Stephenson

Environmental Management Australia

CO-GENERATION PLANT STACK EMISSION TESTING

TOOHEYS PTY LTD

LIDCOMBE, NSW

PROJECT NO.: **5522/S23794/15**

DATE OF SURVEY: **15 JULY 2015**

DATE OF ISSUE: **31 JULY 2015**

Stephenson

Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526
Newington Business Park
Unit 7/2 Holker Street
Newington NSW 2127 Australia
Tel: (02) 9737 9991
Fax: (02) 9737 9993
e-mail: info@stephensonenv.com.au

CO-GENERATION PLANT STACK EMISSION TESTING

TOOHEYS PTY LTD

LIDCOMBE, NSW

PROJECT NO.: **5522/S23794/15**

DATE OF SURVEY: **15 JULY 2015**

DATE OF ISSUE: **31 JULY 2015**

P W STEPHENSON

A MCGHIE

A PRADHAN

J WEBER

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF TABLES – APPENDICES

TABLE OF FIGURES – APPENDICES

1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was requested by Tooheys Pty Ltd to assess emissions from the stack serving their Co-generation Plant at their brewing facility at Lidcombe, New South Wales (NSW).

Tooheys operates under the NSW Office of Environment and Heritage (OEH) EPL No. 1167. Condition L3.4 specifies the emission concentration limits for the stack serving the Co-generation Plant (EPA Identification (ID) No. 7). The objective of this monitoring is to meet the requirements for EPA ID No. 7 and to determine if the specified emission concentration limits are met.

The tests were undertaken on 15 July 2015.

TABLE 1-1 EPL ID NO. 7 – EMISSION CONCENTRATION LIMITS AND MONITORING REQUIREMENTS

Parameter	Units of measure	Frequency	OEH test method	100% conc. limit	Reference condition	Oxygen correction
Volatile Organic Compounds (as n-propane)	mg/m^3	Annual	TM-34	40	Dry, 273k, 101.3kPa,	5%
Nitrogen Oxides	mg/m^3	Annual	TM-11	250	Dry, 273k, 101.3kPa,	5%
Dry Gas Density	kg/m^3	Annual	TM-23	--	--	--
Moisture	%	Annual	TM-22	--	--	--
Molecular Weight	g/g mole	Annual	TM-23	--	--	--
Temperature	^oC	Annual	TM-2	--	--	--
Volumetric Flow Rate	m/s	Annual	TM-2	--	--	--
Velocity	m^3/s	Annual	TM-2	--	--	--

Key:

mg/m^3	=	milligrams per cubic metre
OEH	=	Office of Environment and Heritage
TM	=	Approved Test Method
mg/m^3	=	milligrams per cubic metre @ 0^oC and 1 atmosphere
kg/m^3	=	kilograms per cubic metre
%	=	percent
g/g mole	=	grams per gram mole
^oC	=	degrees Celsius
m/s	=	metres per second
m^3/s	=	cubic metres per second
conc.	=	concentration
--	=	no specified limit

2 PRODUCTION CONDITIONS

On the day of testing, the plant operating procedures and production rate were considered typical by Tooheys personnel. Refer to Appendix D for Screen Shot of Co-generation engine operating conditions for the day of testing.

In essence, the Co-generation Engine and associated waste heat boiler was producing of the order of 2.0 megawatts (MW) of power and steam on the day of testing.

3 EMISSION TEST RESULTS AND DISCUSSION

3.1 INTRODUCTION

SEMA completed all the sampling and analysis for velocity, flow, dry gas density, molecular weight of stack gases, temperature, moisture, Volatile Organic Compounds (VOCs), Oxygen (O_2) and Nitrogen Oxides (NO_x). SEMA is NATA accredited to ISO17025 to complete the sampling and analysis for the above parameters. SEMA NATA accreditation number is 15043.

The VOC sample, collected by SEMA, was analysed by the NATA accredited Testsafe Australia, accreditation number 3726, Report No. 2015-2240.

The emission test results are summarised in table format in Table 3-1. Sections 3.2 and 3.3 provide a description of the results.

Refer to Appendix B for a graphical logged record of NO_x continuous emission analysis.

Appendix C presents SEMA's NATA endorsed Emission Test Report, No. 5522.

Details of the most recent calibration of each instrument used to take measurements is summarised in Appendix E, and the sample location is illustrated in Appendix F.

3.2 OXIDES OF NITROGEN (NO_x)

The one-hour average NO_x (expressed as NO_2) emission concentration during the sampling period was 69 parts per million (ppm) and when corrected to 5% O_2 was 213 mg/m^3. This emission concentration was in compliance with the Co-generation EPL NO_x concentration limit of 250 mg/m^3 at 5% O_2. Refer to Table 3-1 and Figure B-1 in Appendix B for detailed results in tabulated and graphical formats respectively.

3.3 VOLATILE ORGANIC COMPOUNDS

The sum of the total VOC emission concentrations in the suite of 73 analytes is reported as n-propane equivalent as required by the NSW OEH Approved Methods and POEO (Clean Air) Regulation 2010.

The measured total VOCs emission concentration was below the limit of detection for the analytical method (less than 6.3 mg/m^3 corrected to 5% O_2). Refer to Table 3-1 and Appendix C for details.

TABLE 3-1 SUMMARY OF AVERAGE EMISSION TEST RESULTS

Parameter	Unit	EPL ID No.7 Average Result	EPL Concentration Limit
Temperature	^oC	212	--
Pressure	kPa	101.1	--
Velocity	m/s	22	--
Volumetric Flow	m^3/s	2.0	--
Moisture	%	9.7	--
Molecular Weight Dry Stack Gas	g/g mole	29	--
Gas Density	kg/m^3	1.3	--
Nitrogen Oxides	mg/m^3 @ 5% O_2	213	250
Oxygen	%	10.3	--
Volatile Organic Compounds	mg/m^3 @ 5% O_2 as n-propane equiv.	<6.3	40

Key:

^oC	=	degrees Celsius
<	=	less than
*	=	reported as n-propane equivalent
%	=	percentage
EPA	=	Environment Protection Authority
EPL	=	Environment Protection Licence
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
m^3/s	=	dry cubic metre per second 0^oC and 101.3 kilopascals (kPa)
m/s	=	metres per second
mg/m^3	=	milligrams per cubic metre at 0^oC and 101.3 kilopascals (kPa)

4 CONCLUSIONS

From the data presented and test work conducted during typical production, the following conclusions were drawn for the stack emissions:

- The one-hour average NO_x emission concentration, corrected to 5% O_2, was 213 mg/m^3, which was in compliance with the EPL NO_x emission limit of 250 mg/m^3 .

- The VOC emission concentration corrected to 5% O_2 was <6.3 mg/m^3, which was in compliance with the EPL VOC emission limit of 40 mg/m^3 (expressed as n-propane).

5 TEST METHODS

5.1 EXHAUST GAS VELOCITY AND TEMPERATURE

(OEH NSW TM-1 & 2)

Velocity profiles were obtained across each stack utilising an Airflow Developments Ltd. S-type pitot tube and digital manometer. Where practicable, each sampling plane complied with AS4323.1.

The exhaust gas temperature was measured using a Digital thermometer (0-1200^{o}C) connected to a chromel/alumel (K-type) thermocouple probe.

5.2 CONTINUOUS GASEOUS ANALYSIS

(OEH NSW TM-11, 24, 25 & 32)

Sampling and analysis of exhaust gas were performed using one of Stephenson Environmental Management Australia's mobile combustion and environmental monitoring laboratories. Emission gases were distributed to the analysers via a manifold. Flue gas from each stack was pumped continuously. The following components of the laboratory were relevant to this work:

Oxides of Nitrogen	Testo 350XL
Oxygen	Testo 350XL
Carbon Dioxide	Testo 350XL
Calibration	BOC / Air Liquide Special Gas Mixtures relevant for each analyser. Instrument calibrations were performed at the start and finish of sampling at each location.
QA/QC	Calibration (Zero/Span) checks Sample line integrity calibration check

5.3 VOLATILE ORGANIC COMPOUNDS (VOCS)

(OEH NSW TM-34)

A sample of stack air is drawn onto a carbon adsorption tube and analysed using Gas Chromatography/Mass Spectrometry (GC/MS) performed by the NATA accredited laboratory TestSafe Australia, accreditation number, 3726.

5.4 MEASUREMENT OF UNCERTAINTY

All results are quoted on a dry basis. SEMA has adopted the following (Table 5-1) uncertainties for various stack testing methods.

TABLE 5-1 MEASUREMENT OF UNCERTAINITY

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, TM-22, USEPA 4	25%
Nitrogen Oxides	NSW TM-11, USEPA 7E	15%
Oxygen a	NSW TM-24, USEPA 3A	1% actual
Velocity	AS4323.1, TM-2, USEPA 2	5%
Volatile Organic Compounds (adsorption tube)	TM-34, USEPA M18	25%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

APPENDIX A – EMISSION TEST RESULTS

Glossary:

%	=	percent
^{o}C	=	Degrees Celsius
am^3/min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m^3)	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am^3	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
m^2	=	square metre
m/s	=	metre per second
m^3/sec	=	cubic metre per second at 0^0C and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at 0^oC and 1 atmosphere
O_2	=	Oxygen
SEMA	=	Stephenson Environmental Management Australia
VOC	=	Volatile Organic Compounds

Abbreviations of Personnel

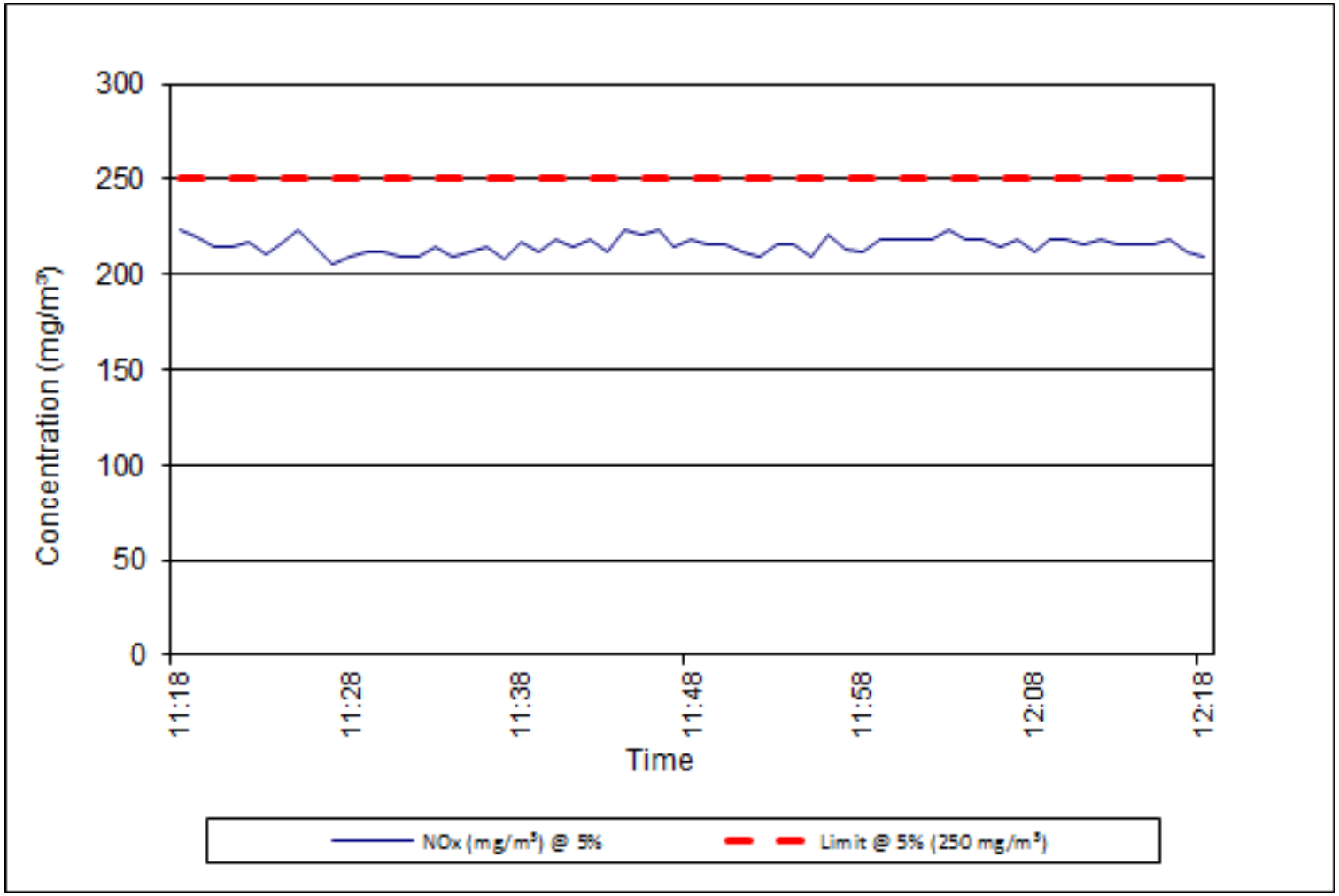
PWS	=	Peter Stephenson
AM	=	Argyll McGhie
AP	=	Alok Pradhan
AN	=	Ali Naghizadeh

TABLE A-1 EMISSION TEST RESULTS – EPL ID NO.7 – FLOW & VOCS

Emission Test Results	**Flow & VOC's**
Project Number	5522
Project Name	Tooheys
Test Location	**EPA ID Point No.7 - Gas Engine**
Date	15 July 2015
RUN	1
Sample Start Time (hrs)	11:16
Sample Finish Time (hrs)	12:25
Sample Location (Inlet/Exhaust)	Exhaust
Stack Temperature (^oC)	212
Stack Cross-Sectional area (m^2)	0.181
Average Stack Gas Velocity (m/s)	22
Actual Gas Flow Volume (am^3/min)	240
Total Normal Gas Flow Volume (m^3/min)	120
Total Normal Gas Flow Volume (m^3/sec)	2.00
Total Stack Pressure (kPa)	101.1
Moisture Content (% by volume)	9.7
Molecular Weight Dry Stack Gas (g/g-mole)	29
Dry Gas Density (kg/m^3)	1.3
Oxygen (%)	10.3
Carbon Dioxide (%)	6.0
Sampling Performed by	JW/ AP/AM
Sample Analysed by (Laboratory)	SEMA
Calculations Entered by	JW
Calculations Checked by	AP
Volatile Organic Compounds	
VOCs Sample Start Time:	11:23
VOCs Sample Finish Time:	12:23
Sampling Period (min):	60
SEMA Sample No.:	724857
Concentration (mg/m^3) @ 5% O_2	<6.6
Concentration as n-prop. Equiv. (mg/m^3) @ 5% O_2	<6.3

APPENDIX B – CONTINUOUS LOGGED DATA

FIGURE B-1 CONTINUOUS LOG OF NITROGEN OXIDES EMISSIONS @ 5% O_2 15 JULY 2015



APPENDIX C – NATA ENDORSED TEST REPORT

Stephenson
Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

Newington Business Park
Unit 7/2 Holker Street
Newington NSW 2127 Australia
Tel: (02) 9737 9991
Fax: (02) 9737 9993
E-Mail: info@stephensonenv.com.au

Emissions Test Report No. 5522

The sampling and analysis was commissioned by:

Client	Organisation:	Tooheys Pty Ltd
	Contact:	Paul Kiely
	Address:	29 Nyrang Street Lidcombe NSW 2141
	Telephone:	9647 9647
	Email:	paul.kiely@lionco.com
	Project Number:	5522/S23794/15
	Test Date(s):	15 July 2015
	Production Conditions:	Normal operating conditions during testing
	Analysis Requested:	Flow, temperature, moisture, Oxygen, Nitrogen Oxides, Dry Gas Density and Volatile Organic Compounds
	Sample Locations:	Co-Generation Engine Stack
	Sample ID Nos.:	See Attachment A

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025.

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report 5522
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report 5522
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report 5522
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report 5522
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, Accreditation No. 15043, Emission Test Report 5522
Oxygen	NSW TM-25, USEPA M3A	SEMA, Accreditation No. 15043, Emission Test Report 5522
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report 5522
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report 5522

Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report 5522
Volatile Organic Compounds	NSW TM-34, USEPA M18	TestSafe, Accreditation No. 3726, Report No. 2015-2240
Deviations from Test Methods	Nil	
Sampling Times	NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.	
Reference Conditions	NSW – As per (1) Environment Protection Licence conditions, or (2) Part 3 of the Protection of the Environment Operations (Clean Air) Regulations	

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date
31 July 2015

P W Stephenson
Managing Director

SUMMARY OF THE AVERAGE EMISSION TEST RESULTS – TEST REPORT NO. 5522

Co-Generation Engine Stack – EPA ID No.7		
Date Tested – 15/07/2015		
Stack Emission Test Parameter	**Unit**	**Average Emission Test Result**
Temperature	°C	212
Pressure	kPa	101.1
Velocity	m/s	22
Volumetric Flow	m^3/s	2.0
Moisture	%	9.7
Molecular Weight Dry Stack Gas	g/g mole	29
Gas Density	kg/m^3	1.3
Nitrogen Oxides	mg/m^3 @ 5% O_2	213
Oxygen	%	10.3
Volatile Organic Compounds (expressed as n-propane equivalent)	mg/m^3 @ 5% O_2	<6.3

Key:

°C	=	degrees Celsius
<	=	less than
%	=	percentage
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
m^3/s	=	dry cubic metre per second 0°C and 101.3 kilopascals (kPa)
m/s	=	metres per second
mg/m^3	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kPa)

ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA 4	25%
Nitrogen Oxides	NSW TM-11, USEPA 7E	15%
Oxygen	NSW TM-24, USEPA 3A	1% actual
Velocity	AS4323.1, NSW TM-2, USEPA 2	5%
Volatile Organic Compounds (adsorption tube)	NSW TM-34, USEPA 18	25%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

Test Safe AUSTRALIA
'Safety is no Accident'

CHEMICAL ANALYSIS BRANCH

WorkCover NEW SOUTH WALES

Alok Pradhan
Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

Lab. Reference: 2015-2240

SAMPLE ORIGIN: Project no: 5522

DATE OF INVESTIGATION: 15/7/15 **DATE RECEIVED:** 17/07/15

ANALYSIS REQUIRED: Volatile Organic Compounds

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

Martin Mazereeuw
Manager
Date: 27/07/15

WorkCover NSW Chemical Analysis Branch
ABN 77 682 742 966 L2, Bldg 1, 9-15 Chilvers Road Thornleigh NSW 2120 AUSTRALIA
T: +61 2 9473 4000 F: +61 2 9980 6849 E: lab@workcover.nsw.gov.au
WorkCover Assistance Service: **13 10 50** W: www.workcover.nsw.gov.au

ilac-MRA NATA
Accreditation No. 3726
Accredited for compliance with ISO/IEC 17025

NSW GOVERNMENT WorkCover

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Alok Pradhan

Sample ID : 724857 **Sample : 2015-2240-1**

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back µg/section
	Aliphatic hydrocarbons (LOD = 5µg/compound/section)					**Aromatic hydrocarbons** (LOD = 1µg/compound/section)			
1	2-Methylbutane	78-78-4	ND	ND	39	Benzene	71-43-2	ND	ND
2	n-Pentane	109-66-0	ND	ND	40	Ethylbenzene	100-41-4	ND	ND
3	2-Methylpentane	107-83-5	ND	ND	41	Isopropylbenzene	98-82-8	ND	ND
4	3-Methylpentane	96-14-0	ND	ND	42	1,2,3-Trimethylbenzene	526-73-8	ND	ND
5	Cyclopentane	287-92-3	ND	ND	43	1,2,4-Trimethylbenzene	95-63-6	ND	ND
6	Methylcyclopentane	96-37-7	ND	ND	44	1,3,5-Trimethylbenzene	108-67-8	ND	ND
7	2,3-Dimethylpentane	565-59-3	ND	ND	45	Styrene	100-42-5	ND	ND
8	n-Hexane	110-54-3	ND	ND	46	Toluene	108-88-3	ND	ND
9	3-Methylhexane	589-34-4	ND	ND	47	p-Xylene &/or m-Xylene	106-42-3 & 108-38-3	ND	ND
10	Cyclohexane	110-8-27	ND	ND	48	o-Xylene	95-47-6	ND	ND
11	Methylcyclohexane	108-87-2	ND	ND		**Ketones** (LOD #49, #54 & #55 =5µg/cis; #50, #51, #52 & #53 =25µg/cis)			
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	ND	ND
13	n-Heptane	142-82-5	ND	ND	50	Acetoin	513-86-0	ND	ND
14	n-Octane	111-65-9	ND	ND	51	Diacetone alcohol	123-42-2	ND	ND
15	n-Nonane	111-84-2	ND	ND	52	Cyclohexanone	108-94-1	ND	ND
16	n-Decane	124-18-5	ND	ND	53	Isophorone	78-59-1	ND	ND
17	n-Undecane	1120-21-4	ND	ND	54	Methyl ethyl ketone (MEK)	78-93-3	ND	ND
18	n-Dodecane	112-40-3	ND	ND	55	Methyl isobutyl ketone (MIBK)	108-10-1	ND	ND
19	n-Tridecane	629-50-5	ND	ND		**Alcohols** (LOD = 25µg/compound/section)			
20	n-Tetradecane	629-59-4	ND	ND	56	Ethyl alcohol	64-17-5	ND	ND
21	α-Pinene	80-56-8	ND	ND	57	n-Butyl alcohol	71-36-3	ND	ND
22	β-Pinene	127-91-3	ND	ND	58	Isobutyl alcohol	78-83-1	ND	ND
23	D-Limonene	138-86-3	ND	ND	59	Isopropyl alcohol	67-63-0	ND	ND
	Chlorinated hydrocarbons (LOD = 5µg/compound/section)				60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	75-34-3	ND	ND		**Acetates** (LOD = 25µg/compound/section)			
26	1,2-Dichloroethane	107-06-2	ND	ND	62	Ethyl acetate	141-78-6	ND	ND
27	Chloroform	67-66-3	ND	ND	63	n-Propyl acetate	109-60-4	ND	ND
28	1,1,1-Trichloroethane	71-55-6	ND	ND	64	n-Butyl acetate	123-86-4	ND	ND
29	1,1,2-Trichloroethane	79-00-5	ND	ND	65	Isobutyl acetate	110-19-0	ND	ND
30	Trichloroethylene	79-01-6	ND	ND		**Ethers** (LOD = 25µg/compound/section)			
31	Carbon tetrachloride	56-23-5	ND	ND	66	Ethyl ether	60-29-7	ND	ND
32	Perchloroethylene	127-18-4	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	1634-04-4	ND	ND
33	1,1,2,2-Tetrachloroethane	79-34-5	ND	ND	68	Tetrahydrofuran (THF)	109-99-9	ND	ND
34	Chlorobenzene	108-90-7	ND	ND		**Glycols** (LOD = 25µg/compound/section)			
35	1,2-Dichlorobenzene	95-50-1	ND	ND	69	PGME	107-98-2	ND	ND
36	1,4-Dichlorobenzene	106-46-7	ND	ND	70	Ethylene glycol diethyl ether	629-14-1	ND	ND
	Miscellaneous (LOD #37= 5µg & #38=25µg/compound/section)				71	PGMEA	108-65-6	ND	ND
37	Acetonitrile	75-05-8	ND	ND	72	Cellosolve acetate	111-15-9	ND	ND
38	n-Vinyl-2-pyrrolidinone	88-12-0	ND	ND	73	DGMEA	112-15-2	ND	ND
	Total VOCs (LOD =50µg/compound/section)		ND	ND		Worksheet check		YES	YES

2015-2240.xlsx

Page 2 of 3

TestSafe Australia – WorkCover NSW ***Chemical Analysis Branch***
WorkCover NSW ABN 77 682 742 966 L2, Building 1, 9-15 Chilvers Rd, Thornleigh, NSW 2120 Australia
Telephone: **61 2 9473 4000** Facsimile: **61 2 9980 6849** Email: lab@workcover.nsw.gov.au
Website: testsafe.com.au/chemical.asp WorkCover Assistance Service 13 10 50

ilac-MRA NATA
Accreditation No. 3726

WC03147NATA 0614

Accredited for compliance with ISO/IEC 17025

NSW GOVERNMENT WorkCover

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Alok Pradhan

Stephenson Environmental Management Australia

ND = Not Detected
VOCs = Volatile Organic Compounds
All compounds numbered 1-73 are included of this analysis in the scope of NATA accreditation. Any additional compounds attonated with * are not covered by NATA accreditation.

Method : Analysis of Volatile Organic Compounds in Workplace Air by Gas Chromatography/Mass Spectrometry
Method Number : WCA 207
Detection Limit : 5µg/section; 25µg/section for oxygenated hydrocarbons except acetone, MEK and MIBK at 5µg/section and aromatic hydrocarbon at 1µg/section.
Brief Description : Volatile organic compounds are trapped from the workplace air onto charcoal tubes by the use of a personal air monitoring pump. The volatile organic compounds are then desorbed from the charcoal in the laboratory with CS_2. An aliquot of the desorbant is analysed by capillary gas chromatography with mass spectrometry detection.

The Total Volatile Organic Compounds (TVOC) test result in µg/section is calculated by combining the determined values of the 73 compounds with other VOCs that have been identified by mass spectrometry in the sample. These extra VOCs were individually estimated by the response of the nearest internal standard to that compound. Therefore, the TVOC test result should be interpreted as a semi-quantitative guide to the amount of VOCs present. If the TVOC test result is greater than the addition of all the compounds quantified then this can indicate that there are additional compounds present other than the 73 quantified compounds reported.

PGME : Propylene Glycol Monomethyl Ether
PGMEA : Propylene Glycol Monomethyl Ether Acetate
DGMEA : Diethylene Glycol Monoethyl Ether Acetate

Measurement Uncertainty
The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Quality Assurance
In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-
- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

2015-2240.xlsx Page 3 of 3

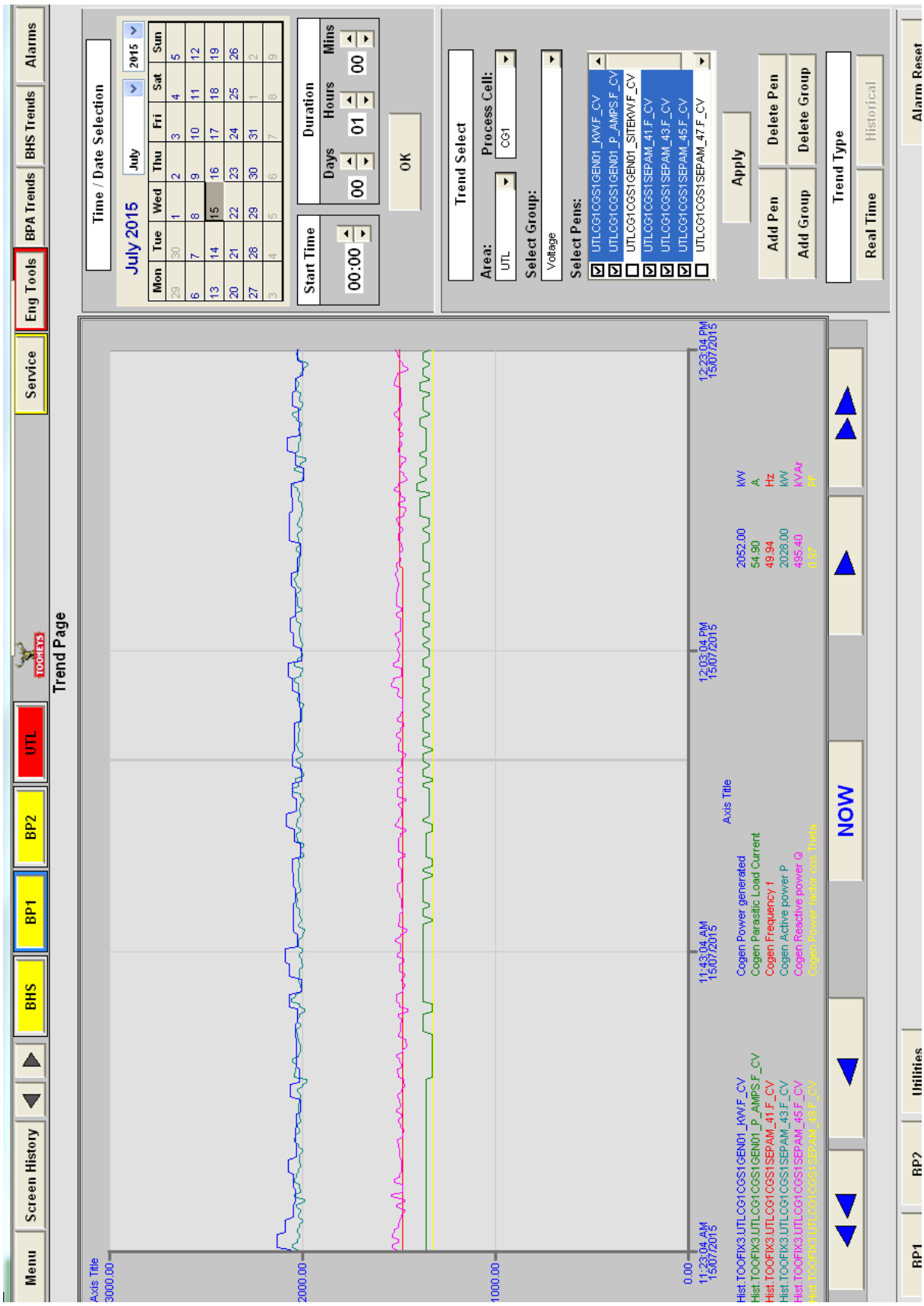
TestSafe Australia – WorkCover NSW ***Chemical Analysis Branch***
WorkCover NSW ABN 77 682 742 966 L2, Building 1, 9-15 Chilvers Rd, Thornleigh, NSW 2120 Australia
Telephone: **61 2 9473 4000** Facsimile: **61 2 9980 6849** Email: lab@workcover.nsw.gov.au
Website: testsafe.com.au/chemical.asp WorkCover Assistance Service 13 10 50

ilac-MRA NATA
Accreditation No. 3726

WC03147NATA 0614

Accredited for compliance with ISO/IEC 17025

APPENDIX D – PRODUCTION DATA


Menu
Screen History
BHS
BP1
BP2
UTL
Service
Eng Tools
BPA Trends
BHS Trends
Alarms
Trend Page
Time / Date Selection
July 2015
July
2015
Start Time
00:00
Duration
Days
Hours
Mins
OK
Trend Select
Area:
UTL
Process Cell:
CG1
Select Group:
Voltage
Select Pens:
Apply
Add Pen
Delete Pen
Add Group
Delete Group
Trend Type
Real Time
Historical
NOW
RP1
RP2
Utilities
Alarm Reset

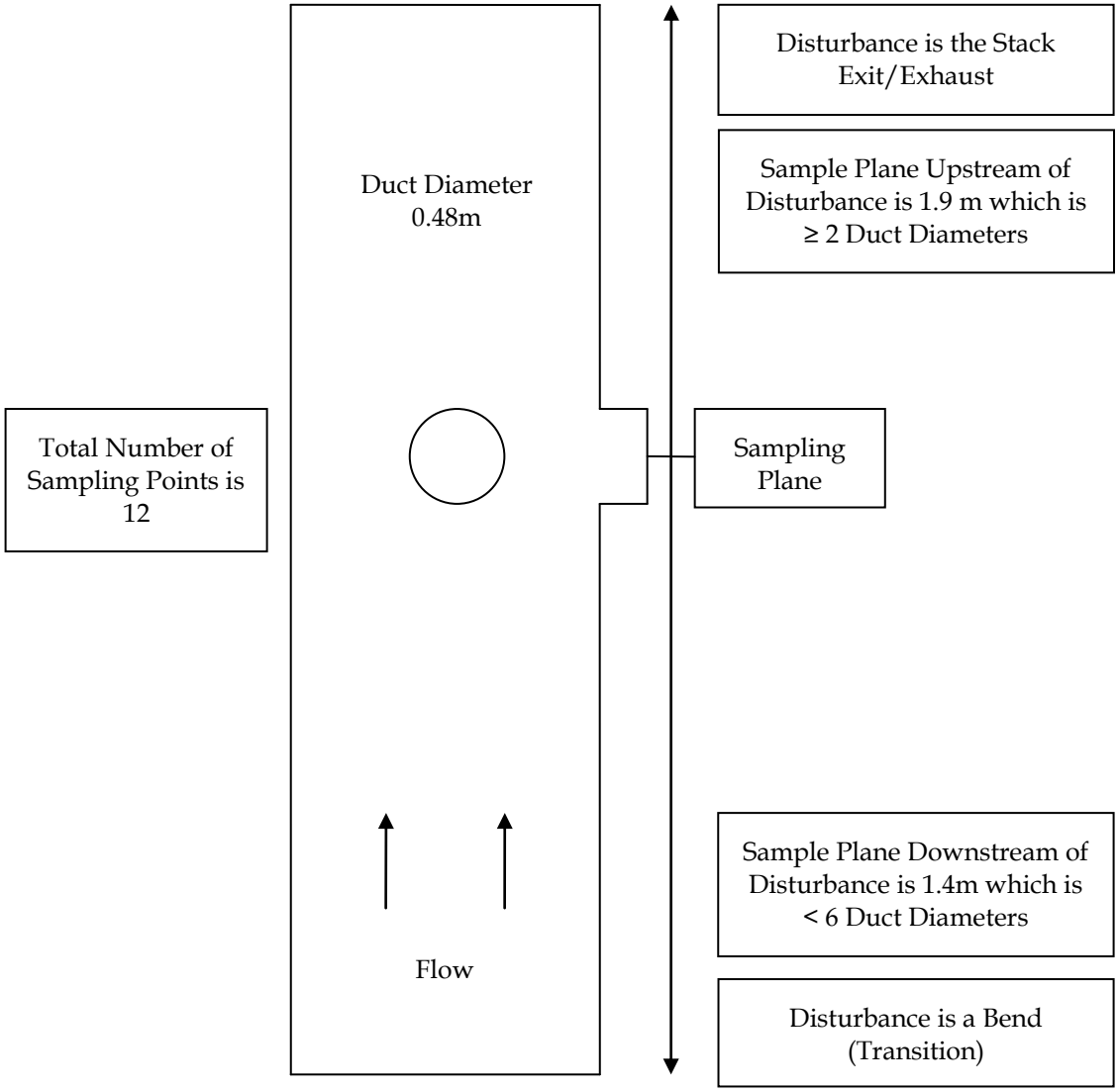
APPENDIX E – INSTRUMENT CALIBRATION DETAILS

TABLE E-1 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
858	Digital Temperature Reader	14-Jul-15	14-Jan-16
921	Thermocouple	14-Jul-15	14-Jan-16
815	Digital Manometer	06-Mar-15	06-Mar-16
613	Barometer	02-Mar-15	02-Mar-16
723	Pitot	03-Jun-15	03-Jun-2016 Visually inspected On-Site before use
833	Personal Sampler	13-Apr-15	13-Apr-16
936	Buck Calibrator 1cc/min - 6L/min	10-Apr-15	10-Oct-15
733	TESTO 350	03-Mar-15	03-Sep-15
926	Balance		Response Check with SEMA Site Mass
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALST 9799	19-Mar-19
243 ppm 247 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen	ALTN1892	20-Aug-19
400 ppm 400 ppm 401 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB6150	15-May-20

APPENDIX F – STACK SAMPLING LOCATION

FIGURE F-1 CO-GENERATION ENGINE STACK – EPA ID NO. 7



In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the sampling plane was non-ideal.

However the sample plane does meet the minimum sampling plane position; sampling plane conditions will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.