



Address (Head Office)  
427 Canterbury Road,  
SURREY HILLS VIC 3127

Postal Address  
Unit 3, 4 Monash Gate,  
JANDAKOT WA 6164

Office Locations  
VIC NSW WA QLD

Freecall: 1300 364 005  
Int'l Call: +61 3 9813 7200  
[www.ektimo.com.au](http://www.ektimo.com.au)  
ABN: 86 600 381 413

**Report Number R002024**

---

**Emission Testing Report**  
**EPA 4 - Benzene Combustor**  
**Terminals Pty Ltd, Port Botany**

---



## Document Information

Client Name: Terminals Pty Ltd  
 Report Number: R002024  
 Date of Issue: 17 December 2015  
 Attention: Michael Selleck  
 Address: Gate 38B, 45 Friendship Rd  
 PORT BOTANY NSW 2036  
 Testing Laboratory: Ektimo (ETC) ABN 74 474 273 172

## Report Status

Format	Document Number	Report Date	Prepared By	Reviewed By (1)	Reviewed By (2)
Preliminary Report	-	-	-	-	-
Draft Report	-	-	-	-	-
Final Report	R002024	17/12/2015	JKr	SCo	ADa
Amend Report	-	-	-	-	-

Template Version: 151203

## Amendment Record

Document Number	Initiator	Report Date	Section	Reason
Nil	-	-	-	-

## Report Authorisation



**Steven Cooper**  
Client Manager

NATA Accredited Laboratory  
No. 14601

**Aaron Davis**  
Operations Manager

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

## Table of Contents

---

1	Executive Summary .....	4
2	Results Summary .....	4
3	Results .....	5
3.1	EPA 4 – Benzene Combustor .....	5
4	Plant Operating Conditions .....	7
5	Test Methods.....	7
6	Quality Assurance/ Quality Control Information .....	7
7	Definitions .....	8

## 1 EXECUTIVE SUMMARY

Ektimo was engaged by Terminals Pty Ltd to perform emission monitoring as required by their NSW EPA Environment Protection Licence (number 1048).

Results from the testing program indicate that Terminals Pty Ltd was within the requirements of the Licence during the sampling period.

Monitoring was performed as follows;

Location	Test Date	Test Parameters*
EPA 4 – Benzene Combustor	2 December 2015	Solid particles, carbon dioxide, oxygen, carbon monoxide, nitrogen oxides, sulfur dioxide, hydrogen sulfide, speciated volatile organic compounds

\* Flow rate, velocity, temperature and moisture were determined unless otherwise stated

Testing commenced approximately half way through the benzene ship loading period after notification from Terminals Pty Ltd personnel.

The methodologies chosen by Ektimo are those recommended by the NSW Office of Environment and Heritage (as specified in the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, January 2007).

Plant operating conditions have been noted in the report.

## 2 RESULTS SUMMARY

The following licence comparison table shows that all analytes highlighted in green are below the licence limit set by the NSW EPA as per licence 1048 (last amended on 30/07/2014).

EPA No.	Location Description	Parameter	Units	Licence limit	Detected values (corrected to 3% O <sub>2</sub> )	
					2/12/2015	2/12/2015
4	Benzene Combustor	Solid Particles	mg/m <sup>3</sup>	50	<1	<1.8
		Nitrogen oxides (as NO <sub>2</sub> )	mg/m <sup>3</sup>	350	47	81
		Volatile organic compounds (VOCs)	mg/m <sup>3</sup>	20	0.25	0.43
		Hydrogen Sulfide (H <sub>2</sub> S)	mg/m <sup>3</sup>	5	<0.0043	<0.0075

### 3 RESULTS

#### 3.1 EPA 4 – Benzene Combustor

Date	2/12/2015	Client	Terminals Pty Ltd		
Report	R002024	Stack ID	EPA 4 Benzene Combustor Stack		
Licence No.	1048	Location	Port Botany	State	NSW
Ektimo Staff	Swo/Dhi				
Process Conditions	Please refer to client records.				
Reason for testing:	Client requested testing to determine emissions to air				

Sampling Plane Details	
Sampling plane dimensions	1010 mm
Sampling plane area	0.801 m <sup>2</sup>
Sampling port size, number & depth	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
Compliance to AS4323.1	Compliant but non-ideal

Comments
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters	
Moisture content, %v/v	12
Gas molecular weight, g/g mole	28.0 (wet) 29.3 (dry)
Gas density at STP, kg/m <sup>3</sup>	1.25 (wet) 1.31 (dry)
% Oxygen correction & Factor	3 % 1.72
Gas Flow Parameters	
Temperature, °C	974
Velocity at sampling plane, m/s	11
Volumetric flow rate, discharge, m <sup>3</sup> /s	8.9
Volumetric flow rate (wet STP), m <sup>3</sup> /s	2
Volumetric flow rate (dry STP), m <sup>3</sup> /s	1.7
Mass flow rate (wet basis), kg/hour	8800
Sampling time, min	80
Isokinetic rate, %	95
Velocity difference, %	<1

Isokinetic	Sampling time	Results		
		0825-0955		
		Concentration	Corrected to	Mass Rate
		mg/m <sup>3</sup>	3% O <sub>2</sub>	g/min
			mg/m <sup>3</sup>	
Solid particles		<1	<1.8	<0.11

Hydrogen Sulfide	Sampling time	Results		
		0835-0935		
		Concentration	Corrected to	Mass Rate
		mg/m <sup>3</sup>	3% O <sub>2</sub>	g/min
			mg/m <sup>3</sup>	
Hydrogen sulfide		<0.0043	<0.0075	<0.00045

Date	2/12/2015	Client	Terminals Pty Ltd
Report	R002024	Stack ID	EPA 4 Benzene Combustor Stack
Licence No.	1048	Location	Port Botany
Ektimo Staff	Swo/Dhi	State	NSW
Process Conditions	Please refer to client records.		
Reason for testing:	Client requested testing to determine emissions to air		

Gases	Sampling time	Average 842-941 Corrected to 3%			Minimum 842-941 Corrected to			Maximum 842-941 Corrected to		
		Concentration mg/m <sup>3</sup>	O <sub>2</sub> mg/m <sup>3</sup>	Mass Rate g/min	Concentration mg/m <sup>3</sup>	3% O <sub>2</sub> mg/m <sup>3</sup>	Mass Rate g/min	Concentration mg/m <sup>3</sup>	3% O <sub>2</sub> mg/m <sup>3</sup>	Mass Rate g/min
Nitrogen oxides (as NO <sub>2</sub> )		47	81	4.9	12	21	1.3	92	160	9.6
Sulfur dioxide		37	64	3.9	<5.7	<9.8	<0.59	94	160	9.8
Carbon monoxide		13	23	1.4	8.7	15	0.91	19	32	1.9
		Concentration %			Concentration %			Concentration %		
Carbon dioxide		4.7			4.1			5.1		
Oxygen		10.5			8.9			11.9		

Total VOCs* (as n-Propane)	Sampling time	Results 0830-0930 Corrected to		
		Concentration mg/m <sup>3</sup>	3% O <sub>2</sub> mg/m <sup>3</sup>	Mass Rate g/min
Total		0.25	0.42	0.025

\*Total VOCs does not include methane

VOC's (specified)	Sampling time	Results 0830-0930 Corrected to		
		Concentration mg/m <sup>3</sup>	3% O <sub>2</sub> mg/m <sup>3</sup>	Mass Rate g/min
Detection limit <sup>(1)</sup>		<0.062	<0.11	<0.0064
Acetone		0.32	0.56	0.034

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

Ethanol, Isopropanol, Isobutanol, Butanol, 1-Methoxy-2-propanol, Cyclohexanol, 2-Butoxyethanol, Pentane, Hexane, Heptane, Octane, Nonane, Decane, Undecane, Dodecane, Tridecane, Tetradecane, Cyclohexane, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Isooctane, Methylcyclohexane, alpha-Pinene, beta-Pinene, d-Limonene, 3-Carene, Acetone, Methyl ethyl ketone, Ethyl acetate, Isopropyl acetate, Propyl acetate, MIBK, 2-Hexanone, Butyl acetate, 1-Methoxy-2-propyl acetate, Cyclohexanone, Cellosolve acetate, 2-Butoxyethyl acetate, Ethyldiglycol acetate, Diacetone alcohol, Isophorone, Benzene, Toluene, Ethylbenzene, m-p-Xylene, Styrene, o-Xylene, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, alpha-Methylstyrene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, m-Diethylbenzene, o-Diethylbenzene, p-Diethylbenzene, Dichloromethane, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Carbon tetrachloride, 1,1-Dichloroethene, cis-1,2-Dichloroethene, trans-1,2-Dichloroethene, Trichloroethene, Tetrachloroethene, 1,1,2-Trichloroethane, 1,1,2,2-Tetrachloroethane, Chlorobenzene, Fluorobenzene

## 4 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See Terminals Pty Ltd's records for complete process conditions.

## 5 TEST METHODS

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

Parameter	Test Method	Method Detection Limit	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sample plane criteria	NSW TM-1	NA	-	✓	NA
Velocity	NSW TM-2	2ms <sup>-1</sup>	7%	✓	NA
Temperature	NSW TM-2	0°C	2%	✓	NA
Flow rate	NSW TM-2	Location	8%	✓	NA
Sulfur dioxide	NSW TM-4	6mg/m <sup>3</sup>	12%	✓	✓
Hydrogen sulfide	NSW TM-5	0.5mg/m <sup>3</sup>	not specified	✓	✓
Nitrogen oxides (NO <sub>x</sub> )	NSW TM-11	4mg/m <sup>3</sup>	12%	✓	✓
Solid particles	NSW TM-15	0.001g/m <sup>3</sup>	5%	✓	✓
Moisture content	NSW TM-22	0.40%	8%	✓	✓
Carbon dioxide	NSW TM-24	0.1%	13%	✓	✓
Oxygen	NSW TM-25	0.1%	13%	✓	✓
Carbon monoxide	NSW TM-32	0.0025g/m <sup>3</sup>	12%	✓	✓
Speciated volatile organic compounds	NSW TM-34	0.3mg/m <sup>3</sup>	19%	✓	✓

\* Uncertainty values cited in this table are calculated at the 95% confidence level (coverage factor = 2)

## 6 QUALITY ASSURANCE/ QUALITY CONTROL INFORMATION

Ektimo (EML) and Ektimo (ETC) are 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](http://www.nata.com.au).

Ektimo (EML) and Ektimo (ETC) are accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025. – General Requirements for the Competence of Testing and Calibration Laboratories. ISO/IEC 17025 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 Compliance Manager.

NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised world –wide.

A formal Quality Control program is in place at Ektimo to monitor analyses performed in the laboratory and sampling conducted in the field. The program is designed to check where appropriate; the sampling reproducibility, analytical method, accuracy, precision and the performance of the analyst. The Laboratory Manager is responsible for the administration and maintenance of this program.

## 7 DEFINITIONS

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

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.
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.
VOC	Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
OU	The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).
PM <sub>2.5</sub>	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PM <sub>10</sub>	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
BSP	British standard pipe
NT	Not tested or results not required
NA	Not applicable
D <sub>50</sub>	'Cut size' of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D <sub>50</sub> 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 <sub>50</sub> of that cyclone and less than the D <sub>50</sub> of the preceding cyclone.
D	Duct diameter or equivalent duct diameter for rectangular ducts
<	Less than
>	Greater than
≥	Greater than or equal to
~	Approximately
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
DER	WA Department of Environment & Regulation
DECC	Department of Environment & Climate Change (NSW)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra Red
NATA	National Association of Testing Authorities
RATA	Relative Accuracy Test Audit
AS	Australian Standard
USEPA	United States Environmental Protection Agency
Vic EPA	Victorian Environment Protection Authority
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
CARB	Californian Air Resources Board
TM	Test Method
OM	Other approved method
CTM	Conditional test method
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
NIOSH	National Institute of Occupational Safety and Health
XRD	X-ray Diffractometry