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Report Number R000594

Emission Stack Testing

EPA 7 - Bitumen Combustor

Terminals Pty Ltd, Port Botany

Document Information

Client Name:	Terminals Pty Ltd
Report Number:	R000594
Report Title:	Bitumen Combustor - Stack Testing
Date of Issue:	25 March 2015
Attention:	Michael Selleck
Address:	Gate 38B, 45 Friendship Rd PORT BOTANY NSW 2036

Sampling Information

Sampling Date:	5 March 2015
Sampling Team:	SC/SJW
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	R000594	25 March 2015	JW	SC	ZX
Amend Report	-	-	-	-	-

Amendment Record

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

Report Authorisation

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Nil

1 LICENCE COMPARISON

EPA No.	EPA No.	Pollutant	Units	Licence limit	Detected values 5/03/2015	Detected values (corrected to 3% O_2) 5/03/2015
7	Bitumen Combustor	Nitrogen oxide (as NO_2)	mg/m3	350	100	200
		Volatile organic compounds (VOCs)	mg/m^3	40	0.08	0.16

Note: All analytes are below the Licence Limit set by the NSW EPA as per licence 1048 (last amended on 30-July-2014). Results have also been corrected to 3% Oxygen as stipulated in Schedule 5 of the *Protection of the Environment Operations (Clean Air) Regulation, (NSW)* 2010.

2 EXECUTIVE SUMMARY

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

Monitoring was performed as follows;

Testing Summary

Location	Test Date	Test Parameters*
EPA 7 - Bitumen Combustor	5 March 2015	Hydrogen sulfide, volatile organic compounds (VOC's) as n-propane, oxygen, carbon dioxide, nitrogen oxides

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

The methodologies chosen by Ektimo are those recommended by the NSW Environmental Protection Authority (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.

3 RESULTS

EPA 7 Bitumen Combustor - Test Results

Date	5/03/2015	**Client**	Terminals Pty Ltd		
Report	R000594	**Stack ID**	Bitumen Combustor		
Licence No.	1048	**Location**	Port Botany	**State**	NSW
Ektimo Staff	SC/SJW				
Process Conditions	Bitumen Grade C320				
Reason for testing:	Client requested testing to determine emissions to air				

Sampling Plane Details		
Sampling plane dimensions (mm) & area	980	0.754 m²
Sampling port size, number & depth	4" Flange (x2)	
Access & height of ports	Fixed ladder	12 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	exit	2 D
Upstream disturbance	Change in diameter	6 D
No. traverses & points sampled	2	12
Traverse method & compliance	AS4323.1	Satisfactory

Comments
All results reported on a dry basis at NTP

Stack Parameters		
Moisture content, %v/v	11	
Gas molecular weight, g/g mole	28.1 (wet)	29.4 (dry)
Gas density at NTP, kg/m³	1.26 (wet)	1.31 (dry)
% Oxygen correction & Factor	3 %	1.98
Gas Flow Parameters		
Temperature, °C	832	
Velocity at sampling plane, m/s	5.2	
Volumetric flow rate, discharge, m³/s	3.9	
Volumetric flow rate (wet NTP), m³/s	0.96	
Volumetric flow rate (dry NTP), m³/s	0.86	
Mass flow rate (wet basis), kg/hour	4400	
Velocity difference, %	-8	

Hydrogen Sulfide	Results		
Sampling time	1135-1235		
	Concentration mg/m³	O2 corrected mg/m³	Mass Rate g/s
Hydrogen sulfide	0.0095	0.019	8.1 E-06

Gases	Average			Minimum			Maximum		
Sampling time	1148-1249			1148-1249			1148-1249		
	Concentration mg/m³	O2 corrected mg/m³	Mass Rate g/s	Concentration mg/m³	O2 corrected mg/m³	Mass Rate g/s	Concentration mg/m³	O2 corrected mg/m³	Mass Rate g/s
Nitrogen oxides (as NO_2)	100	200	0.087	90	180	0.078	110	220	0.094
	Concentration %			Concentration %			Concentration %		
Carbon dioxide	5			4.6			5.2		
Oxygen	11.8			11			13		

Date	5/03/2015	**Client**	Terminals Pty Ltd		
Report	R000594	**Stack ID**	Bitumen Combustor		
Licence No.	1048	**Location**	Port Botany	**State**	NSW
Ektimo Staff	SC/SJW				
Process Conditions	Bitumen Grade C320				
Reason for testing:	Client requested testing to determine emissions to air				

Total VOC's (as n-propane)	Sampling time	Results 1135-1235		
		Concentration mg/m³	O2 corrected mg/m³	Mass Rate g/s
Total		0.08	0.16	0.000067

VOC's (speciated)	Sampling time	Results 1135-1235		
		Concentration mg/m³	O2 corrected mg/m³	Mass Rate g/s
Detection limit[1]		<0.079	<0.16	<0.000068
Toluene		0.17	0.33	0.00014

(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. Bitumen Grade C320 was being unloaded during the sampling period. Sampling was undertaken mid-way through the ship unloading duration. 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

Test Method Table

Parameter	Test Method	Method Detection Limit	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sample plane criteria	NSW TM-1	NA	-	✓	NA
Temperature	NSW TM-2	0°C	2%	✓	NA
Flow rate	NSW TM-2	Location	8%	✓	NA
Hydrogen sulfide	NSW TM-5	0.5mg/m³	not specified	✓	✓
Nitrogen oxides (NO_x)	NSW TM-11	4mg/m³	12%	✓	✓
Carbon dioxide	NSW TM-24	0.1%	13%	✓	✓
Oxygen	NSW TM-25	0.1%	13%	✓	✓
Speciated volatile organic compounds	NSW TM-34	0.3mg/m³	19%	✓	✓

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

6 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.asn.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to Australian Standard 17025 – General Requirements for the Competence of Testing and Calibration Laboratories. Australian Standard 17025 requires that a laboratory have a quality system similar to ISO 9002. More importantly it also 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:

NTP	Normal 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).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PM_{10}	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_{50}	'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_{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.
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