

Citybus Group Limited

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

Monthly Environmental
Monitoring and Audit
Report
August 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 – August 2003

September 2003

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Environmental Permit No	EP-107/2001
Project Proponent	Citybus Group Limited
Environmental Team	Ove Arup & Partners
Independent Environmental Checker	Westwood Hong & Associates
Report Name	Monthly EM&A Report August 2003

This document is prepared to prove that the above said report is prepared by the Environmental Team and certified by the Independent Environmental Checker



Signature of ET Leader

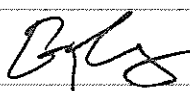




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ABBREVIATIONS AND ACRONYMS

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 twenty-first monthly EM&A report presenting the site inspection findings, and the progress on air quality and noise impact monitoring for August 2003.

Daytime (0700 – 1900 hours) noise monitoring was conducted at 4 locations. The highest noise level was 69.9 dB(A) recorded at Tsui Wan Estate on 11 August 2003 and the lowest was 66.0 dB(A) recorded at Heng Fa Chuen on 26 August 2003 respectively. There were no exceedances on the A/L Levels during the monitoring period.

The highest average 1-hour TSP was 147.8 $\mu\text{g}/\text{m}^3$ recorded at the Hong Kong IVE Chai Wan on 25 August 2003 and the lowest average 1-hour TSP was 129.4 $\mu\text{g}/\text{m}^3$ recorded at the Hong Kong IVE Chai Wan on 13 August 2003. There were no exceedances on the A/L Levels during the monitoring period.

The highest 24-hour TSP level was 74.8 $\mu\text{g}/\text{m}^3$ recorded at the Hong Kong IVE Chai Wan on 1 August 2003 and the lowest 24-hour TSP was 64.0 $\mu\text{g}/\text{m}^3$ recorded at the Hong Kong IVE Chai Wan on 13 August 2003. There were no exceedances on the A/L Levels during the monitoring period.

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

- Cement bags without covering were observed at ground level of depot. As instructed by ET, the Contractor had provided tarpaulin for covering.
- No significant noise impact was identified.
- No significant water impact was identified.
- No significant waste impact was identified.

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

A total of 115 loads of non-inert material have been disposed of at SENT Landfill in August 2003. The total quantity of the disposed non-inert material was 2,760 tonnes in August 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 24 months.

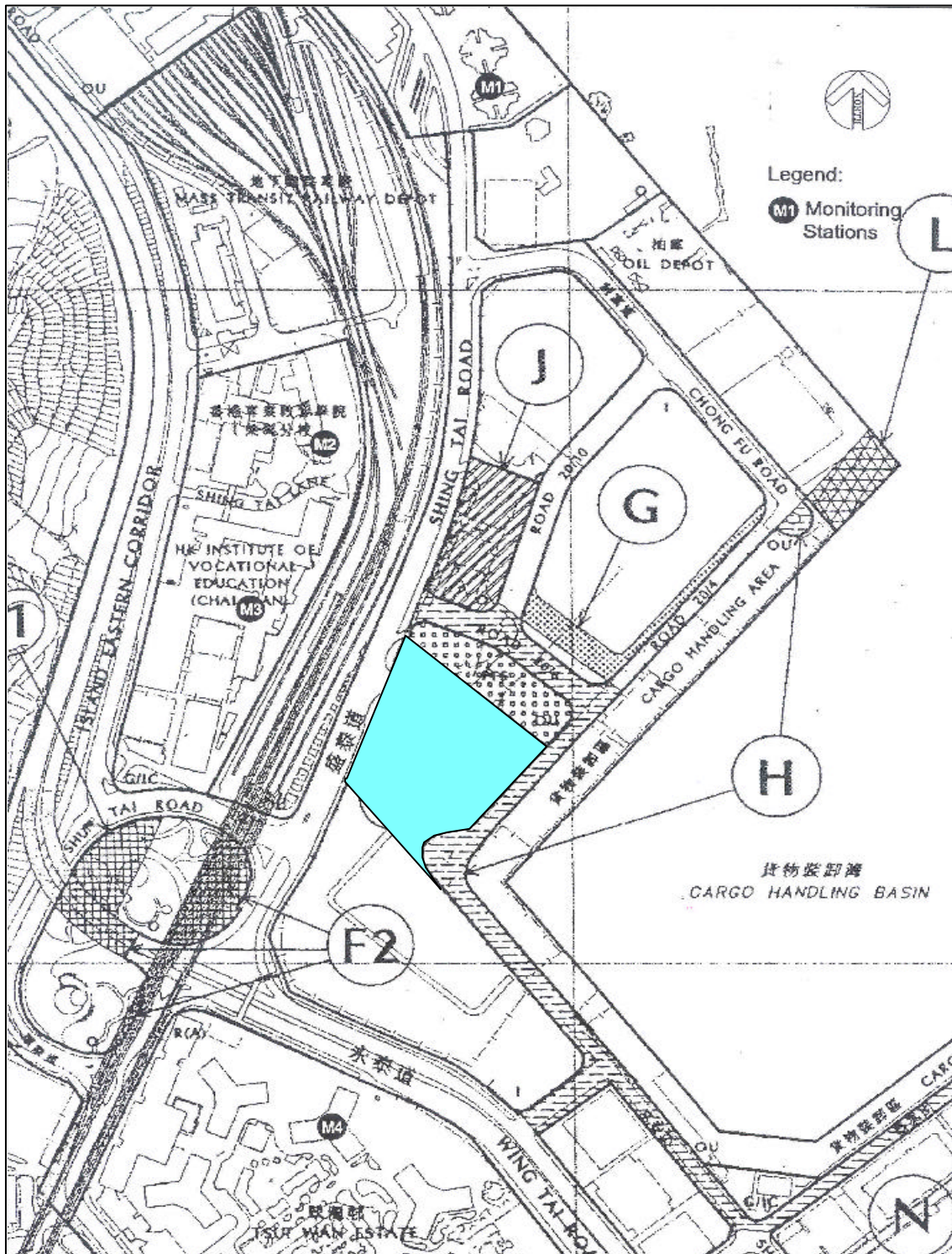
1.1 Purpose of the Report

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 twenty-first 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 August 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.
- Liasing 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 30 months. The construction programme is given in the Monthly EM&A Report – December 2001^[2].

2.2 Construction Activities of the Month

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

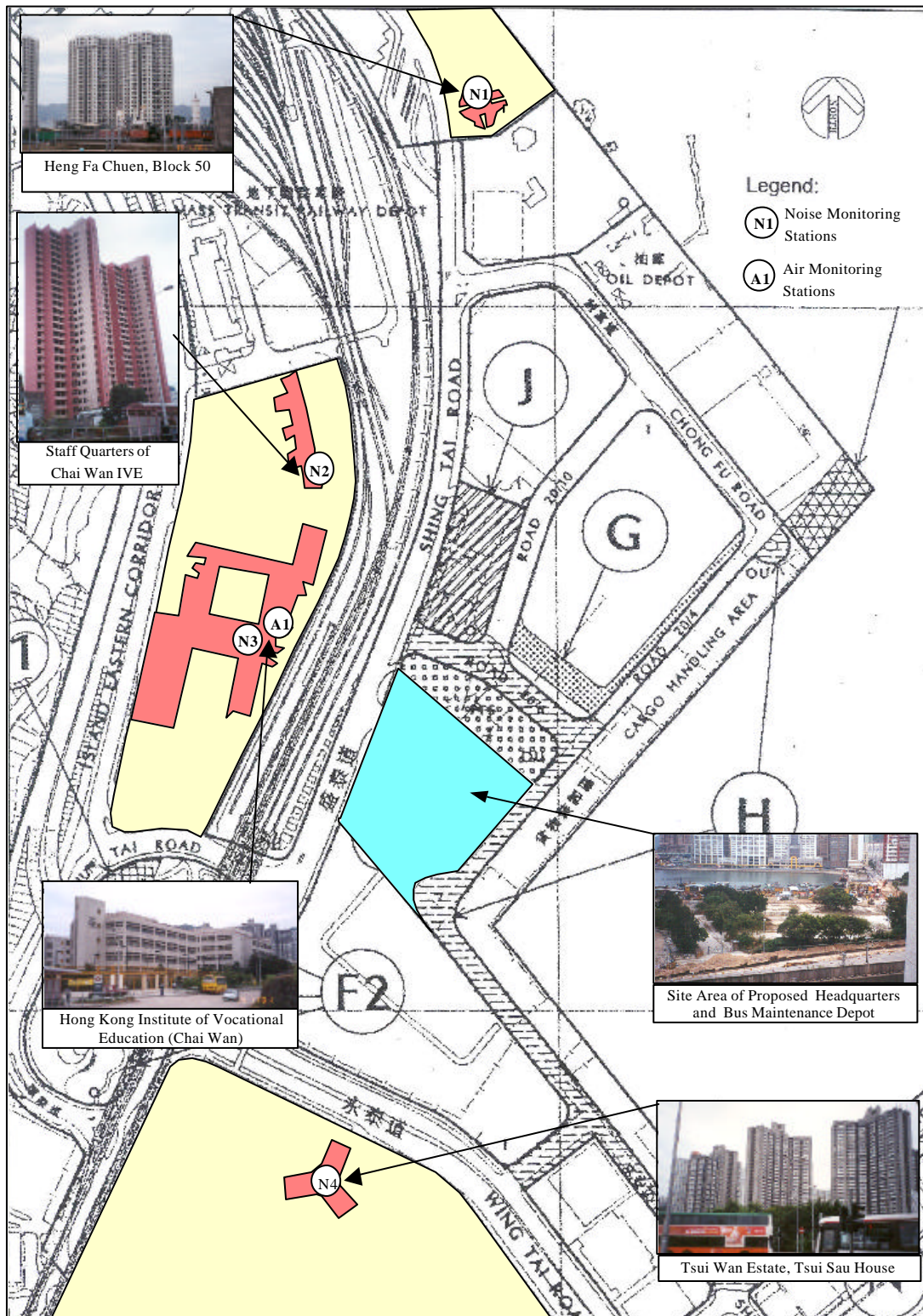
2.3 Environmental Sensitive Receivers

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	Tsui 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 August 2003 and September 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 August 2003 and September 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^[3], 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	<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 Supervisor and Contractor on 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 works 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

3.4 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

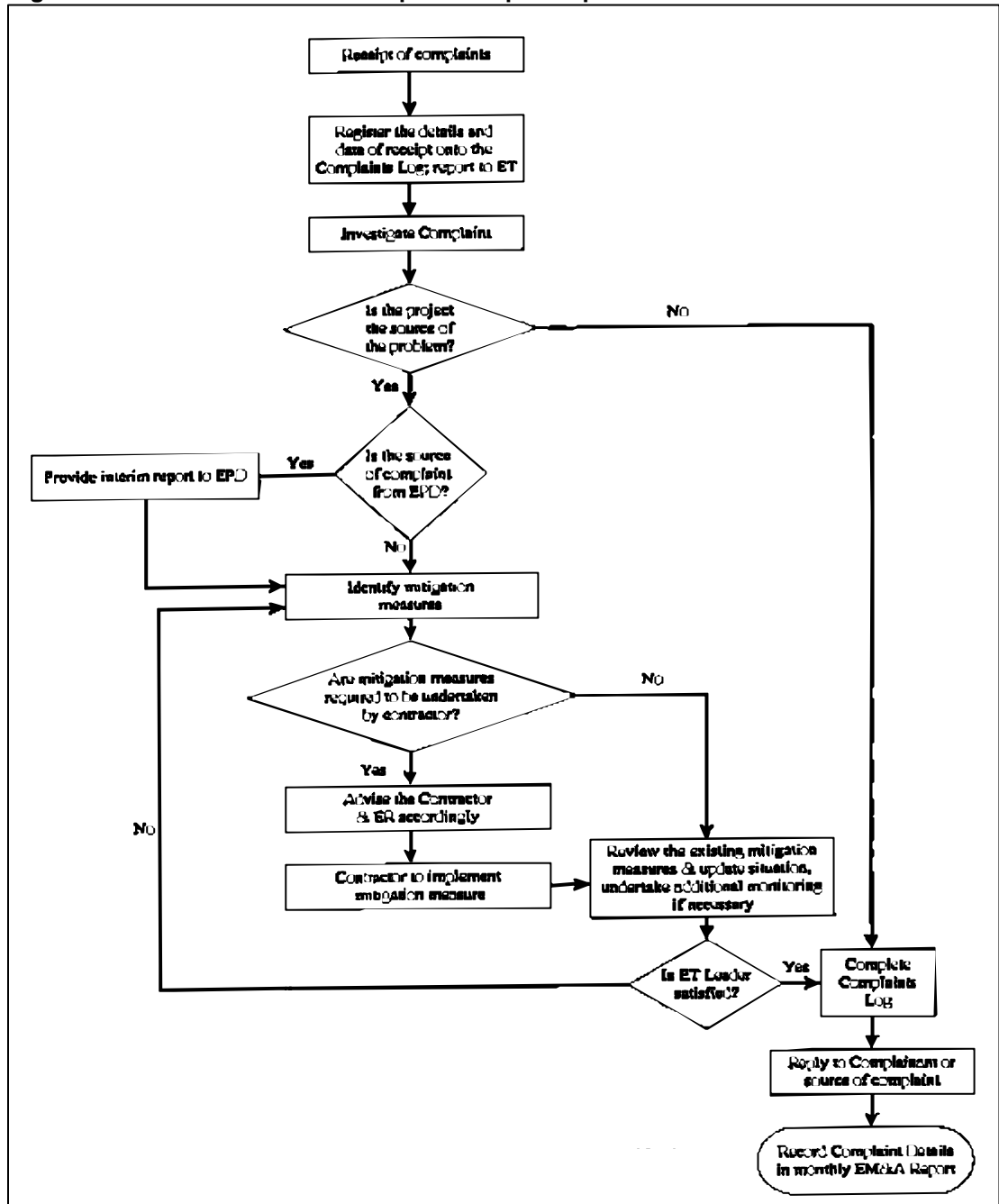
In accordance with the Environmental Management Plan^[1], environmental complaints will be referred to the ET for initiation of the complaint investigation procedures. The ET will undertake the following procedures upon receipt of the complaints:

- 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 IEC 804 Type 1	1
½ " free-field microphone	Brüel & Kjær 4188		1
Windshield	Brüel & Kjær UA0237		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 Appendix B.

4.3 Results and Observations

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

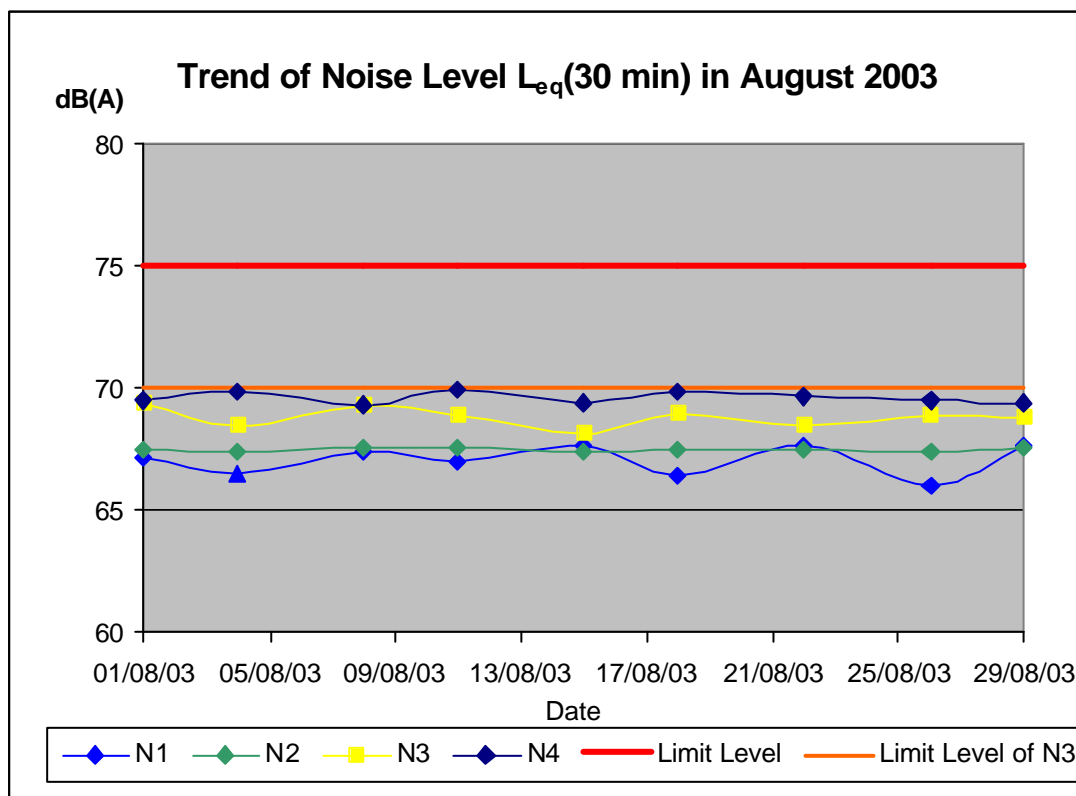
The principal noise sources were mainly from other activities such as idling vehicles, through traffic and school activities not associated with the construction of the Project. A graphical presentation of noise monitoring results is given in Figure 4-1.

Table 4-2 Daytime noise monitoring results for August 2003

Date of Monitoring	Monitoring Parameters	Monitoring Results, dB(A) (30 min)			
		N1	N2	N3	N4
01/08/03 (Fri)	L_{eq}	67.2	67.5	69.4	69.5
	L_{10}	72.1	71.1	75.1	74.6
	L_{90}	62.1	66.1	63.6	62.1
04/08/03 (Mon)	L_{eq}	66.5	67.4	68.5	69.8
	L_{10}	70.1	70.6	73.6	74.1
	L_{90}	61.1	66.1	64.1	63.1
18/08/03 (Fri)	L_{eq}	67.4	67.6	69.3	69.3
	L_{10}	72.6	71.1	74.6	74.1
	L_{90}	62.1	66.1	63.6	62.6
11/08/03 (Mon)	L_{eq}	67.0	67.6	68.9	69.9
	L_{10}	71.6	71.1	73.6	74.6
	L_{90}	63.1	66.1	64.1	62.6
15/08/03 (Fri)	L_{eq}	67.7	67.4	68.2	69.4
	L_{10}	72.1	70.6	73.6	74.1
	L_{90}	62.6	66.1	63.6	62.1

Date of Monitoring	Monitoring Parameters	Monitoring Results, dB(A) (30 min)			
		N1	N2	N3	N4
18/08/03 (Mon)	L _{eq}	66.4	67.5	69.0	69.8
	L ₁₀	70.1	70.6	74.1	73.6
	L ₉₀	61.6	66.1	63.1	63.1
22/08/03 (Fri)	L _{eq}	67.7	67.5	68.5	69.7
	L ₁₀	72.6	70.6	73.1	74.6
	L ₉₀	62.1	66.6	62.6	62.6
25/08/03 (Mon)	L _{eq}	66.0	67.4	68.9	69.5
	L ₁₀	70.1	70.1	73.6	73.6
	L ₉₀	61.1	66.1	63.6	63.1
29/08/03 (Fri)	L _{eq}	67.7	67.6	68.8	69.4
	L ₁₀	72.1	70.6	73.1	74.6
	L ₉₀	62.1	66.1	63.6	62.6

Figure 4-1 Daytime noise monitoring results for August 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 the Appendix D.

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 the Monthly EM&A Report - April 2003^[5].

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^[2].

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 E and the 1-hour TSP monitoring results are provided in Appendix F.

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 August 2003

Date of Monitoring	24-hour TSP Monitoring Results ($\mu\text{g}/\text{m}^3$)	
	Weather	Result
01/08/03 (Fri)	Fine	74.8
07/08/03 (Thu)	Fine	70.0
13/08/03 (Wed)	Fine	64.0
19/08/03 (Tue)	Fine	68.1
25/08/03 (Mon)	Fine	70.1

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

Date of Monitoring	1-hour TSP Monitoring Results ($\mu\text{g}/\text{m}^3$)	
	Weather	Averaged Result
01/08/03 (Fri)	Fine	147.4
07/08/03 (Thu)	Fine	136.4
13/08/03 (Wed)	Fine	129.4
19/08/03 (Tue)	Fine	142.6
25/08/03 (Mon)	Fine	147.8

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

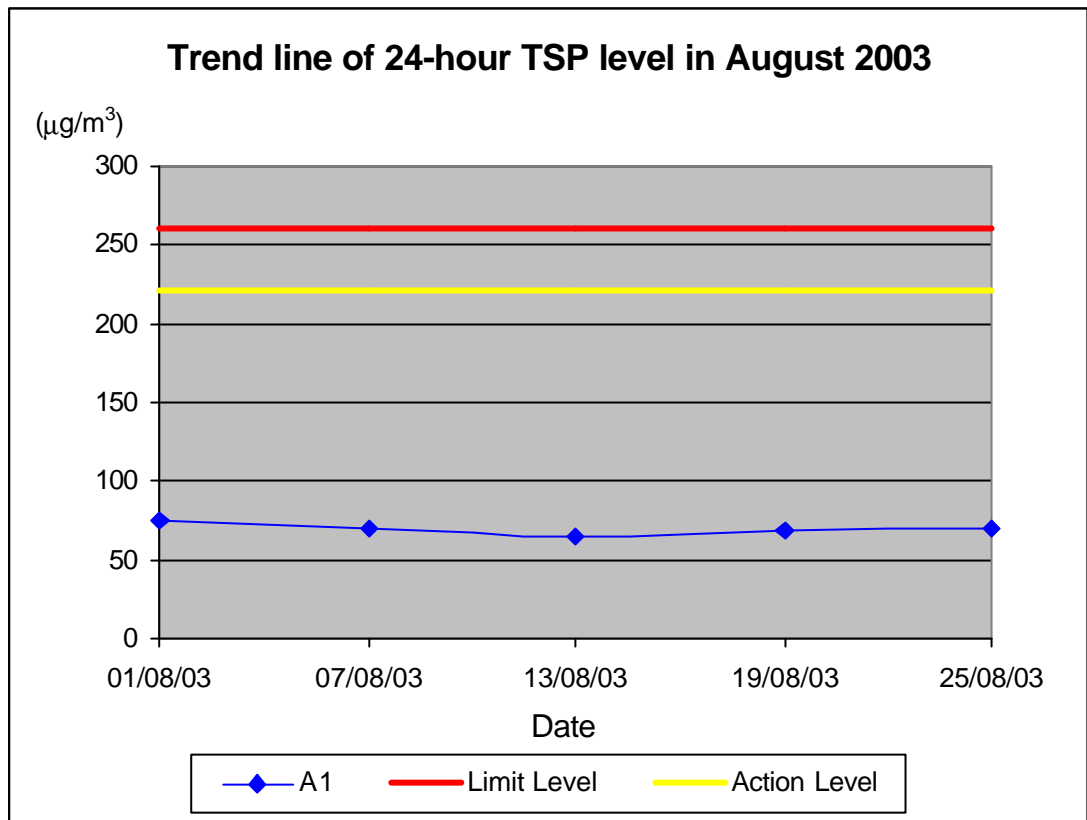
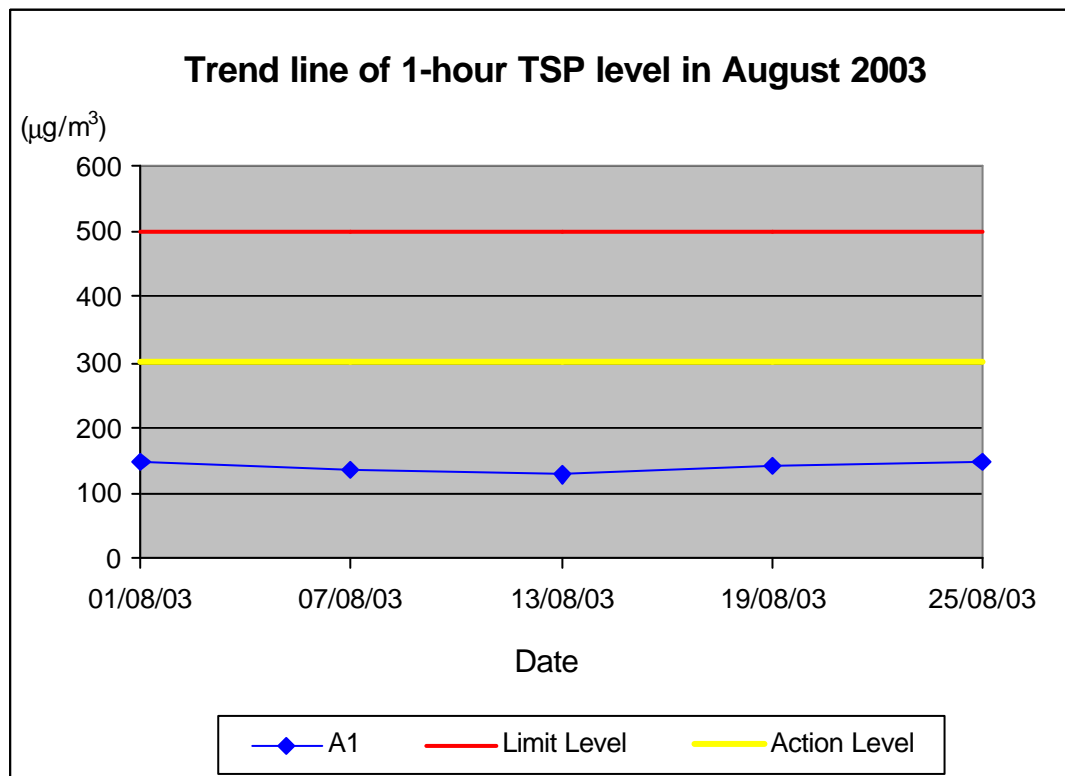


Figure 5-2 1-hour TSP monitoring results for August 2003



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

6.1 Audit Results

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

Air Quality

- Cement bags without covering were observed at ground level of depot. As instructed by ET, the Contractor had provided tarpaulin for covering. Photo showing the chemical toilet at 3/F has been blown down is given in Figure 6-1.

Figure 6-1 Cement bags without covering.



Noise

- No significant noise impact was identified.

Water Quality

- No significant water impact was identified.

Chemical / Waste Management

- No significant waste impact was identified.

6.2 Summary of Waste Disposal

A total of 115 loads of non-inert material have been disposed of at SENT Landfill in August 2003. The total quantity of the disposed non-inert material was 2,760 tonnes in August 2003.

6.3 Complaint Record

No complaint on environmental issues was received in August 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 August 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] Citybus Permanent Headquarters and Bus Maintenance Depot in Chai Wan Monthly EM&A Report - December 2001, Ove Arup & Partners Hong Kong Limited.
- [3] Environmental Baseline Monitoring Report – Citybus Chai Wan Permanent Depot Environmental Team Services. 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.
- [5] Citybus Permanent Headquarters and Bus Maintenance Depot in Chai Wan Monthly EM&A Report - April 2003, Ove Arup & Partners Hong Kong Limited.

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APPENDIX A

**EM&A Schedules for
August 2003 and
September 2003**

Environmental Monitoring and Audit Schedule - September 2003

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

Note 2: **TSP** denotes Total Suspended Particulate

Sep-2003						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">1</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">1</div> <p style="margin: 5px 0;">L30 monitoring</p> <p style="margin: 5px 0;">24-hour TSP monitoring</p> <p style="margin: 5px 0;">3 x 1-hour TSP monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">2</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">3</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">4</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">5</div> <p style="margin: 5px 0;">L30 monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">6</div> <p style="margin: 5px 0;">24-hour TSP monitoring</p> <p style="margin: 5px 0;">3 x 1-hour TSP monitoring</p>
<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">7</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">8</div> <p style="margin: 5px 0;">L30 monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">9</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">10</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">11</div> <p style="margin: 5px 0;">L30 monitoring</p> <p style="margin: 5px 0;">24-hour TSP monitoring</p> <p style="margin: 5px 0;">3 x 1-hour TSP monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">12</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">13</div>
<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">14</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">15</div> <p style="margin: 5px 0;">L30 monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">16</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">17</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">18</div> <p style="margin: 5px 0;">24-hour TSP monitoring</p> <p style="margin: 5px 0;">3 x 1-hour TSP monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">19</div> <p style="margin: 5px 0;">L30 monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">20</div>
<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">21</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">22</div> <p style="margin: 5px 0;">L30 monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">23</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">24</div> <p style="margin: 5px 0;">24-hour TSP monitoring</p> <p style="margin: 5px 0;">3 x 1-hour TSP monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">25</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">26</div> <p style="margin: 5px 0;">L30 monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">27</div>
<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">28</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">29</div> <p style="margin: 5px 0;">L30 monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">30</div> <p style="margin: 5px 0;">24-hour TSP monitoring</p> <p style="margin: 5px 0;">3 x 1-hour TSP monitoring</p>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">31</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">32</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">33</div>	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;">34</div>

Environmental Monitoring and Audit Programme - August 2003

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

Note 2: **TSP** denotes Total Suspended Particulate

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

APPENDIX B

**Calibration Certificates
of Sound Level Meters
and Acoustic Calibrators**

CERTIFICATE OF CALIBRATION

Issued by: Brüel & Kjær UK Ltd.

Date of Issue: 20 MAR 2003

Certificate Number: 11449



Brüel & Kjær 


0174

Bedford House, Rutherford Close, Stevenage,
Hertfordshire. SG1 2ND
Telephone: 01438 739100 Fax.: 01438 739199
E-Mail : service@bkgb.co.uk

Page 1 of 4 pages

Approved signatory

Name: A. M. HAMM

Signature: 

CALIBRATION OF MULTI FREQUENCY CALIBRATOR TYPE 4226 ("Free Field and Random" version)

Client: ARUP ACOUSTICS
ST. GILES HALL
POUND HILL
CAMBRIDGE. CB3 0AE

Calibrator Type 4226, S/No: 1531372

With Coupler UA0915, S/No: 1531372

Client Inventory Number: -

Manufacturer: Brüel & Kjær

Equipment Received on: 18 MAR 2003

Calibration Date: 20 MAR 2003

Brüel & Kjær Reference No: 1-12457681

Measurement Method

The Calibration was performed to Laboratory Procedure TWI-103.

Sound pressure level in the 1/2 inch coupler of the calibrator was measured with a laboratory grade condenser microphone Type 4180, used as a working standard, calibrated by the National Physical Laboratory.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0174

Certificate Number

11449

Page 2 of 4 pages

The measured sound pressure was compared with that generated in the coupler of a working standard pistonphone calibrated by the National Physical Laboratory whose output was cross checked against a reference standard pistonphone, also calibrated by the National Physical Laboratory, using the same microphone and at the same ambient conditions. Appropriate corrections for atmospheric pressure conditions during calibration and for the measurement frequency and level response were taken into account.

Sound pressure level results are the mean of 5 measurements.

Results apply directly to the following settings on the calibrator, pressure, linear, calibration, 94dB, microphone group a, b, c.

Results for frequency and distortion are the result of a single measurement.

Results for 104 and 114dB are only at 125Hz, 1kHz and 8kHz, compared with the output at 94dB.

Calibration results apply at ambient conditions during the process of calibration.

Calibrations marked (Not UKAS Accredited) in this certificate have been included for completeness.

CALIBRATION RESULTS

4226 Settings: Linear, Pressure, 94dB, Microphone Group c.

Frequency Setting Hz	Sound Pressure Level in dB re 20µPa	Frequency Hz (Not UKAS Accredited)	Distortion % (Not UKAS Accredited)
31.5	94.21	31.63	0.4
63	94.17	63.13	0.1
125	94.13	125.9	0.1
250	94.11	251.3	0.1
500	94.11	502.5	0.1
1k	94.12	1.005 _k	0.1
2k	94.09	1.979 _k	0.3
4k	94.04	3.957 _k	0.8
8k	94.07	7.915 _k	0.3
12.5k	94.07	12.66 _k	0.1

CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0174

Certificate Number

11449

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Expanded uncertainty of calibration:

Sound Pressure Level: ± 0.15 dB from 31.5 Hz to 2 kHz,
 ± 0.20 dB at 4 kHz and 8 kHz,
 ± 0.25 dB at 12.5 kHz
Frequency: ± 1 last significant digit reported.
Distortion: $\pm 0.3\%$ distortion.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

ADDITIONAL TESTS

Sound Pressure Levels at Settings of 94, 104 and 114 dB

Frequency	Difference 104-94dB	Difference 114-94dB
125 Hz	9.98	19.96
1kHz	9.99	19.97
8kHz	9.96	19.93

Result of a single measurement, expanded uncertainty ± 0.15 dB

Inverted "A" Weighting, Readings Relative to 1kHz in dB

Frequency Hz	31.5	63	125	250	500	1 k	2 k	4 k	8 k	12.5 k
Target Value	+39.4	+26.2	+16.1	+8.6	+3.2	0	-1.2	-1.0	+1.1	+4.3
Reading	39.5	26.2	16.1	8.6	3.2	0.0	-1.2	-1.0	1.0	4.3

Target values according to BS EN 60651 - 1994 - results of a single measurement, values rounded to 0.1 dB, expanded uncertainty ± 0.3 dB.

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Certificate Number

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Free Field and Random settings

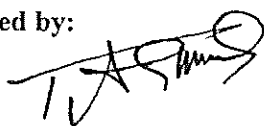
Freq. Hz	Free Field Setting						Random	
	Microphone Group a		Microphone Group b		Microphone Group c		Microphone Group b	
	Target Value dB	Reading dB	Target Value dB	Reading dB	Target Value dB	Reading dB	Target Value dB	Reading dB
250	0	0.00	0	0.00	0	0.00	0	0.00
500	0	0.00	0	0.00	0	0.00	0	0.00
1k	+0.15	0.14	+0.20	0.19	+0.10	0.09	+0.05	0.04
2k	+0.50	0.48	+0.45	0.43	+0.35	0.33	+0.10	0.08
4k	+1.35	1.33	+1.05	1.04	+0.95	0.92	+0.15	0.13
8k	+4.50	4.47	+2.80	2.78	+2.60	2.58	+0.40	0.38
12.5k	+7.35	7.29	+5.60	5.54	+5.05	5.00	+1.50	1.48

Target values as specified in the manufacturer's manual, result of a single measurement, expanded uncertainty $\pm 0.2\text{dB}$.

Ambient conditions during calibration were:

Atmospheric Pressure 101.6 kPa
 Temperature 24 °C
 Relative Humidity 39 %

Checked by:



Arup Acoustics (HK)
Level 5 Festival Walk
80 Tat Chee Avenue
Kowloon Tong, Kowloon
HONG KONG

AAc Certificate No. 2003001

Tel: 2268 3216

Fax: 2268 3950


CERTIFICATE OF CONFORMITY

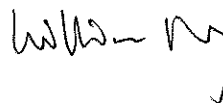
<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer 4230 Acoustic Calibrator	4230	1233887

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: 

Signature: 

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd)

Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

Arup Acoustics (HK) is not a registered HOKLAS accredited calibration laboratory. This certificate is for internal use only (unless otherwise authorised) and is part of Arup Acoustics (HK) development and commitment to QC and QA procedures.

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Arup Acoustics (HK)
Level 5 Festival Walk
80 Tat Chee Avenue
Kowloon Tong, Kowloon
HONG KONG

AAc Certificate No. 2003002

Tel: 2268 3216

Fax: 2268 3950


CERTIFICATE OF CONFORMITY

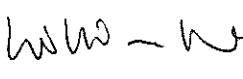
<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer 4231 Acoustic Calibrator	4231	2314016

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: 

Signature: 

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd)

Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

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AAc Certificate No. 2003003

Tel: 2268 3216

Fax: 2268 3950

CERTIFICATE OF CONFORMITY

<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Sound Level Meter Kit 1	2231	1294630
Bruel & Kjaer ½" Microphone Kit 1	4188	2179478

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: *Steven Wong*

Signature: *William Ng*

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd)

Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

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
CERTIFICATE OF CONFORMITY

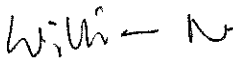
<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Sound Level Meter Kit 2	2231	1709184
Bruel & Kjaer ½" Microphone Kit 2	4188	2179476

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: 

Signature: 

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd) Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

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HONG KONG

AAc Certificate No. 2003005

Tel: 2268 3216

Fax: 2268 3950

CERTIFICATE OF CONFORMITY

<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Sound Level Meter	2238	2320707
Bruel & Kjaer ½" Microphone	4188	2179479

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: *Steven*

Signature: *William Ng*

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd)

Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

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HONG KONG

AAc Certificate No. 2003006

Tel: 2268 3216

Fax: 2268 3950


CERTIFICATE OF CONFORMITY

<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Sound Level Meter	2238	2320694
Bruel & Kjaer ½" Microphone	4188	2274284

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: 

Signature: 

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd) Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

Arup Acoustics (HK) is not a registered HOKLAS accredited calibration laboratory. This certificate is for internal use only (unless otherwise authorised) and is part of Arup Acoustics (HK) development and commitment to QC and QA procedures.

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HONG KONG

AAc Certificate No. 2003007

Tel: 2268 3216

Fax: 2268 3950


CERTIFICATE OF CONFORMITY

<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Sound Level Meter	2238	2320696
Bruel & Kjaer ½" Microphone	4188	2274206

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: 

Signature: 

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd)

Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

Arup Acoustics (HK) is not a registered HOKLAS accredited calibration laboratory. This certificate is for internal use only (unless otherwise authorised) and is part of Arup Acoustics (HK) development and commitment to QC and QA procedures.

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80 Tat Chee Avenue
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HONG KONG

AAc Certificate No. 2003008

Tel: 2268 3216

Fax: 2268 3950

CERTIFICATE OF CONFORMITY

<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
RION Sound Level Meter	NA-27	01070556
Bruel & Kjaer ½" Microphone	4188	2179477

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: *Steven*

Signature: *William Ng*

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test (upto 4kHz). Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document. The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd)

Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

Arup Acoustics (HK) is not a registered HOKLAS accredited calibration laboratory. This certificate is for internal use only (unless otherwise authorised) and is part of Arup Acoustics (HK) development and commitment to QC and QA procedures.

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80 Tat Chee Avenue
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HONG KONG

AAc Certificate No. 2003009

Tel: 2268 3216

Fax: 2268 3950

CERTIFICATE OF CONFORMITY

<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
RION Sound Level Meter	NA-27	00980789
RION ½" Microphone	UC53A	90317

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: *Steven*

Signature: *William Ng*

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd)

Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

Footnote

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Level 5 Festival Walk
80 Tat Chee Avenue
Kowloon Tong, Kowloon
HONG KONG

AAc Certificate No. 2003010

Tel: 2268 3216

Fax: 2268 3950


CERTIFICATE OF CONFORMITY

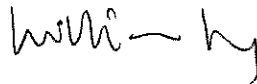
<u>Description of Test Instrument</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Sound Level Meter	2215	935349
Bruel & Kjaer ½" Microphone	4165	1503550

Date of Test: 18 August 2003

Carried out by: Steven Wong

Approved by: William Ng

Signature: 

Signature: 

Ambient Conditions During Test:	
Atmospheric Pressure:	1KPa
Air Temperature:	22°C
Relative Humidity:	60%

This document is to certify that the above Test Instrumentation did conform to the manufacturer's original specification on the date of the test. Any adjustments that were required to bring the instrumentation back into specification are duly noted in this document.

The tests were carried out using the reference calibrator described below.

<u>Description of Reference Calibrator</u>	<u>Type No.</u>	<u>Serial No.</u>
Bruel & Kjaer Multi Frequency Calibrator	4226	1531372

Certificate of Calibration No. 11449

By Bruel & Kjaer (A Division of Spectris (UK) Ltd)

Calibration Date: 20 Mar 2003

The reference calibrator, type 4226 has traceable calibrator back to National Measurement Standards. As such it is used as Arup Acoustics own 'Primary Standard' and is used only for controlled laboratory calibration tests on all sound measuring equipment owned by Arup Acoustics.

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APPENDIX C

**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	
Aug-03	01-Aug-03	N1	14:30	15:00	Fine	67.2	72.1	62.1	Work in Progress
Aug-03	01-Aug-03	N2	13:45	14:15	Fine	67.5	71.1	66.1	Work in Progress
Aug-03	01-Aug-03	N3	11:00	11:30	Fine	69.4	75.1	63.6	Work in Progress
Aug-03	01-Aug-03	N4	15:25	15:55	Fine	69.5	74.6	62.1	Work in Progress
Aug-03	04-Aug-03	N1	8:00	8:30	Overcast	66.5	70.1	61.1	Work in Progress
Aug-03	04-Aug-03	N2	15:00	15:30	Overcast	67.4	70.6	66.1	Work in Progress
Aug-03	04-Aug-03	N3	11:00	11:30	Overcast	68.5	73.6	64.1	Work in Progress
Aug-03	04-Aug-03	N4	8:55	9:25	Overcast	69.8	74.1	63.1	Work in Progress
Aug-03	08-Aug-03	N1	14:45	15:15	Fine	67.4	72.6	62.1	Work in Progress
Aug-03	08-Aug-03	N2	14:00	14:30	Fine	67.6	71.1	66.1	Work in Progress
Aug-03	08-Aug-03	N3	11:00	11:30	Fine	69.3	74.6	63.6	Work in Progress
Aug-03	08-Aug-03	N4	15:25	15:55	Fine	69.3	74.1	62.6	Work in Progress
Aug-03	11-Aug-03	N1	8:00	8:30	Fine	67.0	71.6	63.1	Work in Progress
Aug-03	11-Aug-03	N2	14:15	14:45	Fine	67.6	71.1	66.1	Work in Progress
Aug-03	11-Aug-03	N3	11:00	11:30	Fine	68.9	73.6	64.1	Work in Progress
Aug-03	11-Aug-03	N4	8:55	9:25	Fine	69.9	74.6	62.6	Work in Progress
Aug-03	15-Aug-03	N1	15:00	15:30	Fine	67.7	72.1	62.6	Work in Progress
Aug-03	15-Aug-03	N2	14:15	14:45	Fine	67.4	70.6	66.1	Work in Progress
Aug-03	15-Aug-03	N3	11:00	11:30	Fine	68.2	73.6	63.6	Work in Progress
Aug-03	15-Aug-03	N4	15:40	16:10	Fine	69.4	74.1	62.1	Work in Progress
Aug-03	18-Aug-03	N1	8:00	8:30	Fine	66.4	70.1	61.6	Work in Progress
Aug-03	18-Aug-03	N2	15:00	15:30	Fine	67.5	70.6	66.1	Work in Progress
Aug-03	18-Aug-03	N3	11:00	11:30	Fine	69.0	74.1	63.1	Work in Progress
Aug-03	18-Aug-03	N4	8:50	9:20	Fine	69.8	73.6	63.1	Work in Progress
Aug-03	22-Aug-03	N1	14:45	15:15	Overcast	67.7	72.6	62.1	Work in Progress
Aug-03	22-Aug-03	N2	14:00	14:30	Overcast	67.5	70.6	66.6	Work in Progress
Aug-03	22-Aug-03	N3	11:00	11:30	Overcast	68.5	73.1	62.6	Work in Progress
Aug-03	22-Aug-03	N4	15:30	16:00	Overcast	69.7	74.6	62.6	Work in Progress
Aug-03	26-Aug-03	N1	8:05	8:35	Fine	66.0	70.1	61.1	Work in Progress
Aug-03	26-Aug-03	N2	14:15	14:45	Fine	67.4	70.1	66.1	Work in Progress
Aug-03	26-Aug-03	N3	11:00	11:30	Fine	68.9	73.6	63.6	Work in Progress
Aug-03	26-Aug-03	N4	8:55	9:25	Fine	69.5	73.6	63.1	Work in Progress
Aug-03	29-Aug-03	N1	15:40	16:10	Fine	67.7	72.1	62.1	Work in Progress
Aug-03	29-Aug-03	N2	15:00	15:30	Fine	67.6	70.6	66.1	Work in Progress
Aug-03	29-Aug-03	N3	11:00	11:30	Fine	68.8	73.1	63.6	Work in Progress
Aug-03	29-Aug-03	N4	16:20	16:50	Fine	69.4	74.6	62.6	Work in Progress

APPENDIX D

**Calibration Certificate of
HVS**

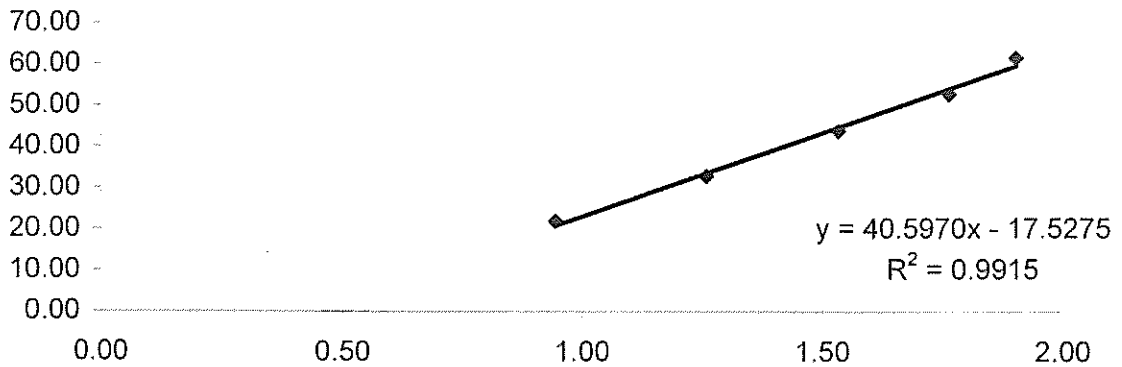
Ove Arup Partners (Hong Kong) Limited

High Volume Air Sampler Calibration Worksheet

Calibration date	15-Aug-03	Barometric pressure	760 mm Hg
Next Calibration date	14-Oct-03	Temperature (°C)	28 °C
Sampler location	Roof floor, Educational Building,	Temperature (K)	301 K
Sampler model	IVE Chai Wan	P _{std}	760 mm Hg
Sampler serial number	Graseby GMW 2310	T _{std}	298 K
Sampler serial number	6932		
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	3.30	22.00	0.94	21.89
7	6.00	33.00	1.26	32.84
10	9.00	44.00	1.53	43.78
13	12.00	53.00	1.76	52.74
18	14.00	62.00	1.90	61.69

Calibration Curve



Linear Regression

Sampler slope (m) : **40.5970**
 Sampler intercept (b) : **-17.5275**
 Correlation coefficient (R²) : **0.9915**

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

Performed by: _____
 Checked by: _____

Date: 15/08/03
 Date: 16/8/03

APPENDIX E

Detailed Air Quality (24-hour TSP) Monitoring Results

Details of 24-Hour TSP Monitoring

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 (mg/m ³)
				Initial	Final		Initial	Final		Start	Finish			
01-Aug-03	A1	Fine	Work in progress	2.7499	2.9112	0.1613	1.5079	1.4871	1.4975	5147.26	5171.26	1440.00	2156.40	74.8
07-Aug-03	A1	Fine	Work in progress	2.7503	2.9006	0.1503	1.5022	1.4815	1.4919	5171.26	5195.26	1440.00	2148.26	70.0
13-Aug-03	A1	Fine	Work in progress	2.7493	2.8862	0.1369	1.4845	1.4845	1.4845	5195.26	5219.26	1440.00	2137.68	64.0
19-Aug-03	A1	Fine	Work in progress	2.7511	2.9131	0.1620	1.6512	1.6531	1.6522	5219.26	5243.26	1440.00	2379.10	68.1
25-Aug-03	A1	Fine	Work in progress	2.7508	2.9162	0.1654	1.6512	1.6268	1.6390	5243.26	5267.26	1440.00	2360.16	70.1

APPENDIX F

Detailed Air Quality (1-hour TSP) Monitoring Results

Details of 1-Hour TSP Monitoring

Month	Date	Receptor No.	Set No.	Time periods		Weather condition	Site condition	Temp. (°C)	Pressure (mmHg)	1-hour TSP Level (mg/m ³)
				Start	Finish					
Aug-03	01-Aug-03	A1	1	10:00	11:00	Fine	Work in progress	32.0	768.0	148.0
Aug-03	01-Aug-03	A1	2	11:00	12:00	Fine	Work in progress	32.0	768.0	147.8
Aug-03	01-Aug-03	A1	3	12:00	13:00	Fine	Work in progress	32.0	768.0	146.3
Aug-03	07-Aug-03	A1	1	10:00	11:00	Fine	Work in progress	33.0	762.0	136.3
Aug-03	07-Aug-03	A1	2	11:00	12:00	Fine	Work in progress	33.0	762.0	136.1
Aug-03	07-Aug-03	A1	3	12:00	13:00	Fine	Work in progress	33.0	762.0	136.7
Aug-03	13-Aug-03	A1	1	10:00	11:00	Fine	Work in progress	32.0	764.0	126.5
Aug-03	13-Aug-03	A1	2	11:00	12:00	Fine	Work in progress	32.0	764.0	128.8
Aug-03	13-Aug-03	A1	3	12:00	13:00	Fine	Work in progress	32.0	764.0	132.8
Aug-03	19-Aug-03	A1	1	10:00	11:00	Fine	Work in progress	32.0	765.0	142.2
Aug-03	19-Aug-03	A1	2	11:00	12:00	Fine	Work in progress	32.0	765.0	142.4
Aug-03	19-Aug-03	A1	3	12:00	13:00	Fine	Work in progress	32.0	765.0	143.2
Aug-03	25-Aug-03	A1	1	10:00	11:00	Fine	Work in progress	31.0	760.0	149.1
Aug-03	25-Aug-03	A1	2	11:00	12:00	Fine	Work in progress	31.0	760.0	148.6
Aug-03	25-Aug-03	A1	3	12:00	13:00	Fine	Work in progress	31.0	760.0	145.7