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

Emission Testing – July 2013
EPA 4 – Benzene Combustor

Dear Mr G Millard,

Tests were performed 5th July 2013 to determine emissions to air from the Benzene 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)
4	Benzene Combustor	Solid particles	milligrams per cubic meter (mg/m^3)	50	< 3	< 4
		Nitrogen dioxide	milligrams per cubic meter (mg/m^3)	350	59	88
		Volatile organic compounds (VOCs)	milligrams per cubic meter (mg/m^3)	20	< 0.9	< 1
		Hydrogen sulphide	milligrams per cubic meter (mg/m^3)	5	< 2	< 3

Note: All analytes are below the Licence Limit set by the NSW EPA as per licence 1048 (last amended on 6-May-2013). Results have also been corrected to 3% Oxygen as stipulated in Part 3, 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 their NSW EPA Environment Protection Licence (number 1048). Monitoring was performed on EPA Point 4 – Benzene Combustor for the following parameters:

- Flow rate
- Velocity
- Temperature
- Moisture
- Solid particles
- Dry gas Density
- Molecular weight
- Carbon dioxide (CO_2)
- Oxygen (O_2)
- Carbon monoxide (CO)
- Nitrogen oxides (NO_x) as NO_2
- Sulphur dioxide (SO_2)
- Hydrogen sulphide (H_2S)
- Volatile organic compounds (VOC)

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

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 4 – Benzene Combustor

5 July 2013

Flow Results	Measured MW	EPA 4 - Benzene Combustor 130224	
Time of flow test		1150 & 1315	hrs
Stack dimensions at sampling plane		1010	mm
Velocity at sampling plane		7.3	m/s
Average temperature		954	°C
Moisture content		0.91	% v/v
Flow rate at discharge conditions		5.9	m³/sec
Flow rate at wet NTP conditions		1.3	m³/sec
Flow rate at dry NTP conditions		1.3	m³/sec

Continuous Analyser Results	EPA 4 - Benzene Combustor 130224 78	Sampling Times	Concentration at NTP		Concentration at 3% O2		Mass rate	
Oxygen (dry basis)		1200-1259	8.9	% v/v	-		-	
Carbon dioxide (dry basis)		1200-1259	4.8	% v/v	-		-	
Dry gas density		1200-1259	1.3	kg/m3	-		-	
Molecular weight of stack gas, dry basis		1200-1259	29	g/g-mole	-		-	
Nitrogen oxides as NO_2		1200-1259	59	mg/m3	88	mg/m3	4.6	g/min
Sulphur dioxide as SO_2		1200-1259	51	mg/m3	75	mg/m3	3.9	g/min
Carbon monoxide as CO		1200-1259	11	mg/m3	16	mg/m3	0.86	g/min

EPA 4 – Benzene Combustor

5 July 2013

Isokinetic Sampling Results	EPA 4 - Benzene Combustor 130224 78	Sampling Times	Concentration at NTP		Concentration at 3% O2		Mass rate	
Solid Particles		1155-1301	< 3	mg/m3	< 4	mg/m3	< 0.2	g/min
No. of sampling points			*12*					
Length of sampling, min			*60*					
Stack gas molecular weight, g/g-mole (wet)			*29*					
Stack gas density, kg/m3, at wet NTP			*1.3*					

Non Isokinetic Sampling Results	EPA 4 - Benzene Combustor 130224 78	Sampling Times	Concentration at NTP		Concentration at 3% O2		Mass rate	
Hydrogen sulphide		1201-1311	< 2	mg/m3	< 3	mg/m3	< 0.2	g/min

Volatile Organic Compound (VOC) Results	EPA 4 - Benzene Combustor 130224 78	Sampling Times	Concentration at NTP		Concentration at 3% O2		Mass rate	
Benzene		1210-1310	< 0.4	mg/m3	< 0.5	mg/m³	< 0.03	g/min
Total VOCs (as n-Propane)		1210-1310	< 0.9	mg/m3	< 1	mg/m³	< 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-chlorotolune), Benzoyl Chloride, Naphthalene, Dodecane

Refer to "SAMPLE PLANE OBSERVATIONS" on page 5.

SAMPLING PLANE OBSERVATIONS

EPA 4 – Benzene Combustor

The sampling plane had 2 x 4 inch flange port(s). 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 benzene (BTX) ship loading operation to provide peak load rate between 1200 to 1259 PM on Friday, 5th July 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)	Analytical Laboratory Report Date(s)
Selection of sampling positions	TM-1	AS4323.1	Yes	NA	NA	Yes	14601	130224r	5/07/2013
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 4	Yes	NA	NA	Yes	14601		
Solid particles	TM-15	AS4323.2	Yes	Emission Testing Consultants	AS4323.2	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		
Carbon monoxide (CO)	TM-32	USEPA 10	Yes	Emission Testing Consultants	USEPA 10	Yes	14601		
Nitrogen oxides (NO_x) as NO_2	TM-11	USEPA 7E	Yes	Emission Testing Consultants	USEPA 7E	Yes	14601		
Sulphur dioxide (SO_2)	TM-4	USEPA 6C	Yes	Emission Testing Consultants	USEPA 6C	Yes	14601		
Hydrogen sulphide (H_2S)	TM-5	USEPA 11	Yes	SGS Australia Pty Ltd	AN513	Yes	2562(4354)	60654	12/07/2013
Volatile organic compounds (VOC)	TM-34	USEPA 18	Yes	SGS Australia Pty Ltd	AN467	Yes	2562(4354)	60654	12/07/2013

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).
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).
Mass rate	Mass of analyte per unit time (µg, mg or g/min).
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_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.

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