

DSD

Ngong Ping Sewage Treatment Works

Quarterly EM&A Report of Odour Impact Monitoring

August 2006

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EXECUTIVE SUMMARY

This serves as part of the Environmental Monitoring and Audit (EM&A) Report for the Ngong Ping Sewage Treatment Works at Ngong Ping, Lantau Island, operated by Sewage Treatment Division 2 of Drainage Services Department (ST2, DSD). This report contains the results of the second quarterly odour impact monitoring conducted by the Environmental Team (ET).

There were no breaches in odour action and limit levels and the odour mitigation measures at the sewage treatment works were performing adequately. Thus, the environmental protection was in compliance with the regulations. No complaints were received in the period.

1. Introduction

This is the second Environmental Monitoring and Audit (EM&A) Report for Ngong Ping Sewage Treatment Works (STW) at Ngong Ping, Lantau Island, operated by Sewage Treatment Division 2 of Drainage Services Department (ST2, DSD). This report presents the results of odour monitoring in the month of August 2006 and has been prepared by the Environmental Team of ST2, DSD.

Odour monitoring and the mitigation measures during operation of the sewage treatment works are carried out as recommended in the EM&A Manual.

The contact information for the key environmental personnel and the site location of Ngong Ping STW are shown in appendices 1 and 2, respectively.

2. Status of Environmental Protection

The EM&A Manual has stated that there would be potential odour impacts associated with the operation of the sewage treatment plant and recommended mitigation measures during the operation phase. As a result all the major odour sources within the proposed STW namely the inlet work, the sequencing batch reactors, the sludge thickeners, and the emergency storage tank are all contained by building structures and ventilated to centralised deodorisation units.

Prior to the operation of the odour generating activities, H₂S (hydrogen sulfide) measurements had been carried out at the site boundary and at nearby ASR's. This established the averaged baseline H₂S concentration conditions at each measurement position at the site boundary and at nearby ASR's. These baseline H₂S concentrations had been used to set the action levels of the odour EM&A program. Low H₂S concentrations at the monitoring locations were reported in the baseline study. No noticeable impact was found near the monitoring stations, thus their findings could be used as background indicator at Ngong Ping Sewage Treatment Works.

3. EM&A requirements

The EM&A Manual originally recommended that the first set of odour monitoring at the site boundary, at selected ASRs, and at the exhaust of the centralised deodorisation units should consist of both odour sampling and H₂S measurement. Site location plan of Ngong Ping STW and its monitoring stations are shown as appendix 2. Sampling at these locations using olfactometry and an H₂S analyser should be carried out simultaneously. The purpose is to establish the correlations between odour level (OUM⁻³) and H₂S concentration for each measurement position. As the first set of odour sampling/monitoring is fundamentally to establish the correlation between OUM⁻³ and

H₂S, the timing of this event should be selected during the summer period, as far as possible, to capture the highest odour concentrations. Once the correlation between H₂S concentrations and odour units is established, H₂S monitoring should be continued during the subsequent odour monitoring and H₂S concentrations measured should be converted to equivalent odour units.

However, both H₂S concentration and odour units at the designated locations were considered to be at trace level during baseline odour monitoring and hence it was found difficult to determine their correlation. According to the recommendation from EPD, there was no objection to correlate H₂S concentration with odour unit by the odour threshold in principle i.e. a H₂S concentration 0.00047ppm or 0.00066mg/m³ is equivalent to 1 odour unit. Therefore, only H₂S measurements were required to be carried out during baseline odour monitoring. As a result, the Action and Limit Levels of odour level were determined by calculation through the correlation of H₂S concentration and odour unit. Following the criteria set out in the EM&A Manual, the Action and Limit Levels for Operational Phase Odour Monitoring was derived and illustrated in Table 1:

Table 1 Action and Limit Levels for Operational Phase Odour Monitoring

Location of Monitoring	Parameters	Action Level	Limit Level
At the site boundary and at ASR's.	Odour level (expressed as equivalent H ₂ S concentration)	Action Level (AL) = 2.5 OUm ⁻³ at the site boundary and at the ASR's	Limit level (LL) = odour criteria of 5 OUm ⁻³ at the site boundary and at ASR's
At the exhaust of the centralised deodorisation unit	H ₂ S concentration in ppb/ppm, flowrate of exhaust in m ³ /s and temperature of exhaust (°C)	AL = LL/2 = 25 µg/s of H ₂ S.	LL = 50 µg/s of H ₂ S.

Should a non-compliance of the odour criteria occur, the relevant parties should undertake the relevant actions in accordance with the Event/Action Plan in Table 2.

Table 2 Event/Action Plan for Odour Monitoring

Event	Action		
	ET	IEC	Operator
Exceedance of Action Level for one or more samples at site boundary or ASRs or exhaust of centralised deodourisation unit	<ul style="list-style-type: none"> Identify source/ reason of exceedance; Inform IEC and Operator; Repeat measurement to confirm finding. 	<ul style="list-style-type: none"> Check with Contractor and Operator on the operating activities and implementation of odour mitigation measures; Discuss with ET and Operator on the possible remedial actions; Advise the Operator on the effectiveness of the proposed remedial measures; Supervise implementation of remedial measures. 	<ul style="list-style-type: none"> Carry out investigation to identify the source/reason of exceedance or complaints. Investigation shall be completed within 1 week; Rectify any unacceptable practice; Amend working methods as required; Inform ET and EPD if the cause of exceedance is considered to be caused by the project; Implement amended working methods.
Exceedance of Limit Level for one or more samples at site boundary or ASRs or exhaust of centralised deodourisation unit	<ul style="list-style-type: none"> Notify IEC, Operator and EPD; Identify source of odour; Increase monitoring frequency; Carry out analysis of the operating activities and implementation of odour mitigation measures to determine possible mitigation to be implemented Arrange meeting with IEC and Operator to discuss the remedial actions to be taken; Assess effectiveness of the remedial actions and keep IEC, EPD and Operator informed of the results; Carry out H₂S Monitoring after implementation of remedial measures to confirm their effectiveness. 	<ul style="list-style-type: none"> Discuss amongst ET, Operator and the Operator on the potential remedial actions; Review the proposed remedial actions whenever necessary to assure their effectiveness and advise the Operator accordingly; Supervise implementation of remedial measures. 	<ul style="list-style-type: none"> Carry out investigation to identify the source/reason of exceedance. Investigation shall be completed within 1 week; Rectify any unacceptable practice; Amend working methods as required; Inform ET and EPD; Formulate remedial actions; Ensure amended working methods and remedial actions properly implemented; If exceedance continues, consider what portion of the work is responsible and stop that portion of work until the exceedance is abated.

With reference to the baseline odour monitoring report (ref: ENA50302), only H₂S measurements were taken at the seven designated monitoring stations locating at the site boundary, at selected ASR's and at the exhaust of the centralised deodorisation units during the first odour impact monitoring.

Apart from odour impact monitoring, regular odour patrolling in the vicinity of the STW would also be conducted in a monthly interval during the operational phase.

4. Implementation Status

All the major odour sources within Ngong Ping STW, namely the inlet work, the sequencing batch reactors, the sludge thickeners, and the emergency storage tank, are all building-contained facilities thus minimising direct emission of odour to the atmosphere. All odour emissions from these facilities mentioned above ventilated to centralised deodorisation units. A backup deodorisation unit was installed to provide buffer for maintenance or breakdown of the main deodorisation unit.

All the sludge generated from the STW will be dewatered onsite to more than 30% dry solids content before transporting to the designated landfill site for disposal and will be stored in covered container along the transporting route to avoid the possible odour impact on nearby sensitive receivers. The transportation of the sludge by sea to the disposal location is recommended, as far as practicable, in order to reduce potential air quality impacts from road transportation. Since the volume of influent into the STW has been low, significant amount of sludge has yet to be produced for transport to landfill.

The STW was designed for a daily flow of 2000 m³. However, an average daily inflow of 272 m³ was recorded for the month of August 2006.

5. Monitoring Results

H₂S concentration (in parts per billion or in parts per million) were measured at seven designated stations as follows:

Monitoring station	Level of monitoring	Location description
D1	1.0 m	STW site entrance
D2	1.0 m	Exhaust point of deodorisation room no. 2
D3	1.0 m	Sludge thickeners
D4	1.0 m	Deodorisation room no. 1 side facing east
D5	1.0 m	Cable car terminal
D6	1.0 m	Public transport interchange
D7	1.0 m	Exhaust point of deodorisation room no. 1

As stipulated by the EM&A Manual, H₂S measurements were taken outside the premises of the identified ASR's (cable car terminal and public transport interchange) and these locations would not be influenced by other nearby odour sources. H₂S measurements was also undertaken at the site boundary downwind of the exhaust point of the deodorisation unit and the covered odour sources.

A 15-minute measurement was taken every 3 hours for over a duration of 24 hours at each of the monitoring stations. The laboratory ALS Technichem (HK) Pty Ltd. undertook the measurement on 12-13 August 2006. Meteorological conditions including temperature, wind speed, wind direction and relative humidity were also measured at the time of the monitoring.

Concentrations of H₂S were measured using a Jerome H₂S Analyzers that utilises a gold film sensor for the detection of hydrogen sulfide. The instrument is capable of measuring H₂S concentrations in the range 1 ppb (1.4µg m⁻³) to 50 ppm (70 mg m⁻³) to an accuracy of ±6%.

The laboratory report (including all data, map of monitoring stations, meteorological conditions) is attached as appendix 3. The second odour impact monitoring results for August 2006 are summarized below:

Monitoring station	Average H ₂ S concentration (ppm)
D1	<0.001
D2	<0.001
D3	<0.001
D4	<0.001
D5	<0.001
D6	<0.001
D7	<0.001

According to the results, odour levels at the site boundary and at ASR's were below the Action Level. H₂S levels at the exhaust of the two centralised deodorisation units were also below the Action Level.

Monthly odour patrols carried out on 14 July and 24 August 2006 around the vicinity of Ngong Ping STW revealed no significant H₂S levels.

6. Summary of Complaints and Remedial Actions

No non-compliance and complaints were received.

7. Conclusions and Comments

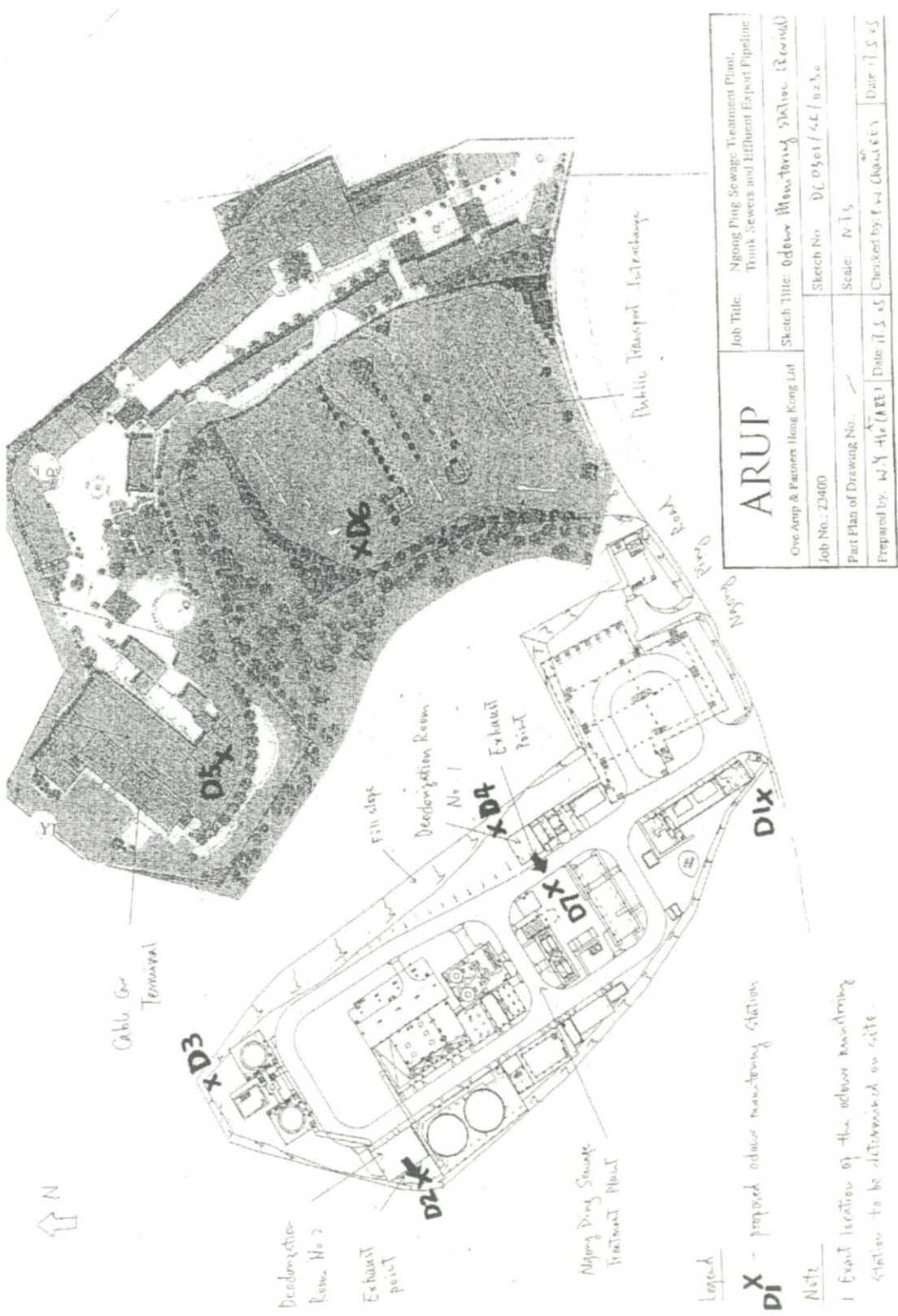
The required environmental protection work has been conducted. No remedial actions

were needed.

Appendix 1 – Contact Information For Key Environmental Personnel

Name	Title	Telephone	Fax
Mr. K.P. CHEUNG (ST2 Division, DSD)	Operator	3472 6103	2984 8804
Mr. M. K. LAU (ST2 Division, DSD)	ET Leader	2195 3338	2991 4233
Mr. Derek SAM (ST2 Division, DSD)	ET Leader Assistant	2195 3453	2991 4233
Mr. Zenith CHAN (ST2 Division, DSD)	ET Leader Assistant	2195 3458	2991 4233
Mr. David YEUNG (CH2M HILL Hong Kong Limited)	Independent Environmental Checker	2872 2934	2507 2293
Mr. Ivan LEUNG (ALS Techichem (HK) Pty Ltd	Laboratory representative	2401 5026	2610 2021

Appendix 2 – Site location plan of Ngong Ping



Appendix 3

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

ALS TECHNICHEM (HK) Pty Ltd

Environmental Division



CERTIFICATE OF ANALYSIS

CONTACT: MR ZENITH CHAN (CHEMIST/ST2/1)
CLIENT: DRAINAGE SERVICES DEPARTMENT
ADDRESS: STONECUTTER ISLAND SEWAGE
TREATMENT WORKS NGONG SHUNG RD
NGONG SHUEN CHAU KOWLOON
ORDER No.:
PROJECT: NGONG PING

Batch: HK53178
Sub Batch: 0
LABORATORY: HONG KONG
DATE RECEIVED: 12/08/2006
DATE OF ISSUE: 08/09/2006
SAMPLE TYPE: AIR
No. of SAMPLES: 7

COMMENTS

Determination of hydrogen sulfide was measured on site by ALS Technichem HK PTY's staff. The model for Hydrogen sulfide meter is Jerone X631-0003 Goldfilm hydrogen sulfide analyser (Serial No. 2210) to monitor the hydrogen sulfide on site.

NOTES

This is the Final Report and supersedes any preliminary report with this batch number. Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ISSUING LABORATORY: HONG KONG

Address

ALS Technichem (HK) Pty Ltd
11/F
Chung Shun Knitting Centre
1-3 Wing Yip Street
Kwai Chung
HONG KONG

Phone: 852-2610 1044
Fax: 852-2610 2021
Email: hongkong@alsenviro.com

Mr Leung Sai Ho Ivan
Environmental Team Leader

Other ALS Environmental Laboratories

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Melbourne
Sydney
Newcastle
Hong Kong
Singapore
Kuala Lumpur
Bogor

AMERICAS

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Lima
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CERTIFICATE OF ANALYSIS



Batch: HK53178
Sub Batch: 0
Date of Issue: 08/09/2006
Client: DRAINAGE SERVICES DEPARTMENT
Client Reference: NGONG PING

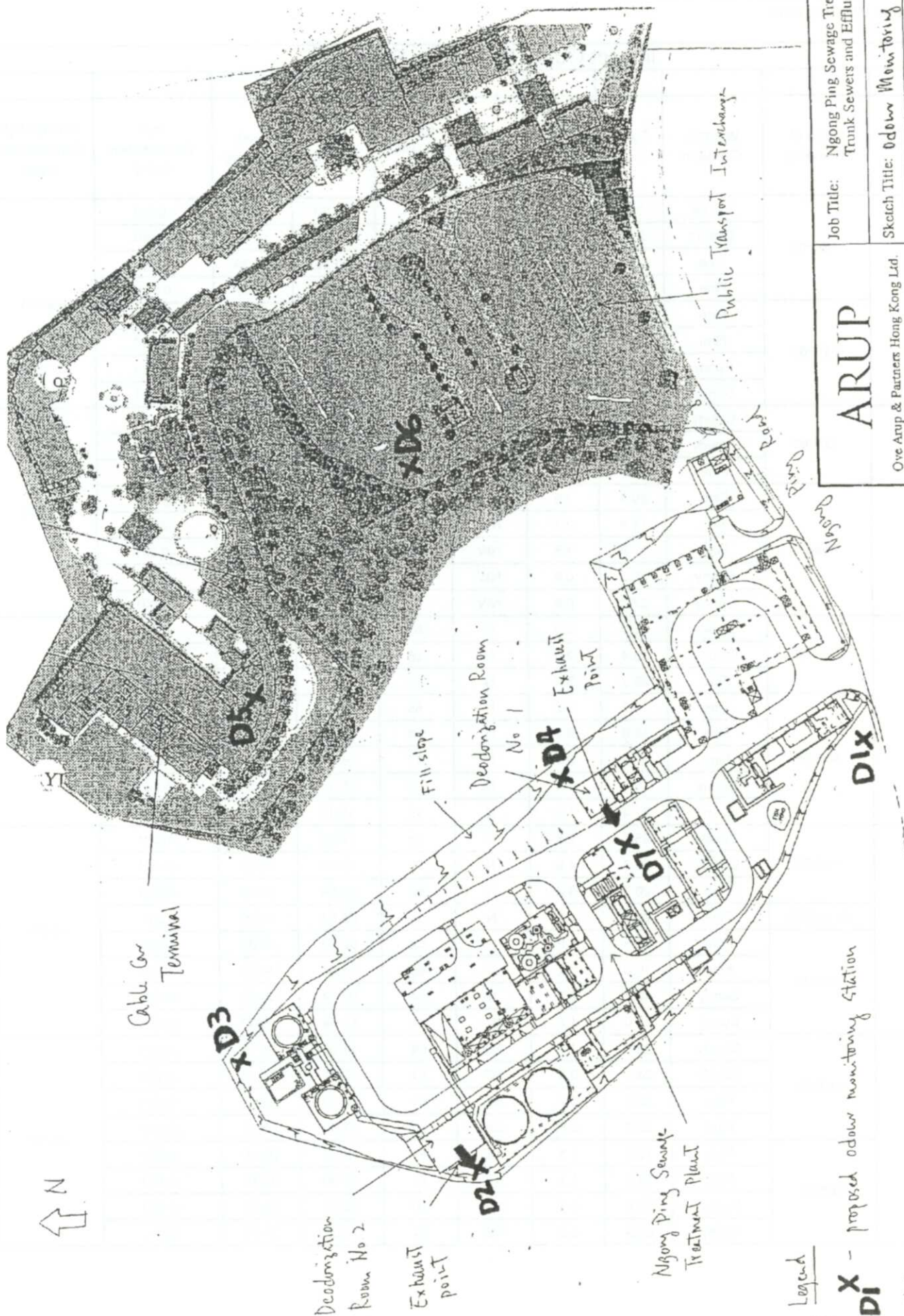
Impact Odour Monitoring Results										
Monitoring Station	Date of Sampling	Weather Condition	Temp. (oC)	Wind Speed (m/s)	Wind Direction	Relative Humidity (%)	Start (hh:mm)	End (hh:mm)	H ₂ S Concentration (ppm)	Average H ₂ S Concentration (ppm)
D1	12/8/06	Sunny	28.8	1.9	NE	63	14:20	14:35	<0.001	<0.001
		Sunny	27.9	4.0	NE	65	17:20	17:35	<0.001	
		Fine drizzle	27.5	4.8	NE	60	20:20	20:35	<0.001	
			26.9	3.2	NE	67	23:20	23:35	<0.001	
	13/8/06	Fine	26.7	2.7	NE	78	2:20	2:35	<0.001	
		Fine	26.5	2.2	NE	83	5:20	5:35	<0.001	
		Sunny	27.6	1.9	NE	70	8:20	8:35	0.001	
	Sunny	29.0	2.0	NE	55	11:20	11:35	<0.001		
D2	12/8/06	Sunny	28.5	2.3	NE	60	15:28	15:43	<0.001	<0.001
		Sunny	28.0	3.9	NE	64	18:28	18:43	0.001	
		Fine	27.9	5.0	NE	61	21:28	21:43	<0.001	
	13/8/06	drizzle	26.8	2.8	NE	68	0:28	0:43	<0.001	
		Fine	26.9	1.6	NE	77	3:28	3:43	<0.001	
		Fine	26.3	2.8	NE	82	6:28	6:43	<0.001	
		Sunny	27.8	3.1	NE	70	9:28	9:43	<0.001	
	Sunny	28.7	1.7	NE	53	12:28	12:43	<0.001		
D3	12/8/06	Sunny	28.5	2.5	NE	65	15:11	15:26	<0.001	<0.001
		Sunny	28.2	3.4	NE	66	18:11	18:26	<0.001	
		Fine	27.3	4.2	NE	61	21:11	21:26	<0.001	
	13/8/06	drizzle	27.2	3.8	NE	65	0:11	0:26	<0.001	
		Fine	26.9	2.2	NE	79	3:11	3:26	<0.001	
		Fine	26.7	2.9	NE	82	6:11	6:26	<0.001	
		Sunny	27.7	2.1	NE	67	9:11	9:26	0.001	
	Sunny	28.9	1.8	NE	53	12:11	12:26	0.001		
D4	12/8/06	Sunny	29.1	2.1	NE	62	14:54	15:09	<0.001	<0.001
		Sunny	28.3	4.5	NE	64	17:54	18:09	<0.001	
		Fine	27.6	4.3	NE	59	20:54	21:09	<0.001	
	12-13/8/06	drizzle	27.5	3.0	NE	68	23:54	0:09	0.001	
	13/8/06	Fine	27.2	2.7	NE	77	2:54	3:09	<0.001	
		Fine	26.4	2.2	NE	82	5:54	6:09	0.001	
		Sunny	27.8	1.6	NE	71	8:54	9:09	<0.001	
Sunny		29.0	1.4	NE	53	11:54	12:09	<0.001		
D5	12/8/06	Sunny	28.7	1.8	NE	64	14:00	14:15	<0.001	<0.001
		Sunny	27.8	3.9	NE	66	17:00	17:15	<0.001	
		Fine	27.6	4.2	NE	58	20:00	20:15	<0.001	
		drizzle	27.6	2.7	NE	67	23:00	23:15	<0.001	
	13/8/06	Fine	27.3	2.5	NE	77	2:00	2:15	0.001	
		Fine	26.7	2.6	NE	84	5:00	5:15	<0.001	
		Sunny	26.9	1.8	NE	71	8:00	8:15	<0.001	
		Sunny	28.9	1.6	NE	57	11:00	11:15	0.001	

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Impact Odour Monitoring Results										
Monitoring Station	Date of Sampling	Weather Condition	Temp. (oC)	Wind Speed (m/s)	Wind Direction	Relative Humidity (%)	Start (hh:mm)	End (hh:mm)	H ₂ S Concentration (ppm)	Average H ₂ S Concentration (ppm)
D6	12/8/06	Fine	28.8	1.9	NE	66	13:40	13:55	<0.001	<0.001
		Fine	27.6	4.7	NE	64	16:40	16:55	<0.001	
		Sunny	28.0	4.9	NE	57	19:40	19:55	0.001	
		Sunny	27.3	3.2	NE	68	22:40	22:55	<0.001	
	13/8/06	Sunny	27.6	2.4	NE	79	1:40	1:55	<0.001	
		Sunny	26.9	3.0	NE	84	4:40	4:55	<0.001	
		Fine	26.5	2.2	NE	71	7:40	7:55	<0.001	
		drizzle	29.2	1.9	NE	53	10:40	10:55	<0.001	
D7	12/8/06	Fine	29.1	2.0	NE	60	14:38	14:53	<0.001	<0.001
		Fine	28.2	3.4	NE	63	17:38	17:53	<0.001	
		Sunny	27.3	3.9	NE	59	20:38	20:53	<0.001	
		Sunny	27.6	2.2	NE	68	23:38	23:53	0.001	
	13/8/06	Sunny	27.5	2.8	NE	80	2:38	2:53	0.001	
		Sunny	27.0	2.9	NE	85	5:38	5:53	<0.001	
		Fine	26.3	1.8	NE	72	8:38	8:53	<0.001	
		drizzle	28.4	1.8	NE	55	11:38	11:53	0.001	



Cable Car Terminal

Deodorization Room No 2

Exhaust point

Ngong Ping Sewage Treatment Plant

Legend

D_iX - proposed odour monitoring station

Note

i. Exact location of the odour monitoring station to be determined on site.

ARUP		Job Title: Ngong Ping Sewage Treatment Plant, Trunk Sewers and Effluent Export Pipeline
Ove Arup & Partners Hong Kong Ltd.	Sketch Title: Odour Monitoring Station (Revised)	Sketch No.: DC 0301/SL/0230
Job No.: 23400	Scale: N.T.S.	Part Plan of Drawing No.: —
Prepared by: W.Y. Ho (AEE)	Date: 17.5.05	Checked by: P.W. Chan (AEE)
		Date: 17.5.05



Certificate of Instrument Calibration

1912 W. 4th Street • Tempe, AZ 85281 • (602) 470-1414 • (800) 528-7411 • Fax (480) 804-0656 • www.azic.com

Manufacturers of Computrac® Moisture Analyzers and Jerome® Toxic Gas Analyzers

Company Guyline (Asia) Ltd
Address Rm 1611 Eastern Harbour Ctr. 28
Hoi Chak Street
Quarry Bay Hon Hong Kong

This is to certify that the JEROME X631-0003 Gold Film Hydrogen Sulfide Analyzer, 220 VAC Serial Number 2210 with Sensor Number 04-9-8-W2C, was calibrated with standard units traceable to NIST

Calibration Status as Received: Out of Calibration

Incoming:

	Actual	Calibration Gas	Tolerance Specification
Level 1	.2368	0.517 ppm H2S	0.491-0.543 (+/-5%)
RSD	10.79		<3%

Outgoing:

	Mean @ Saturation	Calibration Gas	Relative Standard Deviation
	.541	0.517 ppm H2S	1.77

Calibration Status as Left: In Calibration

Estimated Uncertainty of Calibration: 3.5%

Ambient conditions during calibration:

Temperature degrees F: 69.8 % Relative Humidity: 42.6

Calibration Date: 6/19/2006

Re-Calibration Date: 6/18/2007

Approved By: 

Date: 6/19/2006

Name/Title: Marlene Young - Tech Support/Quality Control

Equipment Used

Permeation Tube	S/N: 56-22959	NIST: D3609-96
Calibration Date: 4/7/2006	Calibration Date Due: 4/7/2007	
DynaCalibrator	S/N: MU-568	NIST: 255085,95;NBS Buret #81 and #K10
Calibration Date: 8/25/2005	Calibration Date Due: 8/26/2006	
Digital Multimeter	S/N: 3915086	NIST: 1323-8001013
Calibration Date: 9/6/2005	Calibration Date Due: 9/6/2006	
Flowmeter	S/N: US04I26034	NIST: Teledyne 1760, 1766, 1769
Calibration Date: 9/26/2005	Calibration Date Due: 9/27/2006	

Calibration Procedure Used: 3J09-0006

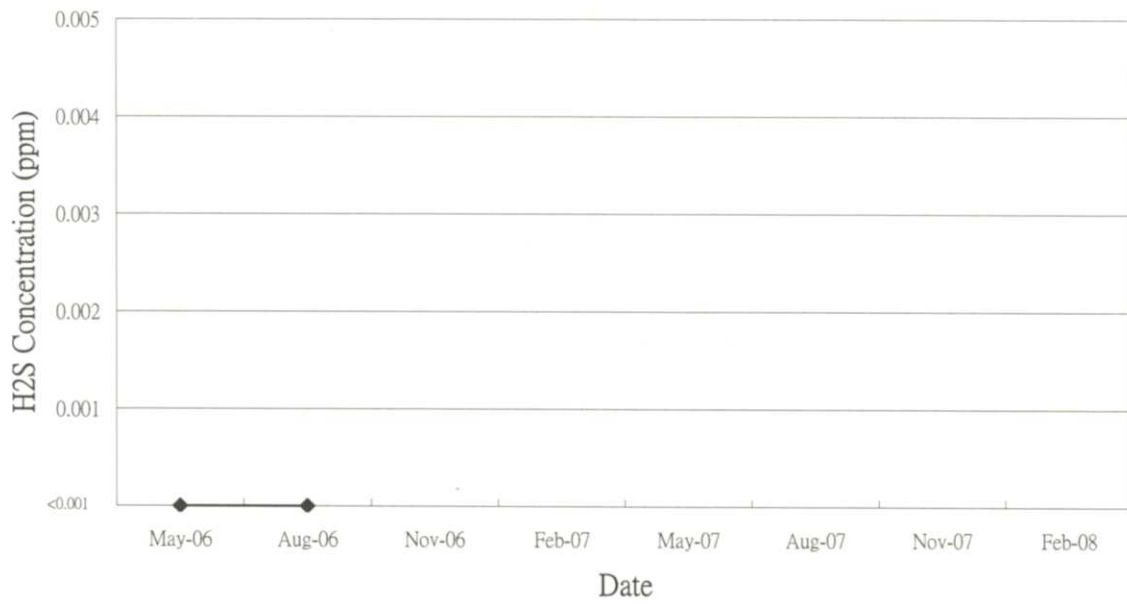
Arizona Instrument certifies that the above listed instrument meets or exceeds all published specifications and has been calibrated using standards whose accuracy is traceable to the NATIONAL INSTITUTE OF STANDARDS TECHNOLOGY within the limitations of the Institute's calibration services, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of self-calibration techniques. Arizona Instrument has reviewed MIL STD 45662A and believes to comply.

DISCLAIMER: Any unauthorized adjustments, removal or breaking of QC seals, or other customer modifications on your Jerome Analyzer WILL VOID this factory calibration certification. Because any of the above acts could affect the calibration and readings of the instrument, their certificate will no longer be valid and, further, Arizona Instrument Corporation WILL NOT be responsible for any liabilities created as a result of using the instrument after such adjustments, seal removal, or modifications.

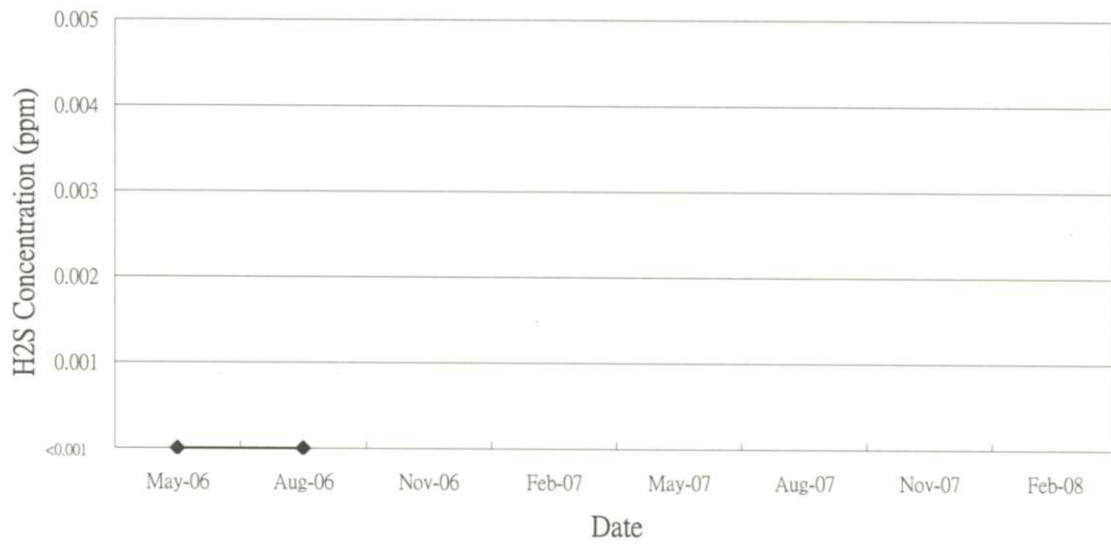
As long as a functional test is within range, according to the procedure outlined in the Operator's Manual, the instrument is performing correctly.

Appendix 4 – Graphical plots of odour impact monitoring

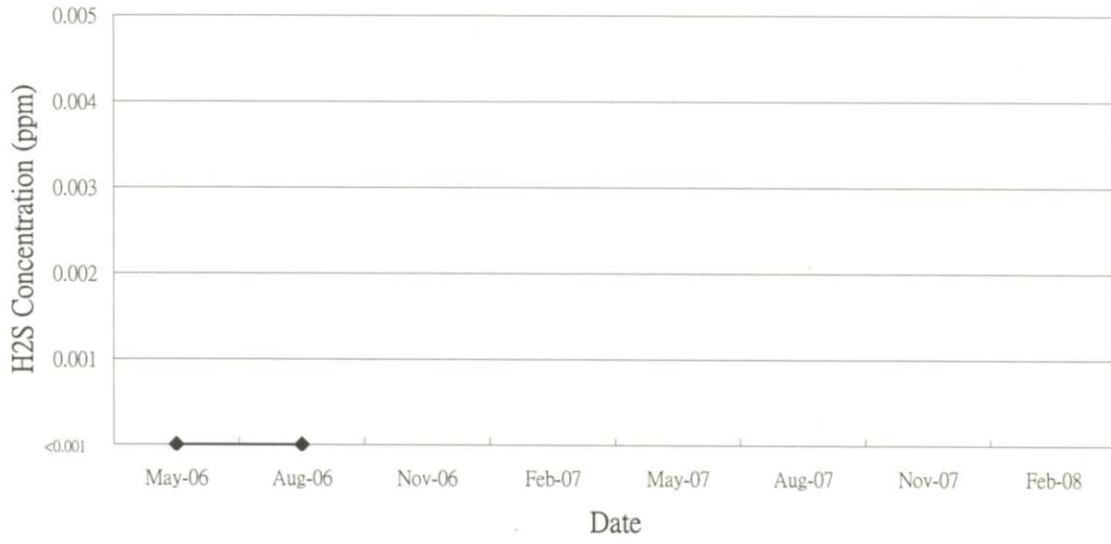
Monitoring Station D1



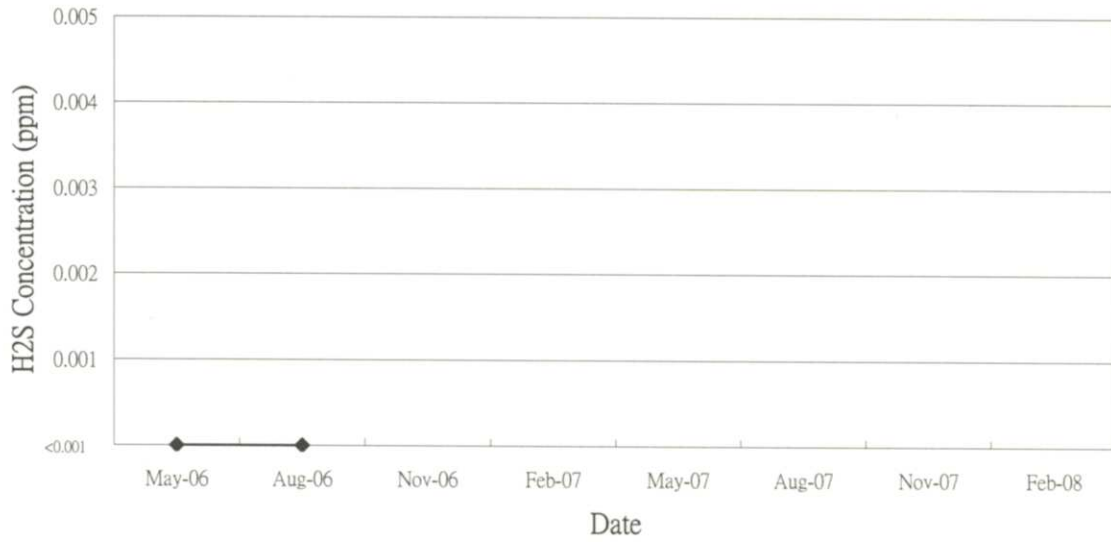
Monitoring Station D2



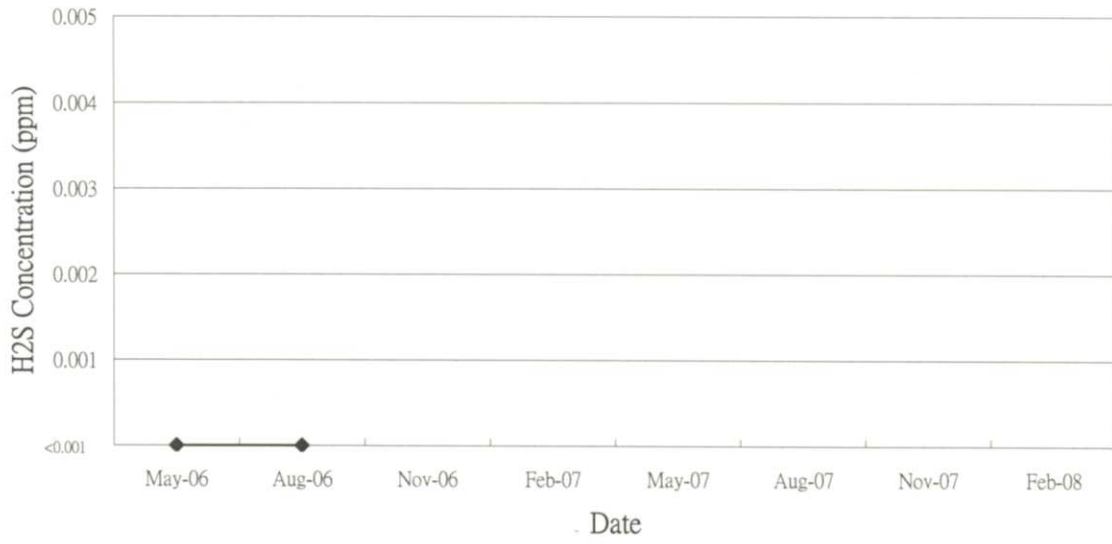
Monitoring Station D3



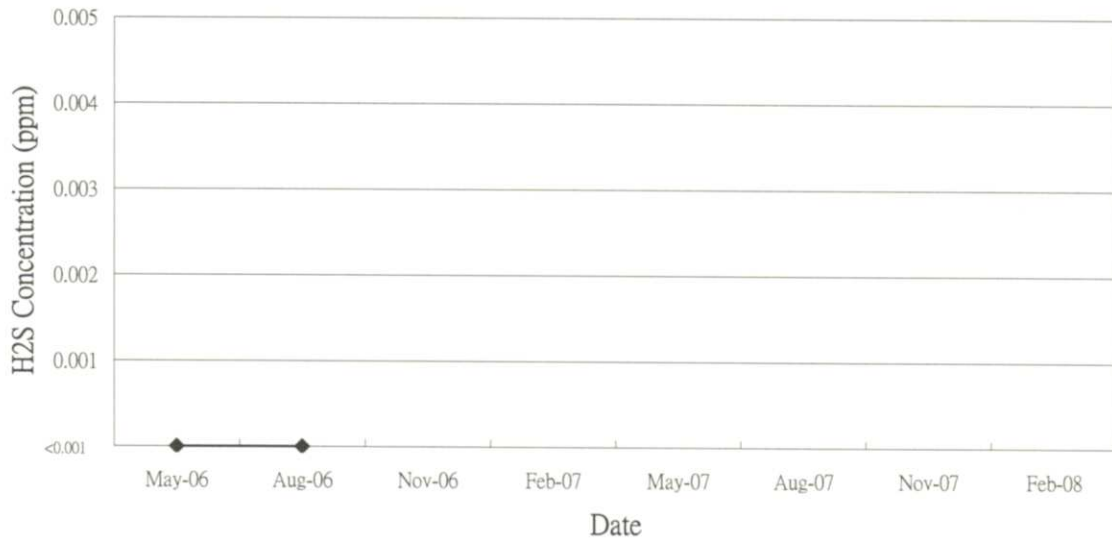
Monitoring Station D4



Monitoring Station D5



Monitoring Station D6



Monitoring Station D7

