Ektimo

Quantem, Port Botany

EPA 4 – Benzene Combustor

Report Number R013728

Document Information

Template Version 190722

Client Name:	Quantem
Report Number:	R013728
Date of Issue:	25 November 2022
Attention:	Xavier Colquhoun
Address:	Gate 38B, 45 Friendship Rd Port Botany NSW 2036
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

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Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Steven Cooper
Ektimo Signatory

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.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, 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

1.1 Background

Ektimo was engaged by Quantem perform emission testing at their Port Botany plant. Testing was carried out in accordance with Environment Protection Licence 1048.

1.2 Project Objective & Overview

The objective of the project is to quantify emissions from one (1) discharge point to determine compliance with Quantem's Environmental Licence.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA 4 - Benzene Combustor Stack (Thermal Oxidiser)	02 November 2022	Benzene 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 (Dry, 273°K, 101.3 kPa)

Plant operating conditions have been noted in the report.

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 15 November 2022).

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 (corrected to 3% O_2) 02-Nov-22
4	Benzene Combustor	Nitrogen oxides (as NO_2)	mg/m^3	350	170
		Volatile organic compounds (VOCs)	mg/m^3	20	<0.1
		Benzene	mg/m^3	1	<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	2/11/2022	**Client**	Quantem
Report	R013728	**Stack ID**	EPA 4 - Benzene Combustor Stack
Licence No.	1048	**Location**	Port Botany
Ektimo Staff	Rick Peralta/Ish Alam	**State**	NSW
Process Conditions	Ship: Gloden Resolution - Product unloaded: BTEX (Benzene)		221028

Sampling Plane Details	
Sampling plane dimensions	1010 mm
Sampling plane area	0.801 m²
Sampling port size, number	4" Flange (x2)
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 AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	6.8	
Gas molecular weight, g/g mole	28.5 (wet)	29.3 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.33	
% Oxygen correction & Factor	3 %	1.83
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0945 & 1052	
Temperature, °C	783	
Temperature, K	1056	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/s	12	
Volumetric flow rate (wet STP), m³/s	3.2	
Volumetric flow rate (dry STP), m³/s	3	
Mass flow rate (wet basis), kg/hour	15000	

Gas Analyser Results	Average			Minimum			Maximum		
Sampling time	0951 - 1046			0951 - 1046			0951 - 1046		
	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min
Combustion Gases									
Nitrogen oxides (as NO_2)	92	170	16	48	88	8.6	170	310	30
	Concentration %v/v			Concentration %v/v			Concentration %v/v		
Carbon dioxide	4.3			3.4			6.3		
Oxygen	11.1			7.9			15.2		

Date	2/11/2022	**Client**	Quantem
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Total VOCs (as n-Propane)	Results		
Sampling time	0950-1050		
	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min
Total	<0.07	<0.1	<0.01

VOC (speciated)	Results		
Sampling time	0950-1050		
	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min
Detection limit[1]	<0.07	<0.1	<0.01
Benzene	<0.07	<0.1	<0.01

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

3 Plant Operating Conditions

Ship name: Golden Resolution

Product unloaded: Benzene

Unloading Operation: Continuous/normal unloading (2nd day/last stage of unloading)

See Quantem's 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	Method detection limit	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	NSW EPA TM-1 (AS 4323.1)	NA	NA	NA	✓	NA
Flow rate, temperature & velocity	NSW EPA TM-2 (USEPA Method 2)	NSW EPA TM-2 (USEPA Method 2)	location specific	8%, 2%, 7%	NA	✓
Moisture content	NSW EPA TM-22 (USEPA Alt-Method 008)	NSW EPA TM-22 (USEPA Alt-Method 008)	1.0%	19%	✓	✓
Molecular weight	NA	NSW EPA TM-23 (USEPA Method 3)	NA	not specified	NA	✓
Dry gas density	NA	NSW EPA TM-23 (USEPA Method 3)	NA	not specified	NA	✓
Carbon dioxide	NSW EPA TM-24 (USEPA Method 3A)	NSW EPA TM-24 (USEPA Method 3A)	0.1%	13%	✓	✓
Nitrogen oxides	NSW EPA TM-11 (USEPA Method 7E)	NSW EPA TM-11 (USEPA Method 7E)	0.004 g/m³	12%	✓	✓
Oxygen	NSW EPA TM-25 (USEPA Method 3A)	NSW EPA TM-25 (USEPA Method 3A)	0.1%	13%	✓	✓
Speciated volatile organic compounds (VOCs)	NSW EPA TM-34[d] (USEPA Method 18)	Ektimo 344	0.4 mg/m³	19%	✓	✓†

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* 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 8 November 2022 in report LV-003516

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

4.1 Deviations to Test Methods

NSW EPA TM-34 (USEPA 18)

Ektimo notes that the sampling and analysis of Volatile Organic Compounds (VOCs), per USEPA Method 18 has excluded the recovery study as specified in Section 8.4.3. Performing the recovery study described in Section 8.4.3 of USEPA Method 18 for analytes present at low levels is problematic. Given this, Ektimo applies a threshold of 50µg as a lower-bound mass, below which the 'spiking' of specific volatile organic compounds is not performed. For the purposes of this round of monitoring, all compounds were below 50µg. Therefore, recovery studies were not performed.

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 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
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM/CEMS	Continuous emission monitoring/Continuous emission monitoring system
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
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.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
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
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), 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.
TM	Test method
TOC	Total organic carbon. This is 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.
Vic EPA	Victorian Environment Protection Authority
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 Photos

EPA 4 - Benzene Combustor Stack

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