

Our reference: **N86506**

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6 December 2010

AGL Upstream Investments Pty Ltd  
PO Box 67  
MENANGLE NSW 2568**Attention Mr Aaron Clifton**

## ROSALIND PARK GAS PLANT

### Emission Testing Report - NOVEMBER 2010

Tests were performed at the request of AGL Upstream Investments Pty Ltd to determine emissions to air as detailed below;

Test Summary		
Location	Test Date	Test Parameters*
Point 3 – Engine 3	9 November 2010	Polycyclic aromatic hydrocarbons (PAH's), nitrogen oxides, carbon dioxide, oxygen, volatile organic compounds (VOC's), metals (Hg, Pb, As), sulfuric acid mist and sulfur trioxide (expressed as sulfur trioxide), sulfur dioxide, particulate matter <10µm (PM <sub>10</sub> ), hydrogen sulfide
Point 4 – Reboiler Flue 4	9 November 2010	Sulfuric acid mist and sulfur trioxide (expressed as sulfur trioxide), sulfur dioxide, nitrogen oxides, carbon dioxide, oxygen
Point 5 – Reflux Column Vent 5	9 November 2010	Sulfuric acid mist and sulfur trioxide (expressed as sulfur trioxide), sulfur dioxide, nitrogen oxides, carbon dioxide, oxygen
Point 1 – Engine 1	16 November 2010	Sulfuric acid mist and sulfur trioxide (expressed as sulfur trioxide), sulfur dioxide, nitrogen oxides, carbon dioxide, oxygen
Point 6 – Carbon Scrubber Vent	16 November 2010	Odour, oxygen, carbon dioxide

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

Please refer to the following pages for results, plant operating conditions, test methods, quality assurance / quality control information and definitions.

**Glenn Trenear**  
**NATA Signatory**  
jk doc:n86506.doc

Enclosed:

Appendix 1, Polycyclic aromatic hydrocarbons (PAH's) Report

**Nguyen Pham**  
**NATA Signatory**

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EML GROUP OF LABORATORIES

Consulting Chemists and Microbiologists MELBOURNE • SYDNEY • BRISBANE • PERTH

**RESULTS**

<b>Date</b>	9/11/2010	<b>Client</b>	AGL Upstream Investments Pty Ltd		
<b>Report</b>	N86506	<b>Stack ID</b>	Point 3 - Engine 3		
<b>Licence No.</b>	-	<b>Location</b>	Menangle	<b>State</b>	NSW
<b>EML Staff</b>	SC/SW/HP				
<b>Process Conditions</b>	Please refer to client records.				
<b>Reason for testing:</b>	Client requested testing to determine emissions to air				

<b>Sampling Plane Details</b>					
Sampling plane dimensions (mm) & area	385	0.116 m <sup>2</sup>			
Sampling port size, number & depth	1 x 4" Flange				
Access & height of ports	Elevated work platform	6 m			
Duct orientation & shape	Vertical	Circular			
Downstream disturbance	Exit	10 D			
Upstream disturbance	Inlet	7 D			
No. traverses & points sampled	1	4			
Traverse method & compliance	AS4323.1	Non-compliant			

<b>Comments</b>

<b>Stack Parameters</b>			
Moisture content, %v/v	17		
Gas molecular weight, g/g mole	28.2 (wet)	30.2 (dry)	
Gas density at NTP, kg/m <sup>3</sup>	1.26 (wet)	1.35 (dry)	
% Oxygen correction & Factor	7 %	0.68	

<b>Gas Flow Parameters</b>	
Temperature, K	728
Velocity at sampling plane, m/s	24
Volumetric flow rate, discharge, m <sup>3</sup> /s	2.7
Volumetric flow rate (wet NTP), m <sup>3</sup> /s	1
Volumetric flow rate (dry NTP), m <sup>3</sup> /s	0.86
Mass flow rate (wet basis), kg/hour	4600
Sampling time, min	60
Isokinetic rate, %	103
Velocity difference, %	<1

Isokinetic	Sampling time	Results		Licence Limit
		Concentration mg/m <sup>3</sup>	Mass Rate mg/s	
Sulfuric acid mist & sulfur trioxide (expressed as sulfur trioxide)		<0.018	<0.016	3.1
		<0.11	<0.091	7

Gases	Sampling time	Average			Licence Limit
		Concentration mg/m <sup>3</sup>	O2 corrected mg/m <sup>3</sup>	Mass Rate mg/s	
Nitrogen oxides (as NO <sub>2</sub> )		220	150	190	461
		Concentration %			
Carbon dioxide		12.8			
Oxygen		0.6			



<b>Date</b>	9/11/2010	<b>Client</b>	AGL Upstream Investments Pty Ltd	
<b>Report</b>	N86506	<b>Stack ID</b>	Point 3 - Engine 3	
<b>Licence No.</b>	-	<b>Location</b>	Menangle	<b>State</b> NSW
<b>EML Staff</b>	SC/SW/HP			
<b>Process Conditions</b>	Please refer to client records.			
<b>Reason for testing:</b>	Client requested testing to determine emissions to air			

Sampling Plane Details			
Sampling plane dimensions (mm) & area	385	0.116 m <sup>2</sup>	
Sampling port size, number & depth	1 x 4" Flange		
Access & height of ports	Elevated work platform	6 m	
Duct orientation & shape	Vertical	Circular	
Downstream disturbance	Exit	10 D	
Upstream disturbance	Inlet	7 D	
No. traverses & points sampled	1	4	
Traverse method & compliance	AS4323.1	Non-compliant	

Comments

Stack Parameters		
Moisture content, %v/v	17	
Gas molecular weight, g/g mole	28.2 (wet)	30.2 (dry)
Gas density at NTP, kg/m <sup>3</sup>	1.26 (wet)	1.35 (dry)
Gas Flow Parameters		
Temperature, K	733	
Velocity at sampling plane, m/s	24	
Volumetric flow rate, discharge, m <sup>3</sup> /s	2.7	
Volumetric flow rate (wet NTP), m <sup>3</sup> /s	1	
Volumetric flow rate (dry NTP), m <sup>3</sup> /s	0.85	
Mass flow rate (wet basis), kg/hour	4600	
Sampling time, min	60	
Isokinetic rate, %	101	
Velocity difference, %	<1	

PAH's	Sampling time	Results	
		Concentration ng/m <sup>3</sup>	Mass Rate ng/min
2-Methylnaphthalene		2200	1.1 E+05
Naphthalene		14000	7.3 E+05
Acenaphthylene		1200	60000
Acenaphthene		370	19000
Fluorene		320	16000
Phenanthrene		920	47000
Anthracene		130	6400
Fluoranthene		740	38000
Pyrene		530	27000
Benz(a)anthracene		110	5600
Chrysene		290	15000
Benzo(b)fluoranthene		130	6800
Benzo(k)fluoranthene		<84	<4300
Benzo(a)pyrene		<120	<6000
Indeno(1,2,3-cd)pyrene		<130	<6400
Dibenz(ah)anthracene		<100	<5100
Benzo(ghi)perylene		<130	<6400
Benzo(e)pyrene		<92	<4700
Perylene		<140	<7300
Total 16 PAH's		19000	9.7 E+05
Total 19 PAH's		21000	1.1 E+06
BaP-TEQ			
Lower Bound		27	1400
Middle Bound		120	5900
Upper Bound		210	10000



Test report prepared for AGL Upstream Investments Pty Ltd

<b>Date</b>	9/11/2010	<b>Client</b>	AGL Upstream Investments Pty Ltd	
<b>Report</b>	N86506	<b>Stack ID</b>	Point 3 - Engine 3	
<b>Licence No.</b>	-	<b>Location</b>	Menangle	<b>State</b> NSW
<b>EML Staff</b>	SC/SW/HP			
<b>Process Conditions</b>	Please refer to client records.			
<b>Reason for testing:</b>	Client requested testing to determine emissions to air			

VOC's (as n-Propane)		Results	
Totals	Sampling time	0915-1015	
		Concentration mg/m <sup>3</sup>	Mass Rate mg/s
Total		0.25	0.21

VOC's (speciated)		Results	
	Sampling time	0915-1015	
		Concentration mg/m <sup>3</sup>	Mass Rate mg/s
Detection limit <sup>(1)</sup>		<0.17	<0.14
Benzene		0.29	0.25
Toluene		0.19	0.16

**(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-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



<b>Date</b>	9/11/2010	<b>Client</b>	AGL Upstream Investments Pty Ltd	
<b>Report</b>	N86506	<b>Stack ID</b>	Point 3 - Engine 3	
<b>Licence No.</b>	-	<b>Location</b>	Menangle	<b>State</b> NSW
<b>EML Staff</b>	SC/SW/HP			
<b>Process Conditions</b>	Please refer to client records.			
<b>Reason for testing:</b>	Client requested testing to determine emissions to air			

<b>Sampling Plane Details</b>			
Sampling plane dimensions (mm) & area	385	0.116 m <sup>2</sup>	
Sampling port size, number & depth	1 x 4" Flange		
Access & height of ports	Elevated work platform	6 m	
Duct orientation & shape	Vertical	Circular	
Downstream disturbance	Exit	10 D	
Upstream disturbance	Inlet	7 D	
No. traverses & points sampled	1	4	
Traverse method & compliance	AS4323.1	Non-compliant	

<b>Comments</b>

<b>Stack Parameters</b>			
Moisture content, %v/v	17		
Gas molecular weight, g/g mole	28.2 (wet)	30.2 (dry)	
Gas density at NTP, kg/m <sup>3</sup>	1.26 (wet)	1.35 (dry)	

  

<b>Gas Flow Parameters</b>			
	Isokinetic	PM10	
Temperature, K	731	731	
Velocity at sampling plane, m/s	24	24	
Volumetric flow rate, discharge, m <sup>3</sup> /s	2.8	2.8	
Volumetric flow rate (wet NTP), m <sup>3</sup> /s	1	1	
Volumetric flow rate (dry NTP), m <sup>3</sup> /s	0.86	0.86	
Mass flow rate (wet basis), kg/hour	4700	4700	
Sampling time, min	60	60	
Isokinetic rate, %	101	105	
Velocity difference, %	2	2	

<b>Isokinetic (PM10)</b>	<b>Results</b>		
	Sampling time	1220-1320 (PM10)	
		Concentration	Mass Rate
		mg/m <sup>3</sup>	mg/s
PM10		2.5	2.1
D50 cut size, 10µm		9.8	

<b>Isokinetic (Metals)</b>	<b>Results</b>		
	Sampling time	1105-1205	
		Concentration	Mass Rate
		mg/m <sup>3</sup>	mg/s
Lead		<0.011	<0.0091
Mercury		0.000011	9.8 E-06
Arsenic		0.0021	0.0018

<b>Hydrogen Sulfide</b>	<b>Results</b>		
	Sampling time	1105-1205	
		Concentration	Mass Rate
		mg/m <sup>3</sup>	mg/s
Hydrogen sulfide		0.013	0.011



Test report prepared for AGL Upstream Investments Pty Ltd

<b>Date</b>	9/11/2010	<b>Client</b>	AGL Upstream Investments Pty Ltd		
<b>Report</b>	N86506	<b>Stack ID</b>	Point 4 - Reboiler Flue 4		
<b>Licence No.</b>	-	<b>Location</b>	Menangle	<b>State</b>	NSW
<b>EML Staff</b>	SC/SW/HP				
<b>Process Conditions</b>	Please refer to client records.				
<b>Reason for testing:</b>	Client requested testing to determine emissions to air				

<b>Sampling Plane Details</b>		
Sampling plane dimensions (mm) & area	260	0.0531 m <sup>2</sup>
Sampling port size, number & depth	1 x 4" Flange	
Access & height of ports	Elevated work platform	7 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Bend	9 D
No. traverses & points sampled	1	2
Traverse method & compliance	AS4323.1	Non-compliant

<b>Comments</b>

<b>Stack Parameters</b>		
Moisture content, %v/v	8.1	
Gas molecular weight, g/g mole	28.6 (wet)	29.5 (dry)
Gas density at NTP, kg/m <sup>3</sup>	1.28 (wet)	1.32 (dry)
% Oxygen correction & Factor	7 %	1.76
<b>Gas Flow Parameters</b>		
Temperature, K	504	
Velocity at sampling plane, m/s	2.3	
Volumetric flow rate, discharge, m <sup>3</sup> /s	0.12	
Volumetric flow rate (wet NTP), m <sup>3</sup> /s	0.065	
Volumetric flow rate (dry NTP), m <sup>3</sup> /s	0.06	
Mass flow rate (wet basis), kg/hour	300	
Sampling time, min	60	
Isokinetic rate, %	103	
Velocity difference, %	4	

Isokinetic	Results		Licence Limit
	1401-1501		
Sampling time	Concentration mg/m <sup>3</sup>	Mass Rate mg/s	mg/m <sup>3</sup>
Sulfuric acid mist & sulfur trioxide (expressed as sulfur trioxide)	0.037	0.0022	1
Sulfur dioxide	<0.14	<0.0081	35

Gases	Sampling time	Average			Licence Limit
		1308-1408			
		Concentration mg/m <sup>3</sup>	O2 corrected mg/m <sup>3</sup>	Mass Rate mg/s	mg/m <sup>3</sup>
Nitrogen oxides (as NO <sub>2</sub> )		57	100	3.4	110
Carbon dioxide		Concentration			
		%			
		5.5			
Oxygen		13			



<b>Date</b>	9/11/2010	<b>Client</b>	AGL Upstream Investments Pty Ltd		
<b>Report</b>	N86506	<b>Stack ID</b>	Point 5 - Reflux column vent 5		
<b>Licence No.</b>	-	<b>Location</b>	Menangle	<b>State</b>	NSW
<b>EML Staff</b>	SC/SW/HP				
<b>Process Conditions</b>	Please refer to client records.				
<b>Reason for testing:</b>	Client requested testing to determine emissions to air				

<b>Sampling Plane Details</b>		
Sampling plane dimensions (mm) & area	100	0.0079 m <sup>2</sup>
Sampling port size, number & depth	1 x 4" Flange	
Access & height of ports	Elevated work platform	12 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Junction	6 D
No. traverses & points sampled	1	1
Traverse method & compliance	AS4323.1	Non-compliant

<b>Comments</b>
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<b>Stack Parameters</b>		
Moisture content, %v/v	65 (saturated)	
Gas molecular weight, g/g mole	22.2 (wet)	30.0 (dry)
Gas density at NTP, kg/m <sup>3</sup>	0.99 (wet)	1.34 (dry)
% Oxygen correction & Factor	7 %	0.91
<b>Gas Flow Parameters</b>		
Temperature, K	362	
Velocity at sampling plane, m/s	1.8	
Volumetric flow rate, discharge, m <sup>3</sup> /s	0.014	
Volumetric flow rate (wet NTP), m <sup>3</sup> /s	0.011	
Volumetric flow rate (dry NTP), m <sup>3</sup> /s	0.0037	
Mass flow rate (wet basis), kg/hour	38	
Sampling time, min	60	
Isokinetic rate, %	99	
Velocity difference, %	<1	

Isokinetic	Sampling time	Results		Licence Limit
		1515-1615		
		Concentration mg/m <sup>3</sup>	Mass Rate mg/s	mg/m <sup>3</sup>
Sulfuric acid mist & sulfur trioxide (expressed as sulfur trioxide)		13	0.047	35
Sulfur dioxide		<0.36	<0.0013	1042

Gases	Sampling time	Average			Licence Limit
		1429-1529			
		Concentration mg/m <sup>3</sup>	O2 corrected mg/m <sup>3</sup>	Mass Rate mg/s	mg/m <sup>3</sup>
Nitrogen oxides (as NO <sub>2</sub> )		<4.1	<3.7	<0.015	13
Carbon dioxide		10.2			
Oxygen		5.6			



Test report prepared for AGL Upstream Investments Pty Ltd

<b>Date</b>	16/11/2010	<b>Client</b>	AGL Upstream Investments Pty Ltd		
<b>Report</b>	N86506	<b>Stack ID</b>	Point 1 - Engine 1		
<b>Licence No.</b>	-	<b>Location</b>	Menangle	<b>State</b>	NSW
<b>EML Staff</b>	SC/SW				
<b>Process Conditions</b>	Please refer to client records.				
<b>Reason for testing:</b>	Client requested testing to determine emissions to air				

<b>Sampling Plane Details</b>		
Sampling plane dimensions (mm) & area	600	0.283 m <sup>2</sup>
Sampling port size, number & depth	1 x 4" Flange	
Access & height of ports	Fixed ladder	3 m
Duct orientation & shape	Horizontal	Circular
Downstream disturbance	Bend	2 D
Upstream disturbance	Bend	8 D
No. traverses & points sampled	1	4
Traverse method & compliance	AS4323.1	Non-compliant

<b>Comments</b>

<b>Stack Parameters</b>		
Moisture content, %v/v	14	
Gas molecular weight, g/g mole	27.7 (wet)	29.4 (dry)
Gas density at NTP, kg/m <sup>3</sup>	1.24 (wet)	1.31 (dry)
% Oxygen correction & Factor	7 %	1.92
<b>Gas Flow Parameters</b>		
Temperature, K	629	
Velocity at sampling plane, m/s	29	
Volumetric flow rate, discharge, m <sup>3</sup> /s	8.3	
Volumetric flow rate (wet NTP), m <sup>3</sup> /s	3.6	
Volumetric flow rate (dry NTP), m <sup>3</sup> /s	3.1	
Mass flow rate (wet basis), kg/hour	16000	
Sampling time, min	60	
Isokinetic rate, %	97	
Velocity difference, %	-4	

Isokinetic	Sampling time	Results		Licence Limit
		Concentration	Mass Rate	
		mg/m <sup>3</sup>	mg/s	mg/m <sup>3</sup>
Sulfuric acid mist & sulfur trioxide (expressed as sulfur trioxide)		0.018	0.057	3.1
Sulfur dioxide		<0.11	<0.33	7

Gases	Sampling time	Average			Licence Limit
		Concentration	O2 corrected	Mass Rate	
		mg/m <sup>3</sup>	mg/m <sup>3</sup>	mg/s	mg/m <sup>3</sup>
Nitrogen oxides (as NO <sub>2</sub> )		170	320	510	461
Carbon dioxide		Concentration			
Oxygen		%	4.5	13.7	



<b>Date</b>	16/11/2010	<b>Client</b>	AGL Upstream Investments	
<b>Report</b>	N86506	<b>Stack ID</b>	Point 6 - Carbon Scrubber Vent	
<b>Licence No.</b>	-	<b>Location</b>	Menangle	<b>State</b> NSW
<b>EML Staff</b>	SC/SW			
<b>Process Conditions</b>	Please refer to client records.			
<b>Reason for testing:</b>	Client requested testing to determine emissions to air			

<b>Sampling Plane Details</b>		
Sampling plane dimensions (mm) & area	190	0.0284 m <sup>2</sup>
Sampling port size, number & depth	2 x 4" BSP	
Access & height of ports	Ground level	2 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Change in diameter	2 D
Upstream disturbance	Inlet	7 D
No. traverses & points sampled	1	1
Traverse method & compliance	AS4323.1	Satisfactory

**Comments**  
All results reported on a dry basis at NTP (except odour - wet NTP)

<b>Stack Parameters</b>		
Moisture content, %v/v	1.5	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at NTP, kg/m <sup>3</sup>	1.28 (wet)	1.29 (dry)
<b>Gas Flow Parameters</b>		
Temperature, K	304	
Velocity at sampling plane, m/s	6	
Volumetric flow rate, discharge, m <sup>3</sup> /s	0.17	
Volumetric flow rate (wet NTP), m <sup>3</sup> /s	0.15	
Volumetric flow rate (dry NTP), m <sup>3</sup> /s	0.15	
Mass flow rate (wet basis), kg/hour	700	
Velocity difference, %	3	

<b>Gases</b>	Sampling time	Average	
		Concentration mg/m <sup>3</sup>	Mass Rate mg/s
	1052-1152		
		Concentration	
		%	
Carbon dioxide		0.1	
Oxygen		20.9	

<b>Odour</b>	Sample		Analysis		Threshold ou	Concentration ou	Mass Rate oum <sup>3</sup> /s
	Pre-dilution	Time	Date	Time			
Test 1	1	1050-1110	17/11/10	1433	460	460	69
n-butanol threshold (ppb)		59ppb					
					Lower Confidence Limit	210	
					Upper Confidence Limit	990	



## PLANT OPERATING CONDITIONS

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

## TEST METHODS

Unless otherwise stated, the following methods meet the requirements of the NSW Department of Environment, Climate Change & Water (as specified in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*, January 2007). All sampling and analysis was performed by EML Air unless otherwise specified.

Parameter	NSW Test Method	Reference Method	Uncertainty	NATA Accredited	
				Sampling	Analysis
Sample Plane Criteria	TM-1	AS 4323.1	-	✓	NA
Flow rate, temperature and velocity	TM-2	USEPA 2	not specified	✓	NA
Moisture content	TM-22	USEPA 4	not specified	✓	✓
Sulfuric acid mist (including sulfur trioxide and sulfur dioxide)	TM-3	USEPA 8	not specified	✓	✓
Hydrogen sulfide	TM-5	USEPA 11	not specified	✓	✓
Nitrogen oxides (NO <sub>x</sub> )	TM-11	USEPA 7E	not specified	✓	✓
Metals (Hg, Pb, As)	TM-12	USEPA 29	not specified	✓	✓ <sup>1</sup>
Carbon dioxide	TM-24	USEPA 3A	not specified	✓	✓
Oxygen	TM-25	USEPA 3A	not specified	✓	✓
Volatile organic compounds (VOC's)	TM-34	USEPA 18	not specified	✓	✓
Particulate matter < 10µm (PM <sub>10</sub> )	OM-5	USEPA 201A	not specified	✓	✓
Polycyclic aromatic hydrocarbons (PAH's)	OM-6	CARB 429	not specified	✓	✓ <sup>2</sup>
Odour	OM-7	AS 4323.3	not specified	✓	✓

AS – Australian Standard

USEPA – United States Environmental Protection Agency

TM - Test Method

OM - Other approved method

1. Analysis was performed by EML (Chem) Pty Ltd, NATA accreditation number 2731. Results were reported to EML Air on 30 November 2010 in report number N023564.
2. Analysis was performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to EML Air on 29 November 2010 in report number #ORG10\_101.



## QUALITY ASSURANCE / QUALITY CONTROL INFORMATION

EML Air Pty Ltd is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources (Accreditation number 2732). Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for EML Air at NATA's website [www.nata.asn.au](http://www.nata.asn.au).

EML Air is accredited 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 Quality Assurance Manager.

A formal Quality Control program is in place at EML Air 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.

## 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.
PM <sub>10</sub>	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
BSP	British standard pipe.
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 basically 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.



# APPENDIX 1

**Polycyclic Aromatic Hydrocarbons (PAHs)  
Australian Government National Measurement Institute  
PAHs Report ORG10\_101**

<i>Sample Identification</i>	<i>NMI Lab Ref</i>	<i>Sample Location</i>	<i>Date of Test</i>
1007021 – 23 Resin, Filter & Rinse	N10/030392	Point 3 – Engine 3	9 November 2010



## ANALYSIS REPORT # ORG10\_101

<b>Client</b>	EML AIR PTY LTD 56 SWAN STREET WOLLONGONG NSW 2500	<b>Job No.</b>	EMLA02/101111
<b>Contact</b>	STEVEN COOPER	<b>Sampled by</b>	Client
		<b>Date Sampled</b>	9-Nov-2010
		<b>Date Received</b>	11-Nov-2010

The results relate only to the sample(s) tested.

**Method** | NGCMS 11.27

**Details** | The samples are spiked with a range of isotopically labelled PAHs then extracted with organic solvent. The extracts were purified by chemical treatment and column chromatography. Analysis was performed using high resolution gas chromatography with low resolution mass spectrometry. Results have been corrected for recoveries of the internal standard.

Instrument: HP 5975 GCMS run in SIM mode. Column is a DB5-ms (30m×0.25mm×0.25µm).  
Method based on CARB429, July 1997 Revision.

**Authorisation**

Danny Slee  
Senior Chemist- Enviro  
November 29, 2010

**Accreditation**



NATA Accredited Laboratory Number : 198

This report is issued in accordance with NATA's accreditation requirements.  
Accredited for compliance with ISO/IEC 17025.

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**Sample Details : Job No. EMLA02/101111**

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N10/030392	1007021 - 23	Emission	Resin # DAU041110C, Rinse, Filter, Engine 3

**Project Details**

Project Name	<i>Not specified</i>
Project Number	<i>Not specified</i>

**Key**

Analytes	Labelled internal std.	Analytes	Labelled internal std.
Naphthalene	d8-Naphthalene	Chrysene	d12-Chrysene
2-Methylnaphthalene		Benzo(b)fluoranthene	d12-Benzo(b)fluoranthene
Acenaphthylene	d8-Acenaphthylene	Benzo(k)fluoranthene	d12-Benzo(k)fluoranthene
Acenaphthene	d10-Acenaphthene	Benzo(e)pyrene	
Fluorene	d10-Fluorene	Benzo(a)pyrene	d12-Benzo(a)pyrene
Phenanthrene	d10-Phenanthrene	Perylene	
Anthracene		Indeno(1,2,3-cd)pyrene	d12-Indeno(1,2,3-c,d)pyrene
Fluoranthene	d10-Fluoranthene	Dibenz(ah)anthracene	d14-Dibenz(ah)anthracene
Pyrene		Benzo(ghi)perylene	d12-Benzo(ghi)perylene
Benz(a)anthracene	d12-Benz(a)anthracene		

**Abbreviations & Definitions**

ng/sample	nanograms per sample
<	level less than limit of reporting (LOR)
BaP-PEF <sup>†</sup>	Benzo(a)pyrene Potency Equivalent Factor
BaP-TEQ <sub>PAH</sub>	Benzo(a)pyrene Toxic Equivalents

<sup>†</sup> as defined in "Benzo(a)pyrene as a Toxic Air Contaminant", CARB/OEHHA Executive Summary, July 1994

TEQs are calculated by multiplying the quantified level for each toxic PAH by corresponding PEF and summing the result:

$$\text{BaP-TEQ}_{\text{PAH}} = \sum_{i=1}^n [\text{PAH}_i \times \text{BaP-PEF}_i] \quad i = \text{toxic PAH analyte index (1 to n=7)}$$

CARB	California Air Resources Board
OEHHA	Office of Environmental Health Hazard Assessment (US)

**Surrogate Standard** Known amount of deuterated standard added to the XAD resin prior to sampling. Surrogates are 'field spikes'. The surrogate recovery indicates how effectively the sample train retains PAHs collected on the resin. It is also a guide to matrix effects caused by time of storage and transportation.

**Internal Standard** Known amount of deuterated PAHs added to field samples, blanks and QC samples prior to laboratory analysis. The internal standard is used to measure the concentration of native PAHs and surrogates. The internal standard recovery will determine the performance of the laboratory method. Usual recoveries are 50 to 150%. Lower recoveries can be accepted as long as the signal/noise ratio of the internal standard is >10.

**Results : Job No. EMLA02/101111**

**Laboratory Reg. No.** N10/030392 **Date Reported** 29-Nov-2010  
**Client Sample Ref.** 1007021 - 23 **Date Extracted** 11-Nov-2010  
**Matrix** Emission  
**Description** Resin # DAU041110C, Rinse, Filter, Engine 3

PAH	Conc. ng	Reporting Level (LOR, ng)	BaP-PEF Value	BaP-TEQ Contribution	Labelled Internal recovery (%)	Flags
Naphthalene	17000	110	-	-	74	
2-Methylnaphthalene	2600	55	-	-		
Acenaphthylene	1400	60	-	-	55	
Acenaphthene	440	50	-	-	64	
Fluorene	380	65	-	-	116	
Phenanthrene	1100	200	-	-	138	
Anthracene	150	80	-	-		
Fluoranthene	880	240	-	-	128	
Pyrene	630	210	-	-		
Benz(a)anthracene	130	110	0.1	13	150	
Chrysene	350	90	0.01	3.5	140	
Benzo(b)fluoranthene	160	90	0.1	16	124	
Benzo(k)fluoranthene	<100	100	0.1	5.0	87	
Benzo(e)pyrene	<110	110	-	-		
Benzo(a)pyrene	<140	140	1.0	70	87	
Perylene	<170	170	-	-		
Indeno(1,2,3-cd)pyrene	<150	150	0.1	7.5	122	
Dibenz(ah)anthracene	<120	120	0.4	24	138	
Benzo(ghi)perylene	<150	150	-	-	99	

**Flags**

" \* " : indicates the recovery is outside range but signal to noise is >10.

Acceptable recovery range set at 50 to 150%.

Surrogate Recovery	%
d14-Terphenyl	140

**Summary Results**

BaP-TEQ <sub>PAH</sub>		
Lower Bound [excluding LOD values]	<b>33</b>	ng
Middle Bound [including half LOD values]	<b>140</b>	ng
Upper Bound [including LOD values]	<b>250</b>	ng