Odour Patrol Methodology:

Odour patrol survey was to be conducted for the Cheung Chau Sewage Treatment Work and Pak She Sewage Pumping Station to understand the existing odour condition in these areas. The odour patrol survey was conducted 6 times during summer time by qualified odour panelists(certificate provided) using their olfactory sensors to sniff odour at different locations. The survey locations are shown in Fig A. The qualified panelists have their individual n-butanol thresholds within a required range of 20 to 80 ppb/v. During the odour patrol survey, the weather conditions of wind direction and wind speed were recorded by a handheld anemometer.

The odour intensty was recorded at 5 different levels according to the criteria below:

0	Not Detected	No odour perceived or an odour so weak that it can not be easily characterised or described
1	Slight	Identifiable odour, slight
2	Moderate	Identifiable odour, moderate
3	String	Identifiable odour, strong
4	Extreme	Severe odour

The survey results are provided below:

Panellist : Lee. M.H Site Location Cheung Chau Weather Sunny Date 05/07/2012

Location	Time	Wind Speed(m/s)	Winf Direction	Temperature,˚C	Odour Intensity	On site Observation	
						Odour Nature	Possible Source
1	10:20	0	n/a	29.5	0	n/a	n/a
2	10:29	1.1	SE	31.1	0	n/a	n/a
3	10:36	0	n/a	33.7	0.5	Detergent	Elderly Home
4	10:43	0.6	S	31.7	0.5	Gasoline	Nearby Dock
5	10:49	0.3	S	31.6	0	n/a	n/a
6	10:55	1.3	S	31.6	1.5	Gasoline	n/a
7	11:01	1	S	31.6	1.5	Sewage	n/a
8	11:08	1	S	34	0.5	Sewage	n/a
9	11:14	1.1	S	31.5	0.5	Gasoline	n/a
10	11:22	0.8	SE	35.2	0.5	Gasoline	n/a
11	11:37	0	n/a	31.6	0	n/a	n/a
12	11:43	1.1	SE	34	0	n/a	n/a
13	11:50	2	SE	34	2	Sewage	Cheung Chau sewage treatment Works
14	11:59	1	SE	34	2	Sewage	Cheung Chau sewage treatment Works

The odour intensty was recorded at 5 different levels according to the criteria below:

0	Not Detected	No odour perceived or an odour so weak that it can not be easily characterised or described
1	Slight	Identifiable odour, slight
2	Moderate	Identifiable odour, moderate
3	String	Identifiable odour, strong
4	Extreme	Severe odour

The survey results are provided below:

Panellist : Lee. M.H Site Location Cheung Chau Weather Sunny Date 05/07/2012

Location	Time	Wind Speed(m/s)	Winf Direction	Temperature,˚C	Odour Intensity	On site Observation	
						Odour Nature	Possible Source
1	13:13	0	n/a	32	0	n/a n/a	n/a n/a
3	13:24	0.4	S	35	0.5	Food being cooked	n/a
4	13:31	1.7	SE	33	0.5	Gasoline residue	n/a
5	13:36	1.4	SE	34	0	n/a	n/a
6	13:39	0.7	S	34	0.5	n/a	n/a
7	13:44	1.3	SE	34	0.5	Sewage	n/a
8	13:50	1.4	SE	34	0	n/a	n/a
9	13:56	2.1	SE	34	0	n/a	n/a
10	14:01	1.2	SE	35	0	n/a	n/a
11	14:10	1.1	E	35	0	n/a	n/a
12	14:18	0.4	SE	35	0	n/a	n/a
13	14:28	1.4	SE	35	0	n/a	n/a
14	14:43	1.8	SE	35	2	Sewage	Cheung Chau sewage treatment Works

The odour intensty was recorded at 5 different levels according to the criteria below:

0	Not Detected	No odour perceived or an odour so weak that it can not be easily characterised or described
1	Slight	Identifiable odour, slight
2	Moderate	Identifiable odour, moderate
3	String	Identifiable odour, strong
4	Extreme	Severe odour

The survey results are provided below:

Panellist : Lee. M.H Site Location Cheung Chau Weather Sunny Date 06/07/2012

Location	Time	Wind Speed(m/s)	Winf Direction	Temperature,˚C	Odour Intensity	On site Observation	
						Odour Nature	Possible Source
1	14:49	0	n/a	28.3	0	n/a	n/a
						n/a	n/a
3	15:05	1.2	NE	32	0	n/a	n/a
4	15:12	1.3	SW	33	0.5	Gasoline	Shipyard
5	15:17	0.9	SE	34	0	n/a	n/a
6	15:24	2.5	SE	34	1	Gasoline	Shipyard
7	15:29	2.9	SW	34	0.5	Sewage	Pak She sewage pumping station
8	15:34	1.2	SW	34	0	n/a	n/a
9	15:37	2.9	SW	34	0	n/a	n/a
10	15:43	1.1	SW	34	0	n/a	n/a
11	15:52	0.6	NE	34	0	n/a	n/a
12	16:02	0.4	SW	34	0.5	Gasoline	Village Vehicle
13	16:11	1.2	SW	34	0.5	Sewage	Cheung Chau sewage treatment Works
14	16:18	1.8	NE	34	2.5	Sewage	Cheung Chau sewage treatment Works

The odour intensty was recorded at 5 different levels according to the criteria below:

0	Not Detected	No odour perceived or an odour so weak that it can not be easily characterised or described
1	Slight	Identifiable odour, slight
2	Moderate	Identifiable odour, moderate
3	String	Identifiable odour, strong
4	Extreme	Severe odour

The survey results are provided below:

Panellist : Lee. M.H Site Location Cheung Chau Weather Sunny Date 07/07/2012

Location	Time	Wind Speed(m/s)	Winf Direction	Temperature,˚C	Odour Intensity	On site Observation	
						Odour Nature	Possible Source
1	14:30	0	n/a	33	0	n/a	n/a
2	14:38	1.6	SW	33	0	n/a	n/a
3	14:44	1.4	SW	33	0	n/a	n/a
4	14:51	1.3	SW	33	0	n/a	n/a
5	14:57	0.4	SW	33	0.5	Food	Kitchen area nearby
6	15:03	1	SW	33	1	Gasoline	Shipyard
7	15:07	1.7	SW	33	1.5	Sewage	Pak She sewage pumping station
8	15:12	1.6	NE	33	0.5	Sewage	Pak She sewage pumping station
9	15:16	1.7	NE	33	0	n/a	n/a
10	15:22	2.4	NE	33	0	n/a	n/a
11	15:31	0.4	NE	33	0	n/a	n/a
12	15:40	0.2	NW	33	0	n/a	n/a
13	15:47	1	NW	33	0.5	Sewage	Cheung Chau sewage treatment Works
14	15:55	1.2	NE	33	2	Sewage	Cheung Chau sewage treatment Works

The odour intensty was recorded at 5 different levels according to the criteria below:

0	Not Detected	No odour perceived or an odour so weak that it can not be easily characterised or described
1	Slight	Identifiable odour, slight
2	Moderate	Identifiable odour, moderate
3	String	Identifiable odour, strong
4	Extreme	Severe odour

The survey results are provided below:

Panellist : Lee. M.H Site Location Cheung Chau Weather Sunny Date 16/07/2012

Location	Time	Wind Speed(m/s)	Winf Direction	Temperature,˚C	Odour Intensity	On site Observation	
						Odour Nature	Possible Source
1	12:52	0	n/a	34	0	n/a	n/a
2	12:56	0.3	SE	34	0	n/a	n/a
3	13:01	2.7	SE	34	1	Food	Kitchen area nearby
4	13:20	2.2	SW	34	2	Gasoline	Shipyard
5	13:11	1.2	SW	34	1	Food	Kitchen area nearby
6	13:15	2	SW	34	1	Gasoline	Shipyard
7	13:18	1.2	SW	34	1.5	Sewage	Pak She sewage pumping station
8	13:22	0.7	SW	34	1.5	Sewage	n/a
9	13:25	3.5	SW	34	2	n/a	n/a
10	13:28	2.2	SW	34	1	n/a	n/a
11	13:35	1.5	SE	34	0	n/a	n/a
12	13:39	1	n/a	34	1	n/a	n/a
13	13:44	1	SW	34	1	Sewage	Cheung Chau sewage treatment Works
14	13:48	5.0	SW	34	3	Sewage	Cheung Chau sewage treatment Works

The odour intensty was recorded at 5 different levels according to the criteria below:

0	Not Detected	No odour perceived or an odour so weak that it can not be easily characterised or described
1	Slight	Identifiable odour, slight
2	Moderate	Identifiable odour, moderate
3	String	Identifiable odour, strong
4	Extreme	Severe odour

The survey results are provided below:

Panellist : LEUNG Hang-Wai Site Location Cheung Chau Weather Sunny Date 16/07/2012

Location	Time	Wind Speed(m/s)	Winf Direction	Temperature,˚C	Odour Intensity	On site Observation	
						Odour Nature	Possible Source
1	12:45	0	n/a	34	0	n/a	n/a
2	12:49	0.0	n/a	34	0	n/a	n/a
3	12:54	1.1	SW	34	0	n/a	n/a
4	13:13	2.5	SW	34	0	n/a	n/a
5	13:04	1.6	SW	34	0	n/a	n/a
6	13:08	3	SW	34	0	n/a	n/a
7	13:11	1.1	SW	34	2.0	Sewage	Pak She sewage pumping station
8	13:15	1.1	SW	34	2	Sewage	n/a
9	13:18	1.6	SW	34	0	n/a	n/a
10	13:21	1.6	SW	34	1	garbage	Refuse collection point
11	13:28	4.1	SW	34	0	n/a	n/a
12	13:32	0	n/a	34	0	n/a	n/a
13	13:37	1	SW	34	0	n/a	n/a
14	13:41	2.8	SW	34	2	Sewage	Cheung Chau sewage treatment Works

Certification of Odour Panelist

Odour Research Laboratory
The Hong Kong Polytechnic University,
Hung Hom, Kowloon, Hong Kong
Tel: (852) 2766 6011 Fax: (852) 2334 6389

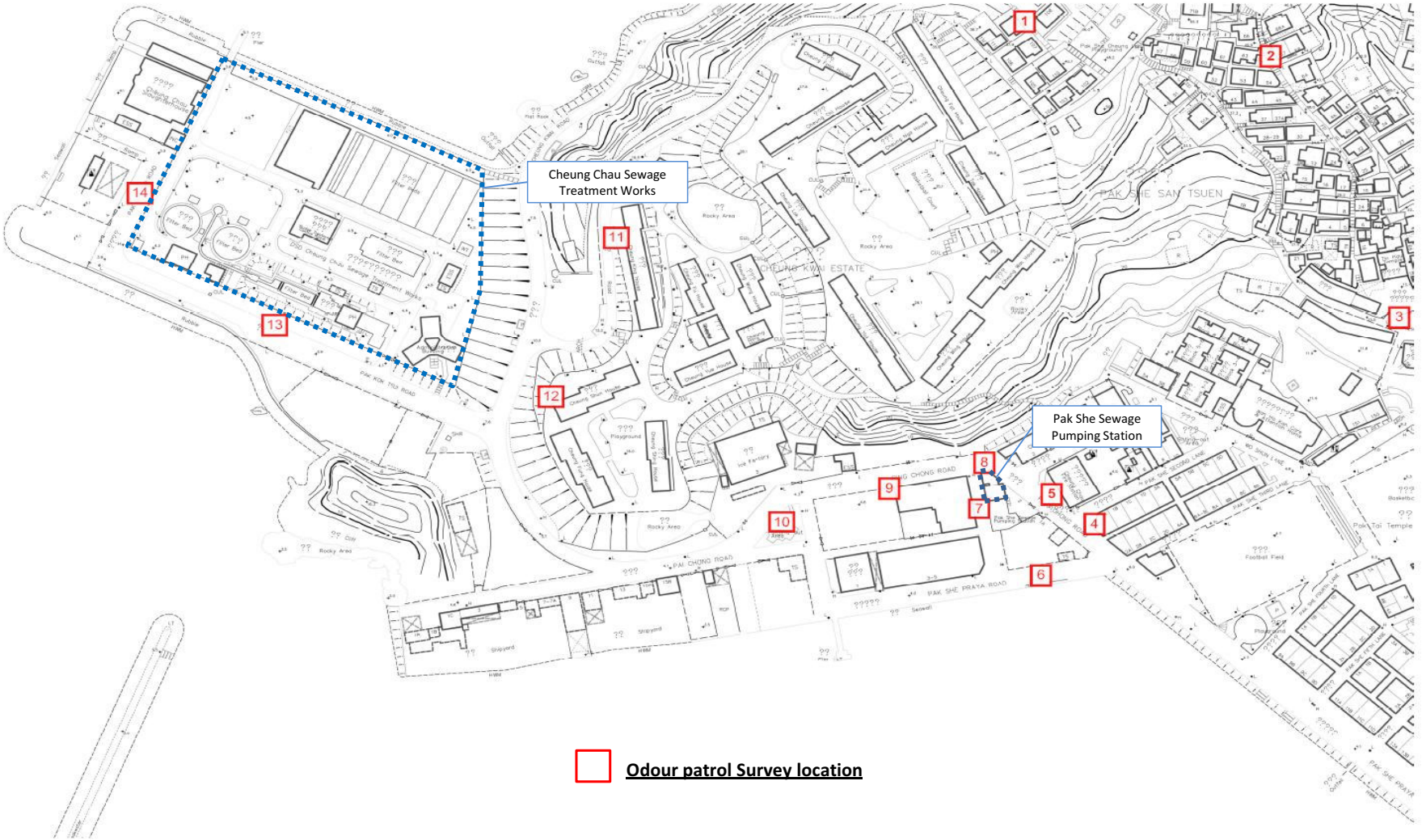
July 19. 2012

Mr. LEE M.H. and **Mr. LEUNG Hang-Wai** have demonstrate that his nose has a normal sensitivity to comply with the requirements of EN13725 by participating a set of screening tests carried out by odour Lab of HK PolyU, in which his individual thresholds (n-butanol) should be in the range of 20 to 80 ppb/v and a standard deviation of R < 2.3.

Test date: 28 May 2012 ~ 4 June 2012

issued by HK PolyU, Odour Lab.

Professor S. C. Lee, ceslee@polyu.edu.hk, tel: 2766-6011
Odour Research Laboratory at PolyU


Cheung Chau Sewage Treatment Works
Pak She Sewage Pumping Station
1
2
3
4
5
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10
11
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13
14
Odour patrol Survey location

Technological and Higher Education Institute of Hong Kong 香港高等科技教育學院

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Telephone No 電話

Facsimile No 傳真

Our Reference 本院檔號

Your Reference 來函檔號

Member of VTC Group
VTC 機構成員

For ATKINS CHINA LIMITED

On-site Odour Sampling and Laboratory Olfactometry Measurement at Cheung Chau Area

21 May 2013

By Odour Research Centre

Faculty of Science and Technology
Technological and Higher Education Institute of Hong Kong

(Member of VTC Group)

Table of Contents

1. Background

An odour assessment service was required by Atkins China Limited to collect odour samples at Cheung Chau Area and to conduct laboratory olfactometry analysis with the European Standard Method (EN13725) to determine the odour concentration.

2. Scope of the Work

Eight sampling locations were previously identified by the client and a sampling map with the exact sampling locations is shown in Appendix A. A total of 24 odour samples need to be collected from the 8 designated sampling locations on 15 May 2013.

The scope of the work is:

. to collect odour samples at the above locations and deliver the collected samples to laboratory for olfactometry analysis;

. to measure and record the weather conditions including air temperature, relative humidity, wind direction and wind speed on site during the sampling time;

. to conduct laboratory olfactometry analysis to determine the odour concentration of the collected odour samples plus 1 QA/QC sample;

. to prepare an analytical report.

3. Methodology

3.1. Odour Sampling

Odour gas sample is collected by a Sampling Device Standard consists of a vacuum container, which is evacuated by a vacuum pump. The sampling point and the standard sampler are connected by a probe. Due to the evacuation in the sampling device, the sample bag, inside the device, sucks in sample air via the probe. During this process, none of its components come into contact with the sample air due to the construction of the sampling device.

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Odour Sampling System

3.2 Odour Measurement by Olfactometry

Odour concentration is determined by a Dynamic Olfactometer (TO9) in accordance with the European Standard Method (EN13725). This European Standard specifies a method for the objective determination of the odour concentration of a gaseous sample using dynamic olfactometry with human assessors and the emission rate of odours emanating from point sources, area sources with outward flow and area sources without outward flow. This European Standard is applicable to the measurement of odour concentration of pure substances, defined mixtures and undefined mixtures of gaseous odorants in air or nitrogen, using dynamic olfactometry with a panel of human assessors being the sensor. The unit of measurement is the odour unit percubic metre: OU_E/m^3. The odour concentration is measured by determining the dilution factor required to reach the detection threshold. The odour concentration at the detection threshold is defined as 1 OU_E/m^3. The odour concentration is then expressed in terms of multiples of the detection threshold. The range of measurement is typically from 2^2 OU_E/m^3 to 2^{17} OU_E/m^3 (excluding pre-dilution).

Olfactometer TO9

4. Odour Sampling and Olfactometry Measurements

4.1. Sampling Activities

The odour sampling works were conducted on 15th May 2013 at eight locations. While three odour samples at each location were collected at Locations CCSH, CSH2, FS, CCA, CCSTW, PSSPS, CCSTW_DW and PSSPS_DW. A total of 24 odour samples were collected on the site and delivered to the Odour Research Centre of THEi immediately.

During the odour sampling, relevant weather conditions including ambient temperature, relative humidity, wind speed, and wind direction were recorded on the sites for references. The sampling conditions are summarized in Table 1.

Table 1: Summary of sampling conditions and results for olfactometry measurement

Location ID	Location description	Date	Time	Type	AT (°C)	RH (%)	WD	WS (m/s)	OC (OU_E/m^3)
CCSH-1	Cheung Chau Slaughter House	15-05-2013	11:58	A	34.8	67.7	S	2.7	43
CCSH-2			12:00						40
CCSH-3			12:02						38
CSH2-1	Cheung Shun House	15-05-2013	12:30	A	35.7	58.2	S	0.3	< 4
CSH2-2			12:32						< 4
CSH2-3			12:34						11
FS-1	Cheung Chau Fire Station	15-05-2013	10:45	A	31.3	75.0	S	1.5	15
FS-2			10:47						12
FS-3			10:49						16
CCA-1	Cheung Chau Commercial Centre	15-05-2013	11:00	A	31.9	74.2	S	0.1	11
CCA-2			11:02						11
CCA-3			11:04						12
CCSTW-1	Cheung Chau Sewage Treatment Work	15-05-2013	11:40	A	35.8	62.5	S	0.8	60
CCSTW-2			11:42						64
CCSTW-3			11:44						64
PSSPS-1	Pak She Sewage Pump Station	15-05-2013	11:20	A	32.5	71.6	S	0.6	45
PSSPS-2			11:22						53
PSSPS-3			11:24						56
CCSTW_DW-1	Downwind direction of Cheung Chau Sewage Treatment Work	15-05-2013	12:15	A	34.9	65.5	S	1.3	60
CCSTW_DW-2			12:17						68
CCSTW_DW-3			12:19						64
PSSPS_DW-1	Downwind direction of Pak She Sewage Pump Station	15-05-2013	12:45	A	35.3	61.8	S	0.4	12
PSSPS_DW-2			12:47						13
PSSPS_DW-3			12:49						14
Blank	QA/QC	15-05-2013	16:05						< 4

Remark: A: Ambient sampling; AT: Air temperature: RH: Relative humidity; WD: Wind direction; WS: Wind speed.

4.2. Olfactometry Measurement and Analytical Results

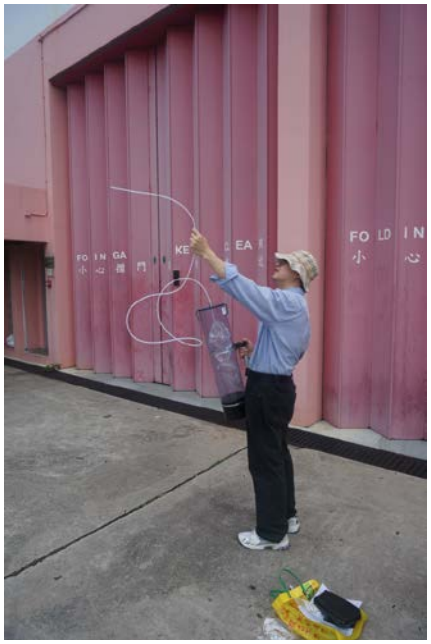
A total of 24 odour samples were tranported to the Odour Research Centre of THEi. One blank sample by purging odour-free nitrogen gas from the certified gas cylinder was also prepared for a purpose of QA/QC. The olfactometry analysis was conducted within 24 hours after the sampling work using a dynamic olfactometer in accordance with the European Standard Method (EN13725). Four qualified panellists participated in the odour testing session, who were previously selected through a set of screening tests using a certified n-butanol gas (60 ppm/v) as a standard reference.

The analytical results of odour concentrations are summarized in Table 1.

Some photos about the on-site sampling activities at the 8 locations are presented below.

CCSH

CSH2



FS

CCA

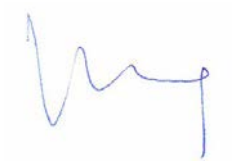
CCSTW

PSSPS

CCSTW_DW

PSSPS_DW

Prepared by:

KH NG Signed: 

Professor H CHUA Signed: 

Odour Research Centre at THEi

Appendix A: Odour Sampling Locations at Cheung Chau Area