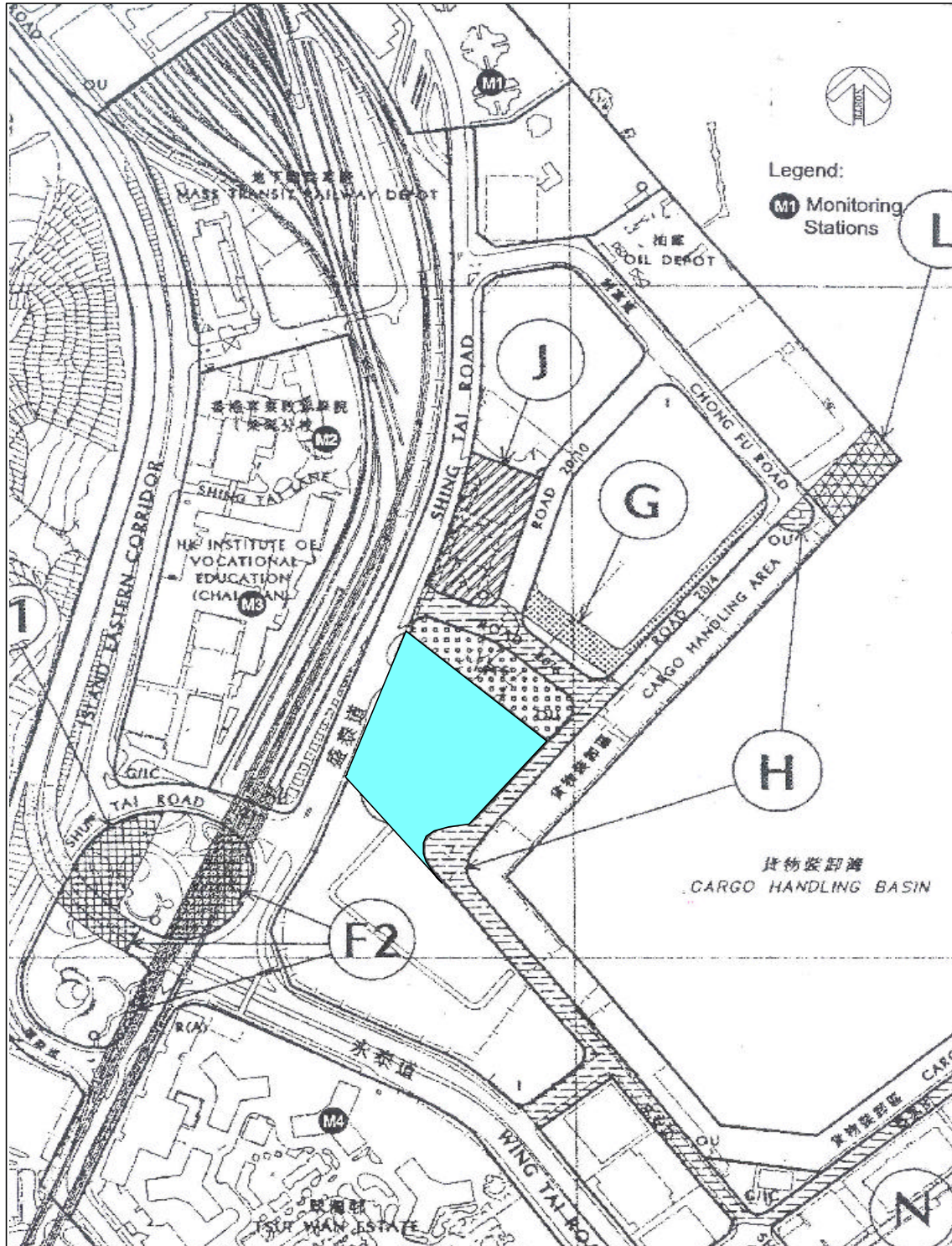
1.1 Purpose of the Report

The purpose of the EM&A report is to present the monitoring and audit results for the environmental issues including air quality, noise, and waste management due to the captioned construction project on a monthly basis. This is the seventeenth monthly EM&A report to summarise the EM&A requirements, the environmental status, equipment, monitoring methodology, monitoring locations, periods, frequencies, results and any observations from the noise and air measurements in April 2003.

1.2 Site Description

The construction site is surrounded by Road 20/4, Road 20/6 and Shing Tai Road as shown in Figure 1-1. The total site area is approximately 1 hectare. The Project consists of five storeys with the bus depot located on G/F to 3/F for bus parking and maintenance, and depot office on 4/F to 5/F.

Figure 1-1 Site location plan of Citybus permanent headquarters and bus maintenance depot in Chai Wan



1.3 Organisation and Personnel

The primary responsibilities and duties of the respective parties in this EM&A programme are described in the following sub-sections:

1.3.1 Project Manager

The entire construction of the Project is managed by *Citybus Group Limited* as the Project Manager. The Project Manager is supported by an Engineer's Representative (ER) and an Environmental Team (ET) to ensure that the environmental quality will comply with the project requirements.

1.3.2 Engineer's Representative

The Engineer is *Ling Chan + Partners Limited (LCP)*. The Engineer's Representative is responsible for:

- Supervising the Contractor (CR) activities and ensuring that the requirements in the Environmental Management Plan^[1] are fully complied with;
- Informing the CR when action is required to reduce impacts in accordance with the Event and Action Plans; and
- Adhering to the procedures for carrying out complaint investigation in accordance with Environmental Management Plan.

1.3.3 Environmental Team

Ove Arup & Partners Hong Kong Limited (Arup), has been appointed by Citybus to take up the role of the Environmental Team (ET), and ET is responsible for:

- Sampling, analysis and statistical evaluation of monitoring parameters with reference to the EIA study recommendations and requirements with respect of noise, dust and water quality.
- Conducting environmental site surveillance.
- Auditing the compliance with environmental protection and pollution prevention and control regulations.
- Monitoring the implementation of environmental mitigation measures.
- Monitoring the compliance with the environmental protection clauses/specifications in the Contract.
- Reviewing construction programme and providing comment as necessary.
- Reviewing construction methodology and providing comment as necessary.
- Conducting complaint investigation, evaluation and identification of corrective measures.
- Auditing of the EMS and recommending and implementing any changes as appropriate.
- Liaising with the Independent Environmental Checker (IC((E))) on all environmental performance matters.

- Advising the Contractor on environmental improvement, awareness, enhancement matter, etc. on site.
- Submitting the designated EM&A reports timely to the ER, the IC(E) and the EPD as appropriate.

1.3.4 Contractors

The site formation works are undertaken by *Vibro (HK) Limited* and construction of superstructure are undertaken by *W. Hing Construction Co. Ltd*, the Contractors (CR). In this EM&A programme, the CR is responsible for:

- Submitting the proposals on mitigation measures in cases of exceedance of Action and Limit levels and in accordance with the Event and Action Plans;
- Implementing measures to reduce impact where Action and Limit levels are exceeded; and
- Adhering the procedures for carrying out complaint investigation in accordance with the Environmental Management Plan.

2. ENVIRONMENTAL STATUS

2.1 Construction Programme

The construction has been commenced in December 2001, and is anticipated to be completed in 18 months. The construction programme is given in the Monthly EM&A Report – December 2001.

2.2 Construction Activities of the Month

The major construction activity carried out by the CR in April 2003 was construction of ground level of the maintenance depot.

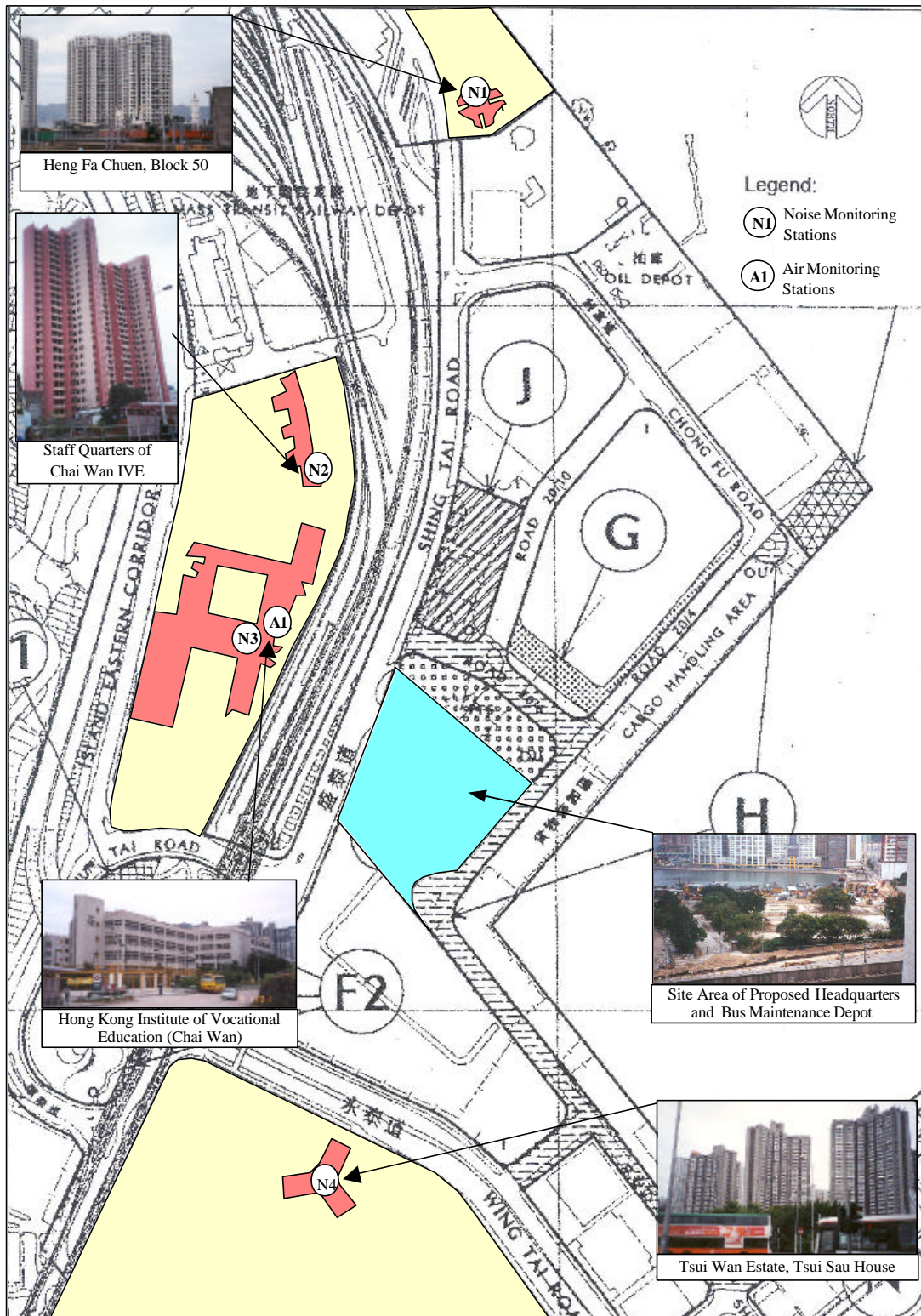
2.3 Environmental Sensitive Receivers

Several residential buildings and an educational institution close to the site have been identified as environmental sensitive receivers in the EIA Report. The identified sensitive receivers are summarised in Table 2-1 and shown in Figure 2-1.

Table 2-1 Identified sensitive receivers

Sensitive Receivers No.	Description
N1	Heng Fa Chuen
N2	Staff Quarters of Chai Wan IVE
N3/A1	Hong Kong IVE Chai Wan
N4	Tsuen Wan Estate

Figure 2-1 Locations of construction site and environmental sensitive receivers



3. SUMMARY OF EM&A REQUIREMENTS

Construction noise and air quality were significant environmental impacts identified for the construction period of the project. In accordance with the Environmental Management Plan, air quality and noise impact monitoring shall be performed by the ET at all specified monitoring locations during the construction stage.

3.1 Construction Noise Monitoring

3.1.1 Monitoring Parameters

Construction noise monitoring shall be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). L_{10} and L_{90} will also be recorded as supplementary reference information for data auditing.

3.1.2 Monitoring Frequency

Construction noise measurements were required to be taken on a weekly basis according to the Environmental Management Plan. The monitoring time periods, monitoring parameters and frequency are specified in Table 3-1. The monitoring schedules for April 2003 and May 2003 are attached in Appendix A.

Table 3-1 Construction noise monitoring parameters and frequency requirements

Time Period (when construction activity is found)	Parameters	Monitoring Frequency	No. of measurements for each monitoring
Between 0700-1900 hours on normal weekdays	$L_{eq(30\text{ min})}$	Once per week	1
Between 1900-2300 hours on normal weekdays	$L_{eq(5\text{ min})}^*$		3 (consecutive)
Between 2300-0700 hours of next day			
Between 0700-1900 hours on holidays			

Remarks: * The $L_{eq(5\text{ min})}$ will only be measured if construction activities are conducted on general holidays and between the period of 1900 and 0700 hours during normal weekdays.

3.1.3 Monitoring Locations

A total of 4 monitoring locations were specified. They are given in Table 3-2. The measurements were taken at 1m from the building facade and maintained at a height 1.2m above floor. Three photos showing the noise monitoring work in action are given in Figure 3-1.

Table 3-2 Noise impact monitoring locations

NSR No.	Location	Monitoring Point
N1	Heng Fa Chuen	Block 50
N2	Staff Quarters of IVE Chai Wan	Roof-top (Block C,D)
N3	Hong Kong IVE Chai Wan	Roof-top
N4	Tsui Wan Estate	Tsui Sau House

Figure 3-1 Noise monitoring in progress

3.2 Air Quality Monitoring

3.2.1 Monitoring Parameters

Air monitoring shall be measured in terms of the TSP levels for both 24-hour and 1-hour periods.

3.2.2 Monitoring Frequency

24-hour TSP and 1-hour TSP levels shall be monitored during the course of construction according to the Environmental Management Plan. The monitoring parameters and frequencies are specified in Table 3-3. The monitoring schedules for April 2003 and May 2003 are attached in Appendix A.

Table 3-3 TSP monitoring parameters and frequency

Parameters	Monitoring Frequency	Time Period	No. of measurement for each monitoring
24-hour TSP	Once every six days	0000 – 2400	1
1-hour TSP	Three times per every six days	0700 – 1900	1

3.2.3 Monitoring Locations

One monitoring location was specified for air quality impact and it is presented in Table 3-4.

Table 3-4 Air quality monitoring location

ASR No.	Location	Monitoring Point
A1	Hong Kong IVE Chai Wan	Roof-top

3.3 Performance Limits and Event-Action Plans

The monitoring results were checked against appropriate standards and requirements. A two-tier system performance limits has been established in Environmental Management Plan. The “Action Level” and the “Limit Level” are established according to the EPD requirements. Corresponding actions will be taken by ET, ER and CR in accordance with the Event-Action Plans if the monitoring results exceed the performance limits.

3.3.1 Construction Noise Impact

The Action and Limit (A/L) levels for the construction noise have been established in accordance with the Generic EM&A Manual and they are tabulated in Table 3-5.

Table 3-5 Action and Limit levels for construction noise

Time Period	Action Level	Limit Level dB(A)
0700 – 1900 hours on weekdays	When one documented complaint is received	75*
0700 – 2300 hours on General Holidays; & 1900 – 2300 hours on all other days		60/65/70**
2300 – 0700 hours of next day		45/50/55**

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

** to be selected based on Area Sensitivity Rating

Note: If works are to be carried out during restricted hours, the conditions stipulated in the construction noise permit issued by the Noise Control Authority have to be followed

Table 3-6 details the actions required to be carried out by different parties in the case of an exceedance of performance limits being detected.

Table 3-6 Event-action plan for construction noise

Event	Action	
	ET or ER	Contractor
Action Level	<ol style="list-style-type: none"> 1. Notify Contractor 2. Analyse investigation 3. Require Contractor to propose measures for the analysed noise problem 4. Increase monitoring frequency to check mitigation effectiveness 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals to ET / ER 2. Implement noise mitigation proposals
Limit Level	<ol style="list-style-type: none"> 1. Notify Contractor 2. Notify EPD 3. Require Contractor to implement mitigation measures, increase monitoring frequency to check mitigation effectiveness 	<ol style="list-style-type: none"> 1. Implement mitigation measures 2. Prove to ET / ER effectiveness of measures applied

3.3.2 Air Quality

The A/L levels for air quality have been established in the Environmental Management Plan and they are tabulated in Table 3-7

Table 3-7 Action and Limit levels for air quality

Parameters	Action Level	Limit Level
24 Hour TSP Level in $\mu\text{g}/\text{m}^3$	<ul style="list-style-type: none"> • For baseline level $\leq 200\mu\text{g}/\text{m}^3$, Action Level = (baseline level plus 30% + Limit Level)/2 • For baseline level $> 200\mu\text{g}/\text{m}^3$, Action Level = Limit Level 	260
1 Hour TSP Level in $\mu\text{g}/\text{m}^3$	<ul style="list-style-type: none"> • For baseline level $\leq 384\mu\text{g}/\text{m}^3$, Action Level = (baseline level plus 30% + Limit Level)/2 • For baseline level $> 384\mu\text{g}/\text{m}^3$, Action Level = Limit Level 	500

In accordance with the Baseline Monitoring Report ^[2], the Action and Limit levels for 24-hour TSP and 1-hour TSP at monitoring location A1 were established and they are tabulated in Table 3-8 and Table 3-9 respectively.

Table 3-8 Action and Limit levels for 24-hour TSP

ASR No.	Monitoring Location	24-hour TSP Level in mg/m ³	
		Action Level	Limit Level
A1	Hong Kong IVE Chai Wan	220.8	260.0

Table 3-9 Action and Limit levels for 1-hour TSP

ASR No.	Monitoring Location	1-hour TSP Level in mg/m ³	
		Action Level	Limit Level
A1	Hong Kong IVE Chai Wan	303.2	500.0

Table 3-10 details the actions required to be carried out by different parties in case of an exceedance of performance limits being detected.

Table 3-10a Event-action plan for air quality (Action Level)

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

Table 3-10b Event-action plan for air quality (Limit Level)

Event	Action		
	ET	ER	Contractor
Limit Level			
1. Exceedance for one sample	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	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	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	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	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 works is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	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

3.4 Site Inspection and Environmental Complaint Handling

3.4.1 Site Inspection Frequency and Areas Covered

Regular site inspections were carried out on a weekly basis. The areas of inspection covered different environmental impacts, such as air, noise, water and waste, and their pollution controls and mitigation measures for both within and outside the site area.

Ad hoc site inspections were carried out if significant environmental non-compliance is identified. Inspections may also be carried out subsequent to receipt of any environmental complaints, or as part of the investigation work, as specified in the Event-Action Plans.

3.4.2 Site Inspection Procedures

- a) The Environmental Auditor (EA) will be advised by the CR and/or ER of all information on any environmental related aspects.
- b) The EA will conduct discussion with the CR and/or ER to sort out and forecast any potential environmental impacts.
- c) The EA will conduct a site walk with the CR and/or ER, particularly in the areas with extensive construction works.
- d) The EA will conduct inspection for the main environmental facilities and measures such as the wheel washing facilities located at the site exits, water spraying truck, temporary noise barrier, and the internal noise-reducing measures of the heavy equipment etc, to ensure that these environmental facilities operate normally and effectively.
- e) The EA will fill up a site inspection checklist during the site inspection for recording of any special observations.
- f) The EA will conduct post-discussion with the CR and/or ER for the establishment of additional/special measures if any non-conformance is found. The completion date for such additional measures will be confirmed during the post-discussion.
- g) The EA will propose a reasonable timeframe together with the CR and/or ER, for the preparation of the proposal for the remediation of environmental non-compliance.
- h) The completed site inspection checklist will be signed by the EA, the CR and/or ER, for reference and for taking actions in accordance with the agreed procedures, reporting systems and time frame.

3.4.3 Environmental Complaints

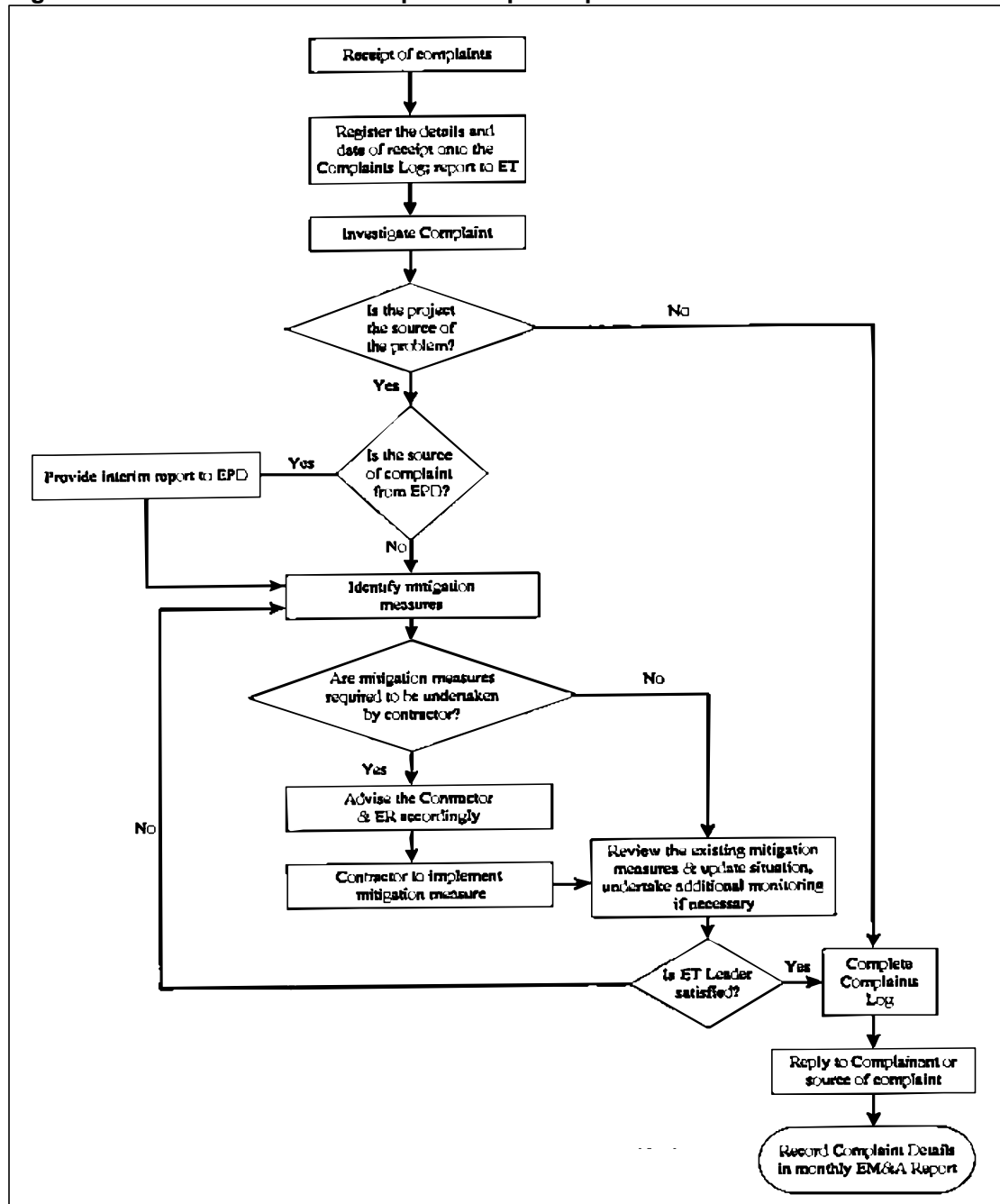
In accordance with the Environmental Management Plan^[1], environmental complaints will be referred to the ET for initiation of the complaint investigation procedures. The ET will undertake the following procedures upon receipt of the complaints:

- a) The ET will record the details of the complaint and the date of receipt onto the complaint database, and inform ER immediately.
- b) The ET will perform compliant investigation to determine its validity, and to assess whether the source of the problem is due to work activities.
- c) The ER will instruct the CR to identify mitigation measures in consultation with the ET, if the compliant is valid and due to works.
- d) The ET will liaise with the CR on their mitigation measure proposals and implementation, if required.
- e) The ET will conduct review of the CR's response on the identified mitigation measures, and of the updated situation.
- f) The ET will submit interim report to EPD if the complaint is received via EPD. The interim report will clearly state the status of the complaint investigation and the follow-up action within the time frame assigned by EPD.
- g) The ET will undertake additional monitoring and audit to verify the situation if necessary, and ensure that any valid reason for complaint does not recur.
- h) The ET will report on the investigation results and the subsequent actions to the source of complaint for responding to the complainant (If the source of complaint is via EPD, the results will be reported within the time frame assigned by EPD).
- i) The ET will record the details of the complaint, investigation, subsequent actions and results in the monthly EM&A reports.

During the complaint investigation work undertaken by the ET, the CR and ER shall cooperate with the ET in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified as necessary in the investigation, the CR shall promptly carry out the required mitigation to the satisfaction of ET. The ER shall ensure that such identified measures have been carried out by the CR.

A flow chart of the complaint response procedures is shown in Figure 3-2 for reference.

Figure 3-2 Flow chart of the complaint response procedure



4. CONSTRUCTION NOISE MONITORING

4.1 Monitoring Equipment

An integrated sound level meter was used for the noise monitoring. The sound level meter complies with the International Electrotechnical Commission Publications (IEC) 651:1979 (Type 1) and 804:1985 (Type 1) specifications. An acoustical calibrator in compliance with IEC 942:1988 (Type 1) was used to calibrate the sound level meter before and after each set of measurements to confirm that the data drift was less than 1dB(A). The detailed descriptions of the noise measurement equipment are listed in Table 4-1.

Table 4-1 Equipment list for construction noise monitoring

Equipment	Manufacturer & Model No.	Precision Grade	Qty.
Integrated sound level meter	Brüel & Kjær 2231	IEC 651 Type 1	1
½ " free-field microphone	Brüel & Kjær 4188		1
Windshield	Brüel & Kjær UA0237	IEC 804 Type 1	1
Acoustical calibrator	Brüel & Kjær 4320	IEC 942 Type 1	1
Acoustical calibrator	Brüel & Kjær 4226		1
LCD wind speed indicator	Kestrel Vane Anemometer	--	1

4.2 Methodology

4.2.1 Field Measurement

- The sound level meter and the battery were checked to ensure that they were in proper condition.
- The sound level meter was set on a tripod at 1.2m above ground and at least 1m from the exterior of the building façade.
- Before conducting the measurement, the sound level meter was calibrated by an acoustical calibrator.
- The measurement parameter was set to A-weighted sound pressure level. The time weighting was set in fast response and the time period of measurement at 30 minutes.
- The wind speed was checked during noise monitoring to ensure the steady wind speed did not exceed 5m/s, or wind with gusts did not exceed 10m/s.
- Any abnormal conditions that generated intrusive noise during the measurement were recorded on the field record sheet.
- After each measurement, the equivalent continuous sound pressure level (L_{eq}), L_{10} and L_{90} were recorded on the field record sheet.

- The sound level meter was re-calibrated by the acoustical calibrator to confirm that there was no significant drift of reading.

4.2.2 Equipment Maintenance and Calibration

The sound level meter complies with the standards of IEC 651 (Fast, Slow, Impulse rms detector tests) and IEC 804 (L_{eq} functions). The acoustical calibrator model no. 4230 is in compliance with IEC 942. Both equipment are calibrated annually in-house using Brüel & Kjær (B&K) calibrator model no. 4226.

The B&K calibrator model no. 4226 is annually calibrated by the National Physical Laboratory in Teddington, London, which is accredited by National Measurement Accreditation Service (NAMAS). All in-house calibrations that are undertaken can be traced back to the National Physical Laboratory. The calibration certificates of the equipment are given in the monthly EM&A report of August 2002 (Report No.: 23420-12)^[3].

4.3 Results and Observations

Noise monitoring was carried out twice per week. The construction noise monitoring results in April 2003 are tabulated in Table 4-2. The detailed noise monitoring results are attached in Appendix B. All noise monitoring results complied with the Limit Level.

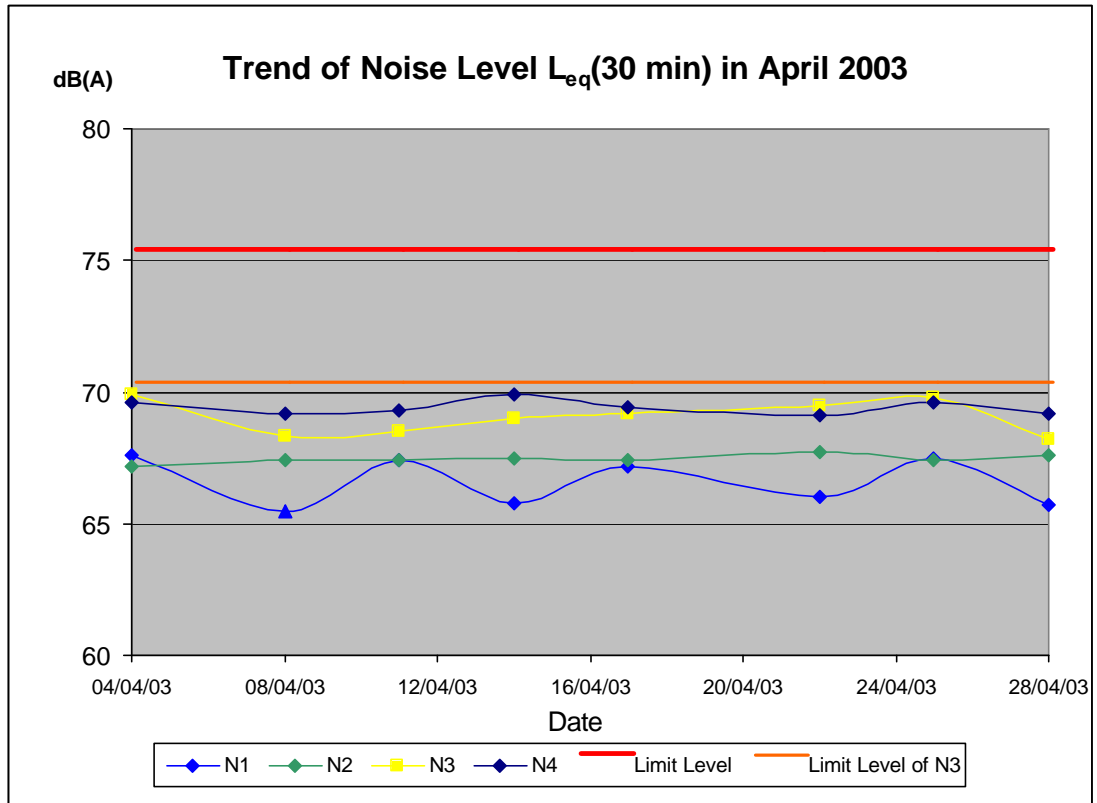
The principal noise sources were mainly from other activities such as idling vehicles, through traffic and school activities not associated with the construction of the Project. A graphical presentation of noise monitoring results is given in Figure 4-1.

Table 4-2 Daytime noise monitoring results for April 2003

Date of Monitoring	Monitoring Parameters	Monitoring Results, dB(A) (30 min)			
		N1	N2	N3	N4
04/04/03 (Fri)	L_{eq}	67.6	67.2	69.9	69.6
	L_{10}	72.6	70.1	75.1	73.1
	L_{90}	62.6	65.1	62.1	62.6
08/04/03 (Tue)	L_{eq}	65.5	67.4	68.3	69.2
	L_{10}	69.6	70.1	73.1	73.6
	L_{90}	59.6	65.1	64.6	62.1
11/04/03 (Fri)	L_{eq}	67.4	67.4	68.5	69.3
	L_{10}	72.6	70.6	74.1	73.6
	L_{90}	62.1	65.1	63.1	62.6
14/04/03 (Mon)	L_{eq}	65.8	67.5	69.0	69.9
	L_{10}	70.1	70.1	74.6	73.6
	L_{90}	59.6	65.6	62.6	63.1
17/04/03 (Thu)	L_{eq}	67.2	67.4	69.2	69.4
	L_{10}	72.1	70.6	74.6	73.1
	L_{90}	62.1	65.1	63.1	62.6

Date of Monitoring	Monitoring Parameters	Monitoring Results, dB(A) (30 min)			
		N1	N2	N3	N4
22/04/03 (Tue)	L _{eq}	66.0	67.7	69.5	69.1
	L ₁₀	70.6	71.1	75.1	72.6
	L ₉₀	60.1	65.6	62.6	62.6
25/04/03 (Fri)	L _{eq}	67.5	67.4	69.8	69.6
	L ₁₀	72.6	70.1	75.1	73.6
	L ₉₀	62.1	65.6	63.1	62.1
28/04/03 (Mon)	L _{eq}	65.7	67.6	68.2	69.2
	L ₁₀	70.1	70.6	73.1	73.1
	L ₉₀	59.1	65.6	64.1	63.1

Figure 4-1 Daytime noise monitoring results for April 2003



5. AIR QUALITY MONITORING

Air quality was measured in terms of 24-hour and 1-hour levels of TSP to assess the impacts of construction dust. The 24-hour and 1-hour TSP levels were measured according to the standard high volume sampling method and laser scanning method respectively. All relevant data including temperature, pressure, weather conditions, start and stop time of the sampler, and other special phenomena and work progress of the monitoring locations were also recorded.

5.1 Monitoring Equipment

The high volume sampling (HVS) method complies with the USEPA ambient air reference method standard for primary and secondary ambient particulate matter (*40 CFR_{50-B}*)^[4].

HVS in compliance with the specifications of *40 CFR_{50-B}* were used for carrying out the 24-hour TSP. A photometric aerosol monitor was used for 1-hour TSP monitoring. The details of the HVS, photometric aerosol monitor and the calibration kit used are listed in Table 5-1.

Table 5-1 Equipment list for TSP monitoring

Equipment	Manufacturer & Model No.	Measurement Parameter	Qty.
High Volume Sampler	TE-5170	24-hour TSP	1
Fibreglass Filter	G810		--
HVS Calibration Kit	GMW-2535		1
Photometric Aerosol Monitor	MIE <i>persona</i> /DataRAM	1-hour TSP	1
Hand Held Barometer	Cole-Parmer EB833	Pa, Temperature	1

5.2 Methodology

5.2.1 24-hour TSP Monitoring

- The HVS was set up at a fixed monitoring location under the following conditions:
 - the filter of HVS was at least 1.3m above ground;
 - it was separated from any obstacle by at least twice the height of the obstacle protruding above the sampler;
 - there were no furnaces or incineration flues operating near the sampler;
 - it has unrestricted airflow 270° around the sampler; and
 - the wire fence and gate did not cause obstruction to the air flow.

- The flow rate of the HVS was set within the range of $1.1\text{m}^3/\text{min}$ and $1.7\text{m}^3/\text{min}$, (39CFM - 60CFM) as specified in *40 CFR*_{50-B}.
- The power supply was checked to ensure the HVS worked properly
- The HVS was switched on and allowed to operate for 5 minutes before placing any filter on the supporting screen.
- The filter holding frame was removed by loosening the four wing nuts and allowing the brass bolts and washers to swing down out of the way.
- The fibreglass filter (G810) for TSP sampling was prepared by a HOKLAS accredited laboratory for weighing before and after sampling. Before weighing, the filter was equilibrated in a conditioned environment of:
 - temperature between 25°C and 30°C and not vary by more than 3°C ; and
 - relative humidity $<50\%$ and not vary by more than 5% .
- The pre-weighted, conditioned and numbered fibreglass filter was centred, with rougher side up, on the supporting screen. The filter was aligned so that the gasket of the frame formed an airtight seal on the outer edges of the filter.
- The filter holding frame was placed onto the filter and then tightened with the brass bolts and washers with sufficient pressure to avoid air leakage from the edges.
- Any dirt accumulation from around the filter holder was wiped out and then the shelter lid closed and secured with the aluminium strip.
- A piece of flow record chart was inserted onto the flow rate recorder and placed under the chart guide clip and the time index clip so that it would rotate freely without binding. Set the time by rotating the drive hub clockwise until the correct time on chart was aligned with time index pointer.
- The flow recorder pen was checked to ensure it was inking by pressing on the chart with sufficient pressure to make a visible trace.
- The timer was programmed and the start time was recorded on specified field record sheet. Other information such as the filter identification number, the weather and site conditions were also recorded.

5.2.2 1-hour TSP Monitoring

- The MIE monitor was switched on by pressing the ON/OFF button. The NEXT button was pressed to select Run or Ready mode.
- The NEXT button was pressed subsequently to check the following settings:
 - i. data logging function: on
 - ii. log period: 5 minutes
 - iii. tag number: storage
 - iv. analogue output: $0-4.000\text{mg}/\text{m}^3$
 - v. calibration factor: 1.0
 - vi. averaging time: 10s
 - vii. battery charge: $\geq 50\%$
 - viii. remaining memory: $\geq 10\%$

- The monitoring was started by pressing ENTER. The real-time concentration was displayed as CONC and the time-averaged concentration was displayed as TWA.
- The monitoring was stopped by pressing EXIT and ENTER buttons.
- The date and start time, weather, site condition and the downloaded monitoring results were recorded on a specific field record sheet.

5.2.3 Maintenance and Calibration

The HVS and their accessories were frequently checked and maintained in accordance with the manufacturer's operation & maintenance manual. Maintenance includes the checking of the supporting screen and the gasket, and routine replacement of motor carbon brushes for the blower motor. The power cords and power supply were checked each time before sampling to ensure proper operation.

The HVS are calibrated at 2-month intervals using GMW-2535 Calibration Kit. The calibration certificate of the HVS is given in Appendix C. The calibration kit will be re-calibrated by the manufacturer after one year of use. The calibration certificate of the calibration orifice is given in Appendix C.

The MIE monitor and its accessories are frequently checked and maintained in accordance with the manufacturer's operation & maintenance manual to ensure proper operation. Maintenance includes the checking of batteries, zero and sensitive adjustment and filter replacement.

The MIE monitor is returned to the manufacturer for calibration bi-annually. The calibration certificate of the MIE monitor was given in the Monthly EM&A Report - December 2001.

5.3 Results and Observations

Tables 5-2 and 5-3 summarise the 24-hour TSP and 1-hour TSP monitoring results respectively. The detailed 24-hour TSP monitoring results are provided in Appendix D and the 1-hour TSP monitoring results are provided in Appendix E.

Graphical presentations of 24-hour TSP and 1-hour TSP are given in Figure 5-1 and Figure 5-2 respectively.

Table 5-2 24-hour TSP monitoring results for April 2003

Date of Monitoring	24-hour TSP Monitoring Results ($\mu\text{g}/\text{m}^3$)	
	Weather	Result
03/04/03 (Thu)	Rainy	72.3
09/04/03 (Wed)	Rainy	60.2
15/04/03 (Tue)	Overcast	74.9
22/04/03 (Tue)	Fine	79.8
28/04/03 (Mon)	Overcast	81.3

Table 5-3 1-hour TSP monitoring average results for April 2003

Date of Monitoring	1-hour TSP Monitoring Results ($\mu\text{g}/\text{m}^3$)	
	Weather	Averaged Result
03/04/03 (Thu)	Rainy	151.4
09/04/03 (Wed)	Rainy	120.6
15/04/03 (Tue)	Overcast	133.2
22/04/03 (Tue)	Fine	159.3
28/04/03 (Mon)	Overcast	167.7

Figure 5-1 24-hour TSP monitoring results for April 2003

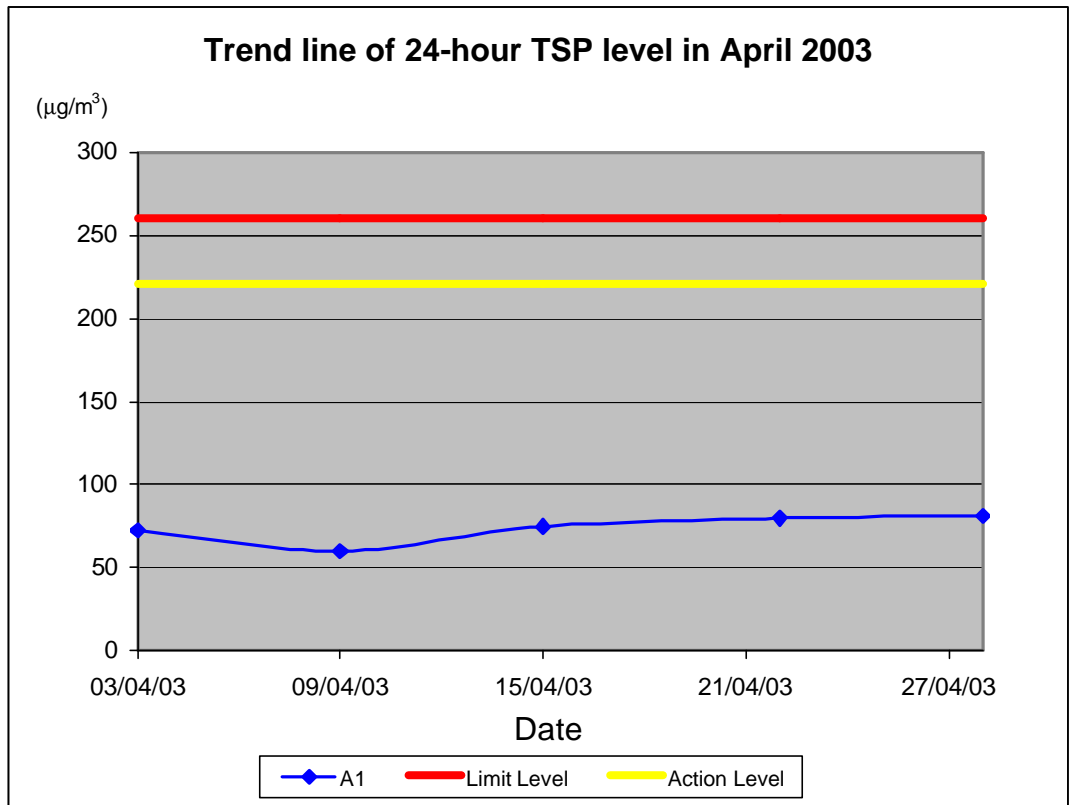
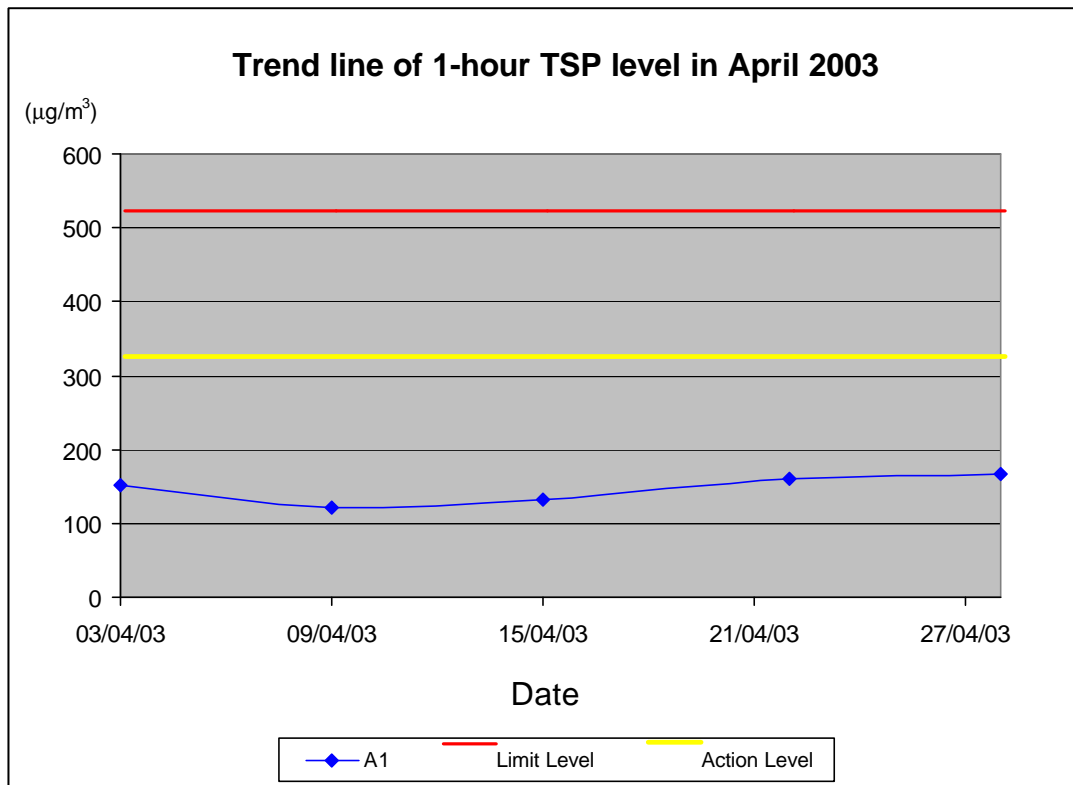


Figure 5-2 1-hour TSP monitoring results for April 2003



6. SITE AUDIT, ENVIRONMENTAL COMPLAINTS, ENVIRONMENTAL LICENSE AND NON-COMPLIANCE RECORDS

6.1 Audit Results

Site audits were conducted weekly in April 2003. The major construction activity on site was bore piling. The audit findings are summarised as follows:

Air Quality

- No significant air quality impact was identified.

Noise

- No significant noise impact was identified.

Water Quality

- No significant water impact was identified.

Chemical / Waste Management

- Oil spillage from timber lubrication was observed behind site office. As instructed by ET, the Contractor agreed to place a sheet of tarpaulin on the ground as the temporary mitigation measure. Photo showing the lubricated timbers is given in Figure 6-1

Figure 6-1 The lubricated timbers



- No drip-tray was provided for the diesel drums at the site. As instructed by ET, the Contractor had provided drip-trays for diesel drums. Photo showing the diesel drums without drip-tray is given in Figure 6-2.

Figure 6-2 No drip-tray was provided for the diesel drums



6.2 Summary of Waste Disposal

No inert material has been disposed of at Quarry Bay Public Filling Barging Point in April 2003.

6.3 Complaint Record

No complaint on environmental issues was received in April 2003. The summary of environmental complaints since the commencement is presented in Table 6-1.

Table 6-1 Summary of environmental complaints

No. of Complaints received this month	No. of Outstanding Complaints	Total Complaints Received since the commencement of the Project
0	0	0

6.4 Non-compliances

There are no non-compliances recorded for April 2003.

7. REFERENCES

- [1] Environmental Management Plan for Proposed Headquarters and Bus Maintenance Depot in Chai Wan. Ref : R0474-3.01. CH2M HILL (China) Limited.
- [2] Environmental Baseline Monitoring Report – Citybus Chai Wan Permanent Depot Environmental Team Services. Ove Arup & Partners Hong Kong Limited.
- [3] Citybus Permanent Headquarters and Bus Maintenance Depot in Chai Wan Monthly EM&A Report - August 2002, Ove Arup & Partners Hong Kong Limited.
- [4] Title 40 of the Code of Federal Regulations, Chapter 1, Part 50 - National Primary and Secondary Ambient Air Quality Standards, Appendix B - Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-volume Method), Environmental Protection Agency, US.

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APPENDIX A

**EM&A Schedules for
April 2003 and May
2003**

Environmental Monitoring and Audit Programme - April 2003

Note 1: L30 denotes $L_{eq}(30 \text{ min})$

Note 2: TSP denotes Total Suspended Particulate

Apr-2003						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6	7	8	9	10	11	12
	L30 monitoring	L30 monitoring	24-hour TSP monitoring 3 x 1-hour TSP monitoring	24-hour TSP monitoring 3 x 1-hour TSP monitoring	L30 monitoring	L30 monitoring
13	14	15	16	17	18	19
	L30 monitoring	24-hour TSP monitoring 3 x 1-hour TSP monitoring		L30 monitoring		
20	21	22	23	24	25	26
		L30 monitoring 24-hour TSP monitoring 3 x 1-hour TSP monitoring			L30 monitoring	
27	28	29	30			
	L30 monitoring 24-hour TSP monitoring 3 x 1-hour TSP monitoring					

Environmental Monitoring and Audit Schedule - May 2003

Note 1: L30 denotes $L_{eq}(30 \text{ min})$

Note 2: TSP denotes Total Suspended Particulate

May-2003						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
					L30 monitoring	24-hour TSP monitoring 3 x 1-hour TSP monitoring
8	9	10	11	12	13	14
	L30 monitoring				L30 monitoring	L30 monitoring 24-hour TSP monitoring 3 x 1-hour TSP monitoring
15	16	17	18	19	20	21
	L30 monitoring			L30 monitoring		24-hour TSP monitoring 3 x 1-hour TSP monitoring
22	23	24	25	26	27	28
	L30 monitoring			L30 monitoring	24-hour TSP monitoring 3 x 1-hour TSP monitoring	
29	30	31				
	L30 monitoring					

APPENDIX B

**Detailed Noise
Monitoring Results**

Details of Noise Impact Monitoring

Month	Date	NSR No.	Time periods		Weather condition	Noise Level dB(A)			Influencing factors/ Site condition
			Start	Finish		L _{eq}	L ₁₀	L ₉₀	
Apr-03	04-Apr-03	N1	14:30	15:00	Overcast	67.6	72.6	62.6	Work in Progress
Apr-03	04-Apr-03	N2	13:45	14:15	Overcast	67.2	70.1	65.1	Work in Progress
Apr-03	04-Apr-03	N3	12:00	12:30	Overcast	69.9	75.1	62.1	Work in Progress
Apr-03	04-Apr-03	N4	15:10	15:40	Overcast	69.6	73.1	62.6	Work in Progress
Apr-03	08-Apr-03	N1	8:00	8:30	Overcast	65.5	69.6	59.6	Work in Progress
Apr-03	08-Apr-03	N2	15:00	15:30	Overcast	67.4	70.1	65.1	Work in Progress
Apr-03	08-Apr-03	N3	11:05	11:35	Overcast	68.3	73.1	64.6	Work in Progress
Apr-03	08-Apr-03	N4	8:50	9:20	Overcast	69.2	73.6	62.1	Work in Progress
Apr-03	11-Apr-03	N1	14:15	14:45	Overcast	67.4	72.6	62.1	Work in Progress
Apr-03	11-Apr-03	N2	13:30	14:00	Overcast	67.4	70.6	65.1	Work in Progress
Apr-03	11-Apr-03	N3	11:05	11:35	Overcast	68.5	74.1	63.1	Work in Progress
Apr-03	11-Apr-03	N4	14:55	15:25	Overcast	69.3	73.6	62.6	Work in Progress
Apr-03	14-Apr-03	N1	8:00	8:30	Overcast	65.8	70.1	59.6	Work in Progress
Apr-03	14-Apr-03	N2	13:30	14:00	Overcast	67.5	70.1	65.6	Work in Progress
Apr-03	14-Apr-03	N3	10:45	11:15	Overcast	69.0	74.6	62.6	Work in Progress
Apr-03	14-Apr-03	N4	8:45	9:15	Overcast	69.9	73.6	63.1	Work in Progress
Apr-03	17-Apr-03	N1	15:00	15:30	Overcast	67.2	72.1	62.1	Work in Progress
Apr-03	17-Apr-03	N2	14:15	14:45	Overcast	67.4	70.6	65.1	Work in Progress
Apr-03	17-Apr-03	N3	11:00	11:30	Overcast	69.2	74.6	63.1	Work in Progress
Apr-03	17-Apr-03	N4	15:40	16:10	Overcast	69.4	73.1	62.6	Work in Progress
Apr-03	22-Apr-03	N1	8:00	8:30	Fine	66.0	70.6	60.1	Work in Progress
Apr-03	22-Apr-03	N2	14:00	14:30	Fine	67.7	71.1	65.6	Work in Progress
Apr-03	22-Apr-03	N3	10:45	11:15	Fine	69.5	75.1	62.6	Work in Progress
Apr-03	22-Apr-03	N4	8:50	9:20	Fine	69.1	72.6	62.6	Work in Progress
Apr-03	25-Apr-03	N1	14:50	15:20	Overcast	67.5	72.6	62.1	Work in Progress
Apr-03	25-Apr-03	N2	14:00	14:30	Overcast	67.4	70.1	65.6	Work in Progress
Apr-03	25-Apr-03	N3	10:55	11:25	Overcast	69.8	75.1	63.1	Work in Progress
Apr-03	25-Apr-03	N4	15:40	16:10	Overcast	69.6	73.6	62.1	Work in Progress
Apr-03	28-Apr-03	N1	8:05	8:35	Overcast	65.7	70.1	59.1	Work in Progress
Apr-03	28-Apr-03	N2	14:30	15:00	Overcast	67.6	70.6	65.6	Work in Progress
Apr-03	28-Apr-03	N3	10:45	11:15	Overcast	68.2	73.1	64.1	Work in Progress
Apr-03	28-Apr-03	N4	8:55	9:25	Overcast	69.2	73.1	63.1	Work in Progress

APPENDIX C

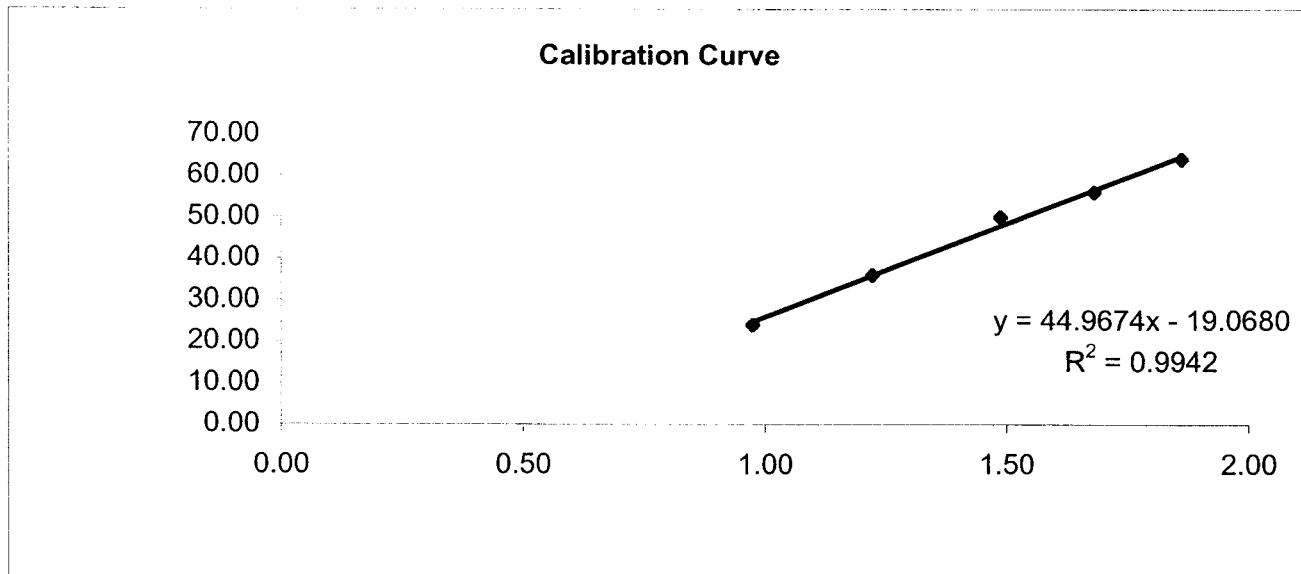
**Calibration Certificates
of HVS and Calibration
Orifice**

Ove Arup Partners (Hong Kong) Limited

High Volume Air Sampler Calibration Worksheet

Calibration date	22-Apr-03	Barometric pressure	765 mm Hg
Next Calibration date	21-Jun-03	Temperature (°C)	28 °C
	Roof floor, Educational Building,		
Sampler location	IVE Chai Wan	Temperature (K)	301 K
Sampler model	Graseby GMW 2310	P _{std}	760 mm Hg
Sampler serial number	6932	T _{std}	298 K
Calibrator model	GMW-2535		
Calibrator serial number	1378		
Slope of the standard curve, m _s	2.000011		
Intercept of the standard curve, b _s	-0.08159		

Resistance Plate No.	Manometer Reading (inch H ₂ O)	Flow Recorder Reading (CFM)	Calculated Q _{std} (m ³ /min)	Continuous Flow Recorder Reading IC (CFM)
5	3.50	24.00	0.97	23.96
7	5.60	36.00	1.22	35.94
10	8.40	50.00	1.49	49.91
13	10.80	56.00	1.68	55.90
18	13.30	64.00	1.86	63.89



Linear Regression

Sampler slope (m) : **44.9674**
 Sampler intercept (b) : **-19.0680**
 Correlation coefficient (R²) : **0.9942**

Correlation coefficient is greater than 0.9900 and the calibration result is accepted.

Performed by: *Poky*

Date: 22/4/03

Checked by: *McLean*

Date: 22/04/03

TSP/PM-10 ORIFICE CALIBRATION

Orifice SN: **1378**

Calibration Date : **03/25/03**

Ref.Rootsmeter S/N: **81951107**

T # (min)	V (M ³)	DelP # ("H2O)	Vstd (M ³)	Qstd (M ³ /min)	DelH # ("H2O)	(DelHc) ^{1/2} (corr.)
3.644	3.11	28.00	2.891	0.79	2.3	1.51
3.067	3.11	24.30	2.920	0.95	3.3	1.80
2.571	3.11	19.00	2.960	1.15	4.9	2.21
2.335	3.11	16.00	2.984	1.28	6.2	2.48
2.172	3.11	13.30	3.004	1.38	7.3	2.69

Temp = 72.50 °F = 22.50 °C = 295.5 °K
 Bar P= 29.60 in Hg = 751.75 mmHg

$$Qstd = [(DelHc)^{1/2} - (-0.08159)] / (2.000011) \quad r^2 = 0.999917$$

Where : DelHc = DelH(Pa/Ta)(298/760) a = at actual condition

LOOKUP TABLE

Qstd	DelHc	Qstd	DelHc	Qstd	DelHc	Qstd	DelHc
0.79	2.25	0.94	3.25	1.09	4.44	1.25	5.82
0.79	2.27	0.95	3.29	1.10	4.49	1.25	5.87
0.80	2.30	0.95	3.32	1.10	4.53	1.26	5.92
0.80	2.33	0.96	3.36	1.11	4.57	1.26	5.97
0.81	2.36	0.96	3.40	1.11	4.61	1.27	6.01
0.81	2.40	0.97	3.43	1.12	4.65	1.27	6.06
0.82	2.43	0.97	3.47	1.12	4.70	1.28	6.11
0.82	2.46	0.98	3.50	1.13	4.74	1.28	6.16
0.83	2.49	0.98	3.54	1.13	4.78	1.29	6.21
0.83	2.52	0.99	3.58	1.14	4.83	1.29	6.26
0.84	2.55	0.99	3.62	1.14	4.87	1.30	6.31
0.84	2.58	1.00	3.65	1.15	4.91	1.30	6.36
0.85	2.61	1.00	3.69	1.15	4.96	1.31	6.41
0.85	2.64	1.01	3.73	1.16	5.00	1.31	6.46
0.86	2.68	1.01	3.77	1.16	5.04	1.32	6.51
0.86	2.71	1.02	3.81	1.17	5.09	1.32	6.56
0.87	2.74	1.02	3.84	1.17	5.13	1.33	6.61
0.87	2.77	1.03	3.88	1.18	5.18	1.33	6.66
0.88	2.81	1.03	3.92	1.18	5.22	1.34	6.71
0.88	2.84	1.04	3.96	1.19	5.27	1.34	6.76
0.89	2.87	1.04	4.00	1.19	5.31	1.35	6.81
0.89	2.91	1.05	4.04	1.20	5.36	1.35	6.86
0.90	2.94	1.05	4.08	1.20	5.40	1.36	6.91
0.90	2.97	1.06	4.12	1.21	5.45	1.36	6.96
0.91	3.01	1.06	4.16	1.21	5.49	1.37	7.02
0.91	3.04	1.07	4.20	1.22	5.54	1.37	7.07
0.92	3.08	1.07	4.24	1.22	5.59	1.38	7.12
0.92	3.11	1.08	4.28	1.23	5.63	1.38	7.17
0.93	3.15	1.08	4.32	1.23	5.68	1.38	7.23
0.93	3.18	1.09	4.36	1.24	5.73	1.39	7.28
0.94	3.22	1.09	4.40	1.24	5.77	1.39	7.33

APPENDIX D

Detailed Air Quality (24-hour TSP) Monitoring Results

Details of 24-Hour TSP Monitoring

Month	Date	Receptor No.	Weather condition.	Site condition	Filter Weight (g)		TSP weight (g)	Flow Rate (m ³ /min)		Average Flow Rate (m ³ /min)	Elapse Time		Sampling Time (mins.)	Total vol. (m ³)	24-hour TSP Level (µg/m ³)
					Initial	Final		Initial	Final		Start	Finish			
Apr-03	03-Apr-03	A1	Rainy	Work in progress	2.7459	2.8973	0.1514	1.4533	1.4568	1.4551	4665.36	4689.36	1440.00	2095.27	72.3
Apr-03	09-Apr-03	A1	Rainy	Work in progress	2.7421	2.8698	0.1277	1.4838	1.4606	1.4722	4689.36	4713.36	1440.00	2119.97	60.2
Apr-03	15-Apr-03	A1	Overcast	Work in progress	2.7456	2.9017	0.1561	1.4582	1.4369	1.4476	4715.26	4739.26	1440.00	2084.47	74.9
Apr-03	22-Apr-03	A1	Fine	Work in progress	2.7501	2.9285	0.1784	1.5633	1.5409	1.5521	4739.26	4763.26	1440.00	2235.02	79.8
Apr-03	28-Apr-03	A1	Overcast	Work in progress	2.7489	2.9302	0.1813	1.5603	1.5380	1.5492	4763.26	4787.26	1440.00	2230.78	81.3

APPENDIX E

Detailed Air Quality (1-hour TSP) Monitoring Results

Details of 1-Hour TSP Monitoring

Date	Receptor		Time periods		Weather condition	Site condition	Temp. (°C)	Pressure (mmHg)	1-hour TSP Level ($\mu\text{g}/\text{m}^3$)
	No.	Set No.	Start	Finish					
03-Apr-03	A1	1	9:00	10:00	Rainy	Work in progress	25.0	769.0	153.9
03-Apr-03	A1	2	10:00	11:00	Rainy	Work in progress	25.0	769.0	153.7
03-Apr-03	A1	3	11:00	12:00	Rainy	Work in progress	25.0	769.0	146.7
09-Apr-03	A1	1	9:00	10:00	Rainy	Work in progress	24.0	772.0	120.4
09-Apr-03	A1	2	10:00	11:00	Rainy	Work in progress	24.0	772.0	120.2
09-Apr-03	A1	3	11:00	12:00	Rainy	Work in progress	24.0	772.0	121.2
15-Apr-03	A1	1	9:00	10:00	Overcast	Work in progress	25.0	771.0	134.6
15-Apr-03	A1	2	10:00	11:00	Overcast	Work in progress	25.0	771.0	132.1
15-Apr-03	A1	3	11:00	12:00	Overcast	Work in progress	25.0	771.0	132.8
22-Apr-03	A1	1	9:00	10:00	Fine	Work in progress	27.0	772.0	157.8
22-Apr-03	A1	2	10:00	11:00	Fine	Work in progress	27.0	772.0	160.6
22-Apr-03	A1	3	11:00	12:00	Fine	Work in progress	27.0	772.0	159.5
28-Apr-03	A1	1	9:00	10:00	Overcast	Work in progress	29.0	773.0	166.4
28-Apr-03	A1	2	10:00	11:00	Overcast	Work in progress	29.0	773.0	166.2
28-Apr-03	A1	3	11:00	12:00	Overcast	Work in progress	29.0	773.0	170.4