

**Date:** 18 September 2014

**Report No:** 140412r

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Terminals Pty Ltd  
Gate 38B  
45 Friendship Rd Port Botany NSW

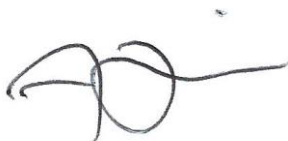
***Emission Testing – August 2014***  
*EPA 7 – Bitumen Combustor*

Dear Mr Michael Selleck,

Tests were performed 20 August 2014 to determine emissions to air from the Bitumen Combustor at the Port Botany plant of Terminals Pty Ltd.

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Yours faithfully  
Emission Testing Consultants



**Aaron Davis** BSc, LLB (Hons)  
State Manager

*aaron.davis@ektimo.com.au*

## LICENCE COMPARISON

EPA No.	Location Description	Pollutant	Unit of measure	Licence limit	Detected Values	Detected Values (corrected to 3% O <sub>2</sub> )
7	Bitumen Combustor	Nitrogen oxides (as NO <sub>2</sub> )	milligrams per cubic meter (mg/m <sup>3</sup> )	350	95	190
		Volatile organic compounds (VOCs)	milligrams per cubic meter (mg/m <sup>3</sup> )	40	< 0.9	< 2

**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*.

## EXECUTIVE SUMMARY

Emission Testing Consultants (ETC) was engaged by Terminals Pty Ltd to perform emission monitoring as required by NSW EPA Environment Protection Licence 1048. Monitoring was performed on EPA Point 7 – Bitumen Combustor for the following parameters:

- Flow rate
- Velocity
- Temperature
- Moisture
- Dry gas Density
- Molecular weight
- Carbon dioxide (CO<sub>2</sub>)
- Oxygen (O<sub>2</sub>)
- Nitrogen oxides (NO<sub>x</sub>) as NO<sub>2</sub>
- Hydrogen sulphide (H<sub>2</sub>S)
- Volatile organic compounds (VOC)

The methodologies chosen by ETC are those stipulated by Terminals Pty Ltd Licence (1048). There were no technical issues in terms of sampling on the days of testing. Plant operating conditions have been noted in the report.

## RESULTS

### EPA 7 – Bitumen Combustor

20 August 2014

Flow Results		Measured MW	Bitumen Combustor 140412
Date and time of flow test		20/08/2014 21:50	
Date and time of flow test		20/08/2014 23:00	
Stack dimensions at sampling plane		980	mm
Velocity at sampling plane		8.0	m/s
Average temperature		918	°C
Moisture content	Alt008	12	% v/v
Flow rate at discharge conditions		6.0	m <sup>3</sup> /sec
Flow rate at wet NTP conditions		1.4	m <sup>3</sup> /sec
Flow rate at dry NTP conditions		1.2	m <sup>3</sup> /sec

Continuous Analyser Results	Bitumen Combustor 140412.74	Sampling Times	Concentration at NTP	Concentration at 3% O <sub>2</sub>	Mass rate
Oxygen (dry basis)		2158-2258	12.1 % v/v	-	-
Carbon dioxide (dry basis)		2158-2258	4.6 % v/v	-	400 kg/hour
Dry gas density		2158-2258	1.3 kg/m <sup>3</sup>	-	-
Molecular weight of stack gas, dry basis		2158-2258	29 g/g-mole	-	-
Nitrogen oxides as NO <sub>2</sub>		2158-2258	95 mg/m <sup>3</sup>	190 mg/m <sup>3</sup>	7.0 g/min

Volatile Organic Compound (VOC) Results	Bitumen Combustor 140412.74	Sampling Times	Concentration at NTP	Concentration at 3% O <sub>2</sub>	Mass rate
Total VOC as n-propane		2159-2259	< 0.9 mg/m <sup>3</sup>	< 2 mg/m <sup>3</sup>	< 0.07 g/min

**Note:** If not listed above, the following compounds were not detected above the analytical range of the instrument. Please contact ETC should you wish to discuss detection limits of specific undetected compounds; Acetone (2-propanone), Propylene Oxide, Acrylonitrile, Methylene Chloride, MEK (2-butanone), Hexane, Ethyl Acetate, 1,2-dichloroethane, Benzene, Carbon tetrachloride, Cyclohexane, Ethyl Acrylate, Trichloroethene (Trichloroethylene, TCE), 1,4-Dioxane, Epichlorohydrin, MIBK (4-methyl-2-pentanone), Toluene, Tetrachloroethene (Perchloroethylene, PCE), n-Butyl Acetate, Chlorobenzene, Ethylbenzene, m/p-xylene, Styrene (Vinyl benzene), o-xylene, Cyclohexanone, Nonane, Isopropylbenzene (Cumene), DIBK (Diisobutyl Ketone), α-Methylstyrene, Decane, Benzyl Chloride (α-chlorotoluene), Benzoyl Chloride, Naphthalene, Dodecane

Manual Sampling Results	Bitumen Combustor 140412.74	Sampling Times	Concentration at NTP	Concentration at 3% O <sub>2</sub>	Mass rate
Hydrogen sulphide		2158-2258	< 0.03 mg/m <sup>3</sup>	< 0.06 mg/m <sup>3</sup>	< 0.002 g/min

Refer to "SAMPLING PLANE OBSERVATIONS" on page 4.

## SAMPLING PLANE OBSERVATIONS

### EPA 7 – Bitumen Combustor

The sampling plane had 2 x 4 inch flange ports. The location was determined to be “ideal” as per AS4323.1. It was more than the required 2 duct diameters upstream from the exit. It was more than the required 6 duct diameters downstream from a junction. The sampling plane passed the flow assessment (items (a) to (f) of AS4323.1) and was therefore “compliant”.

## PLANT OPERATING CONDITIONS

Plant operating conditions were supplied by Terminals Pty Ltd personnel.

Plant operating conditions were representative of typical operation for the duration of sampling. Testing was performed during a bitumen ship loading operation to provide peak load rate between 2145PM to 2315PM on 20 August 2014.

## TEST METHODS

The following methods are accredited with the National Association of Testing Authorities (NATA) and are approved for the sampling and analysis of gases unless otherwise stated. Specific details of the methods are available on request.

All sampling and analysis will be conducted in accordance with the test methods (TM) prescribed in NSW EPA’s *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*, Jan 2007 and in accordance with the *Protection of the Environment Operations (Clean Air) Regulation* 2010 unless otherwise specified.

All parameters are reported adjusted to dry NTP conditions unless otherwise stated.

Parameter	Sampling			Analysis			Analytical Laboratory Report Number(s)
	NATA	NSW TM Method	Sampling Method	NATA	Analytical Laboratory	Analytical Method	
Selection of sampling positions	Yes	TM-1	AS4323.1	Yes	NA	NA	140412r
Flow rate	Yes	TM-2	USEPA 2	Yes	NA	NA	140412r
Velocity	Yes	TM-2	USEPA 2	Yes	NA	NA	140412r
Temperature	Yes	TM-2	USEPA 2	Yes	NA	NA	140412r
Moisture	Yes	TM-22	Alt008	Yes	NA	NA	140412r
Dry gas Density	Yes	TM-23	USEPA 3	Yes	Emission Testing Consultants	USEPA 3	140412r
Molecular weight	Yes	TM-23	USEPA 3	Yes	Emission Testing Consultants	USEPA 3	140412r
Carbon dioxide (CO <sub>2</sub> )	Yes	TM-24	USEPA 3A	Yes	Emission Testing Consultants	USEPA 3A	140412r
Oxygen (O <sub>2</sub> )	Yes	TM-25	USEPA 3A	Yes	Emission Testing Consultants	USEPA 3A	140412r
Nitrogen oxides (NO <sub>x</sub> ) as NO <sub>2</sub>	Yes	TM-11	USEPA 7E	Yes	Emission Testing Consultants	USEPA 7E	140412r
Hydrogen sulphide (H <sub>2</sub> S)	Yes	TM-5	USEPA 11	Yes	National Measurement Institute (NMI)	NWD16	RN1035525
Volatile organic compounds (VOC)	Yes	TM-34	USEPA 18	Yes	SGS Australia Pty Ltd	AN467	90702

## DEFINITIONS

The following symbols and abbreviations are used in test reports:

BSP	British standard pipe.
Concentration	Mass of analyte per cubic metre expressed at NTP dry conditions (ng, µg or mg/m <sup>3</sup> ).
Flow rate at discharge conditions	Volume of gas flow per unit time expressed at discharge temperature, pressure and moisture content (m <sup>3</sup> /min).
Flow rate at wet NTP conditions	Volume of gas flow per unit time expressed at 0°C, an absolute pressure of 101.325 kPa and discharge moisture content (m <sup>3</sup> /min).
Flow rate at dry NTP conditions	Volume of gas flow per unit time expressed at 0°C, an absolute pressure of 101.325 kPa and 0% moisture content (m <sup>3</sup> /min).
Lowerbound	(Lower) results do not include any limit of detection values (< values).
Mass rate	Mass of analyte per unit time (µg, mg or g/min).
Mediumbound	(Medium) results include half limit of detection values (< values).
Moisture content	Percentage of gaseous moisture in the gas expressed on a volume / volume percentage basis. This does not include moisture in the gas stream that is in the liquid phase (free moisture).
NA	Not applicable.
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.
ppm	Parts per million expressed on a volume / volume wet basis.
Sampling plane	Location at which measurements were conducted.
Velocity	Gas velocity expressed at discharge temperature, pressure and moisture content (m/s)
VOC	Any chemical compound based on carbon in the boiling range 36 to 126°C, with a vapour pressure of at least 0.010kPa at 25°C (or having a corresponding volatility under the particular conditions of use) that adsorb onto activated charcoal and desorb into CS <sub>2</sub> , or that can be collected in a tedlar bag and be quantitatively recovered, and that are detected by GCMS. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are CO, CO <sub>2</sub> , carbonic acid, metallic carbides and carbonate salts.
>	Greater than.
<	Less than the minimum limit of detection using the specified method.
~	Approximately.

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