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Date: 29 October 2013

Report No: 130611r

Terminals Pty Ltd
Gate 38B, 45 Friendship Rd
Port Botany NSW 2036

Emission Testing – September 2013
EPA 7 – Bitumen Combustor

Dear Mr G Millard,

Tests were performed 27 September 2013 to determine emissions to air from the Bitumen Combustor at the Port Botany plant of Terminals Pty Ltd.

Yours faithfully
Emission Testing Consultants

David Corbett Ba/BCom
Client Manager

dc@emission.com.au

LICENCE COMPARISON

EPA No.	Location Description	Pollutant	Unit of measure	Licence limit	Detected Values	Detected Values (corrected to 3% O_2)
7	Bitumen Combustor	Nitrogen oxides (as NO_2)	milligrams per cubic meter (mg/m^3)	350	59	130
		Volatile organic compounds (VOCs)	milligrams per cubic meter (mg/m^3)	40	<0.8	<2

Note: All analytes are below the Licence Limit set by the NSW EPA as per licence 1048 (last amended on 13-Sep-2013). 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 during ship discharge for the following parameters:

- Flow rate
- Velocity
- Temperature
- Moisture
- Dry gas Density
- Molecular weight
- Carbon dioxide (CO_2)
- Oxygen (O_2)
- Nitrogen oxides (NO_x) as NO_2
- Hydrogen sulphide (H_2S)
- 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

27 September 2013

Flow Results	Measured MW	EPA 7 Bitumen Combustor 130611	
Date and time of flow test		27/09/2013 13:55	
Date and time of flow test		27/09/2013 15:11	
Stack dimensions at sampling plane		980	mm
Velocity at sampling plane		8.3	m/s
Average temperature		830	°C
Moisture content	Alt008	14	% v/v
Flow rate at discharge conditions		6.3	m³/sec
Flow rate at wet NTP conditions		1.5	m³/sec
Flow rate at dry NTP conditions		1.3	m³/sec

Continuous Analyser Results	EPA 7 Bitumen Combustor 130611 80	Sampling Times	Concentration at NTP		Concentration at 3% O2		Mass rate	
Oxygen (dry basis)		1403-1502	12.9	% v/v	-		-	
Carbon dioxide (dry basis)		1403-1502	3.9	% v/v	-		370	kg/hour
Dry gas density		1403-1502	1.3	kg/m3	-		-	
Molecular weight of stack gas, dry basis		1403-1502	29	g/g-mole	-		-	
Nitrogen oxides as NO_2		1403-1502	59	mg/m3	130	mg/m3	4.8	g/min

Volatile Organic Compound (VOC) Results	EPA 7 Bitumen Combustor 130611 80	Sampling Times	Concentration at NTP		Concentration at 3% O2		Mass rate	
Total VOC as n-propane		1400-1500	< 0.8	mg/m3	< 2	mg/m3	< 0.06	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-chlorotolune), Benzoyl Chloride, Naphthalene, Dodecane

Manual Sampling Results	EPA 7 Bitumen Combustor 130611 80	Sampling Times	Concentration at NTP		Concentration at 3% O2		Mass rate	
Hydrogen sulphide		1400-1500	< 0.03	mg/m3	< 0.07	mg/m3	< 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 1400PM to 1500PM on 27 September 2013.

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	NSW TM Method	Sampling Method	NATA	Analytical Laboratory	Analytical Method	NATA	Analytical Laboratory NATA accreditaion number	Analytical Laboratory Report Number(s)
Selection of sampling positions	TM-1	AS4323.1	Yes	NA	NA	Yes	14601	-
Flow rate	TM-2	USEPA 2	Yes	NA	NA	Yes	14601	-
Velocity	TM-2	USEPA 2	Yes	NA	NA	Yes	14601	-
Temperature	TM-2	USEPA 2	Yes	NA	NA	Yes	14601	-
Moisture	TM-22	USEPA ALT008	Yes	NA	NA	Yes	14601	-
Dry gas Density	TM-23	USEPA 3A	Yes	Emission Testing Consultants	USEPA 3A	Yes	14601	-
Molecular weight	TM-23	USEPA 3A	Yes	Emission Testing Consultants	USEPA 3A	Yes	14601	-
Carbon dioxide (CO_2)	TM-24	USEPA 3A	Yes	Emission Testing Consultants	USEPA 3A	Yes	14601	-
Oxygen (O_2)	TM-25	USEPA 3A	Yes	Emission Testing Consultants	USEPA 3A	Yes	14601	-
Nitrogen oxides (NO_x) as NO_2	TM-11	USEPA 7E	Yes	Emission Testing Consultants	USEPA 7E	Yes	14601	-
Hydrogen sulphide (H_2S)	TM-5	USEPA 11	Yes	MGT-LabMark Environmental Pty Ltd	USEPA 11	Yes	1261	394763-A
Volatile organic compounds (VOC)	TM-34	USEPA 18	Yes	SGS Australia Pty Ltd	AN467	Yes	2562	67142

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^3).
Dioxins & furans	2,3,7,8-substituted polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzofurans) PCDF
Dioxin & furan TEQ values	Toxic equivalent. The TEQ values have been calculated using the toxicity equivalence factors (TEF) according to the World Health Organisation (2005)
Flow rate at discharge conditions	Volume of gas flow per unit time expressed at discharge temperature, pressure and moisture content (m^3/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^3/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^3/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 **(wet in the case of odour only)** basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
Odour concentration	Number of odour units (ou).
Odour flux rate	Odour emission rate per unit surface area per unit time (ou/m^2/min).

Odour mass rate	Odour emission rate per unit time (ou/min).
Odour unit	One odour unit (ou) is that concentration of odorant(s) at standard concentrations that elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PAH's	Polycyclic aromatic hydrocarbons.
PAH's TEQ values	The TEQ values have been calculated using the toxicity equivalence factors (TEF's) relative to Benzo(a)pyrene, as reported by Larsen & Larsen (1998) (TEF factors reported in the 2003 World Health Organisation (WHO) report E78963 - HEALTH RISKS OF PERSISTENT ORGANIC POLLUTANTS FROM LONG-RANGE TRANSBOUNDARY AIR POLLUTION).
ppm	Parts per million expressed on a volume / volume wet basis.
Sampling plane	Location at which measurements were conducted.
TOC	Total Organic Compounds. Total gaseous organic concentration of vapours consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons) The concentration can be expressed in terms of propane, hexane (or other appropriate organic calibration gas) or in terms of methane.
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_2, 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_2, carbonic acid, metallic carbides and carbonate salts.
>	Greater than.
<	Less than the minimum limit of detection using the specified method.
~	Approximately.