

**Quantem, Port Botany
EPA 4 – Benzene Combustor
Report Number R012515**

Document Information

Template Version 211117

Client Name: Quantem (Botany NSW)
Report Number: R012515
Date of Issue: 30 March 2022
Attention: Richard McGrath
Address: Gate 38B, 45 Friendship Rd
Port Botany NSW 2036
Testing Laboratory: Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation



Aaron Davis
Senior Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

This document is confidential and is prepared for the exclusive use of Quantem (Botany NSW) and those granted permission by Quantem (Botany NSW).

The report shall not be reproduced except in full.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation. This does not include comments, conclusions or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

Table of Contents

1	Executive Summary	4
1.1	Background	4
1.2	Project Objective	4
1.3	Licence Comparison	4
2	Results	5
2.1	EPA 4 – Benzene Combustor Stack	5
3	Plant Operating Conditions	7
4	Test Methods.....	7
5	Quality Assurance/Quality Control Information	7
6	Definitions	8
7	Appendix 1: Site Photos	9

1 Executive Summary

1.1 Background

Ektimo was engaged by Quantem (Port Botany) to perform annual emission monitoring as required by NSW EPA Environment Protection Licence 1048.

1.2 Project Objective

The objective of the project is to conduct a monitoring programme to quantify emissions from one (1) discharge point to determine compliance with Quantem's Environment Protection Licence.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA 4 - Benzene Combustor Stack	1 March 2022	Volatile organic compounds (VOCs as n-propane) Oxygen (O ₂), Carbon dioxide (CO ₂), Nitrogen oxides (as NO ₂)

* Flow rate, velocity, temperature and moisture were also determined.

All results are reported on a dry basis at STP.

1.3 Licence Comparison

The following licence comparison table shows that all analytes highlighted in green are within the licence limit set by the NSW EPA as per licence 1048 (last amended on 30 October 2020).

Results have also been corrected to 3% Oxygen as stipulated in Schedule 5 of the *Protection of the Environment Operations (Clean Air) Regulation, (NSW) 2021*.

EPA No.	Location Description	Parameter	Units	Licence limit	Detected values	
					1/03/2022	Detected values (corrected to 3% O ₂) 1/03/2022
4	Benzene Combustor	Nitrogen oxides (as NO ₂)	mg/m ³	350	89	160
		Volatile organic compounds (VOCs)	mg/m ³	20	0.71	1.3
		Benzene	mg/m ³	1	<0.08	<0.1

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 EPA 4 – Benzene Combustor Stack

Date	1/03/2022	Client	Quantem
Report	R012515	Stack ID	EPA 4 - Benzene Combustor Stack
Licence No.	1048	Location	Port Botany
Ektimo Staff	Rick Peralta	State	NSW
Process Conditions	Ship: Golden Creation - product loaded: BTEX (Benzene)		

220218

Sampling Plane Details	
Sampling plane dimensions	1010 mm
Sampling plane area	0.801 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Fixed ladder 9 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 3 D
Upstream disturbance	Change in diameter 2 D
No. traverses & points sampled	2 16
Sample plane conformance to AS4323.1 (2021)	Non-conforming

The sampling plane is deemed to be non-conforming due to the following reasons:
 The differential pressure at one or more sampling points is less than 5 Pa
 The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	7.2	
Gas molecular weight, g/g mole	28.5 (wet)	29.3 (dry)
Gas density at STP, kg/m ³	1.27 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m ³	0.33	
% Oxygen correction & Factor	3 %	1.86

Gas Flow Parameters	
Flow measurement time(s) (hhmm)	0945 & 1105
Temperature, °C	768
Temperature, K	1041
Velocity at sampling plane, m/s	4.7
Volumetric flow rate, actual, m ³ /s	3.8
Volumetric flow rate (wet STP), m ³ /s	0.99
Volumetric flow rate (dry STP), m ³ /s	0.92
Mass flow rate (wet basis), kg/hour	4500

Gas Analyser Results	Sampling time	Average			Minimum			Maximum		
		0956 - 1055			0956 - 1055			0956 - 1055		
Combustion Gases		Corrected to			Corrected			Corrected		
		Concentration	3% O2	Mass Rate	Concentration	to 3% O2	Mass Rate	Concentration	to 3% O2	Mass Rate
Nitrogen oxides (as NO ₂)		mg/m ³	mg/m ³	g/min	mg/m ³	mg/m ³	g/min	mg/m ³	mg/m ³	g/min
Carbon monoxide		89	160	4.9	81	150	4.5	95	180	5.2
		6.1	11	0.34	3.7	7	0.21	8.7	16	0.48
		Concentration			Concentration			Concentration		
		%v/v			%v/v			%v/v		
Carbon dioxide		4.5			4.2			4.8		
Oxygen		11.3			10.8			11.7		

Date	1/03/2022	Client	Quantem
Report	R012515	Stack ID	EPA 4 - Benzene Combustor Stack
Licence No.	1048	Location	Port Botany
Ektimo Staff	Rick Peralta	State	NSW
Process Conditions	Ship: Golden Creation - product loaded: BTEX (Benzene)		

220218

Total VOCs (as n-Propane)	Results		
	Concentration mg/m ³	Corrected to 3% O ₂ mg/m ³	Mass Rate g/min
Total	0.71	1.3	0.039

VOC (speciated)	Sampling time	Results		
		Concentration mg/m ³	Corrected to 3% O ₂ mg/m ³	Mass Rate g/min
			0948-1057	
Detection limit ⁽¹⁾		<0.08	<0.1	<0.004
Benzene		<0.08	<0.1	<0.004
Toluene		0.68	1.3	0.037
Pentane		0.64	1.2	0.035

(1) Unless otherwise reported, the following target compounds were found to be below detection:

Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane

3 Plant Operating Conditions

See Quantem (Botany NSW) records for complete process conditions.

4 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sampling points - Selection	NSW EPA TM-1	NA	NA	✓	NA
Flow rate, temperature and velocity	NSW EPA TM-2	NSW EPA TM-2	8%, 2%, 7%	NA	✓
Moisture content	NSW EPA TM-22	NSW EPA TM-22	19%	✓	✓
Molecular weight	NA	NSW EPA TM-23	not specified	NA	✓
Dry gas density	NA	NSW EPA TM-23	not specified	NA	✓
Carbon dioxide	NSW EPA TM-24	NSW EPA TM-24	13%	✓	✓
Nitrogen oxides	NSW EPA TM-11	NSW EPA TM-11	12%	✓	✓
Oxygen	NSW EPA TM-25	NSW EPA TM-25	13%	✓	✓
Speciated volatile organic compounds (VOCs)	NSW EPA TM-34 ^d	Ektimo 344	19%	✓	✓ [†]

220302

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

† Analysis conducted at the Ektimo Mitcham, VIC laboratory, NATA accreditation number 14601. Results were reported on 9 March 2022 in report LV-002482.

d Excludes recovery study as specified in section 8.4.3 of USEPA Test Method 18.

5 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

6 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
AS	Australian Standard
CEM/CEMS	Continuous Emission Monitoring/Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NT	Not tested or results not required
OM	Other approved method
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those not matching a standard compound), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
TM	Test method
TOC	The sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

7 Appendix 1: Site Photo



EPA 4 - Benzene Combustor Stack

Ektimo

ektimo.com.au

1300 364 005

MELBOURNE (Head Office)

26 Redland Drive

Mitcham

VIC 3132

AUSTRALIA

SYDNEY

6/78 Reserve Road,

Artarmon

NSW 2064

AUSTRALIA

WOLLONGONG

1/251 Princes Highway

Unanderra

NSW 2526

AUSTRALIA

PERTH

52 Cooper Road

Cockburn Central

WA 6164

AUSTRALIA

BRISBANE

3/109 Riverside Place

Morningside

QLD 4170

AUSTRALIA