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Report Number R005758[DRAFT]

Emissions Testing Report
Enwave Central Park Pty Ltd, Chippendale

Document Information

Client Name:	Enwave Central Park Pty Ltd
Report Number:	R005758[DRAFT]
Date of Issue:	27 April 2018
Attention:	Atiq Rehman
Address:	2 Chippendale Way Chippendale NSW 2008
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

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Report Authorisation

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Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

Table of Contents

1 Executive Summary 4

2 Results Summary 4

3 Results 5

3.1 EPA ID 1 - Engine 1 5

3.2 EPA ID 2 - Engine 2 6

4 Plant Operating Conditions 7

5 Test Methods 7

6 Quality Assurance/Quality Control Information 7

7 Definitions 8

1 EXECUTIVE SUMMARY

Ektimo was engaged by Enwave Central Park Pty Ltd to perform emissions testing and compare results to the NSW EPA Environmental Protection Licence 20768.

Results from this stack emission monitoring program indicate that Enwave Central Park Pty Ltd was compliant with requirements of Licence 20768 during the sampling period.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA ID 1 - Engine 1	29 March 2018	Ammonia, nitrogen oxides (as NO_2), carbon dioxide, oxygen
EPA ID 2 - Engine 2		

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

All results are reported on a dry basis at STP. Unless otherwise indicated, the methods cited in this report have been performed without deviation.

Plant operating conditions have been noted in the report.

2 RESULTS SUMMARY

The following licence comparison table shows that all analytes highlighted in green are below the licence limit set by the NSW EPA as per licence 20768 (last amended on 18/04/2016).

EPA No.	Location Description	Pollutant	Units	Licence Limit	Detected Values
1	Engine 1	Nitrogen Oxides	mg/m^3	57	40
		Ammonia	mg/m^3	4	0.25
2	Engine 2	Nitrogen Oxides	mg/m^3	57	41
		Ammonia	mg/m^3	4	0.088

3 RESULTS

3.1 EPA ID 1 - Engine 1

Date	29/03/2018	**Client**	Enwave Central Park Pty Ltd
Report	R005758	**Stack ID**	EPA ID No. 1 - Engine 1
Licence No.	20768	**Location**	Chippendale
Ektimo Staff	Ryan Collins	**State**	NSW
Process Conditions	Engine load 100% during test.		180322

Sampling Plane Details		
Sampling plane dimensions	430 mm	
Sampling plane area	0.145 m²	
Sampling port size, number & depth	1" BSP (x2), 60 mm	
Access & height of ports	Stairs 1.5 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 7 D	
Upstream disturbance	Bend 6 D	
No. traverses & points sampled	2 8	
Sample plane compliance to AS4323.1	Satisfactory	

Stack Parameters		
Moisture content, %v/v	11	
Gas molecular weight, g/g mole	28.3 (wet)	29.5 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.32 (dry)
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1312 & 1430	
Temperature, °C	122	
Temperature, K	395	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, discharge, m³/s	1.9	
Volumetric flow rate (wet STP), m³/s	1.3	
Volumetric flow rate (dry STP), m³/s	1.2	
Mass flow rate (wet basis), kg/hour	6100	
Velocity difference, %	<1	

Gas Analyser Results	Average	
Sampling time	1312 - 1421	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	40	2.9
	Concentration %	
Carbon dioxide	6.2	
Oxygen	9.8	

Ammonia	Results	
Sampling time	1320-1420	
	Concentration mg/m³	Mass Rate g/min
Ammonia	0.25	0.018

3.2 EPA ID 2 - Engine 2

Date	29/03/2018	**Client**	Enwave Central Park Pty Ltd
Report	R005758	**Stack ID**	EPA ID No. 2 - Engine 2
Licence No.	20768	**Location**	Chippendale
Ektimo Staff	Ryan Collins	**State**	NSW
Process Conditions	Engine load 85% - 95% during test.		180322

Sampling Plane Details		
Sampling plane dimensions	430 mm	
Sampling plane area	0.145 m²	
Sampling port size, number & depth	1" BSP (x2), 60 mm	
Access & height of ports	Stairs 1.5 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Bend 7 D	
Upstream disturbance	Bend 6 D	
No. traverses & points sampled	2 8	
Sample plane compliance to AS4323.1	Satisfactory	

Stack Parameters		
Moisture content, %v/v	11	
Gas molecular weight, g/g mole	28.2 (wet)	29.5 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.32 (dry)
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1042 & 1204	
Temperature, °C	123	
Temperature, K	396	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, discharge, m³/s	1.9	
Volumetric flow rate (wet STP), m³/s	1.3	
Volumetric flow rate (dry STP), m³/s	1.2	
Mass flow rate (wet basis), kg/hour	5900	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1046 - 1155
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	41 / 2.9
	Concentration %
Carbon dioxide	6.4
Oxygen	9.7

Ammonia	Results
Sampling time	1050-1150
	Concentration mg/m³ / Mass Rate g/min
Ammonia	0.088 / 0.0061

4 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See Enwave Central Park 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.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sample plane criteria	NSW TM-1	NA	-	✓	NA
Flow rate, temperature and velocity	NSW TM-2	NA	8%, 2%, 7%	✓	NA
Moisture content	NSW TM-22	NSW TM-22	19%	✓	✓
Carbon dioxide	NSW TM-24	NSW TM-24	13%	✓	✓
Nitrogen oxides (NO_x)	NSW TM-11	NSW TM-11	12%	✓	✓
Oxygen	NSW TM-25	NSW TM-25	13%	✓	✓
Ammonia	ETC 330	Envirolab Inorg-093	18%	✓	✓‡

180404

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

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 13 April 2018 in report number 188875.

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.com.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing 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 Director.

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 worldwide.

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:

~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
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.
DECC	Department of Environment & Climate Change (NSW)
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.
DWER	Department of Water and Environmental Regulation
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra Red
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
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_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis
RATA	Relative Accuracy Test Audit
STP	Standard 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.
TM	Test Method
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Vic EPA	Victorian Environment Protection Authority
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.
XRD	X-ray Diffractometry