

Report Number R003731

Emission Testing Report
Clingcast Metals Pty Ltd, Kirrawee Plant



Document Information

Client Name: Clingcast Metals Pty Ltd
Report Number: R003731
Date of Issue: 26 June 2017
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Report Status

Format	Document Number	Report Date	Prepared By	Reviewed By (1)	Reviewed By (2)
Preliminary Report	-	-	-	-	-
Draft Report	R003731[DRAFT]	7/06/2017	JWe	DHi/ADa	ZXa
Final Report	R003731	26/06/2017	JWe	DHi	ZXa
Amend Report	-	-	-	-	-

Template Version: 170407

Amendment Record

Document Number	Initiator	Report Date	Section	Reason
Nil	-	-	-	-

Report Authorisation



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

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1 EXECUTIVE SUMMARY

Ektime was engaged by Clingcast Metals Pty Ltd to determine emissions to air as detailed below;

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Baghouse Stack	11 May 2017	Total solid particles, type 1 & 2 substances (metals or metal compounds), smoke, nitrogen oxides, carbon dioxide, oxygen, carbon monoxide, volatile organic compounds (VOC's)

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

The sampling methodologies chosen by Ektime are those recommended by the NSW Office of Environment and Heritage (as specified in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, January 2007*).

All results are reported on a dry basis at STP (273 K, 101.3 kPa). 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 TABLE

The table below outlines the proposed licence limits and the detected results for testing on the 11th of May 2017.

Results from this stack emission monitoring program indicate that Clingcast Metals Pty Ltd are compliant with the proposed baghouse stack emission limits during the sampling period.

Location Description	Pollutant	Units	POEO Reg Group C Limits ¹	POEO Reg Group 6 Limits ²	Detected values 11/05/17
Baghouse Stack	Total solid particles	mg/m ³	100	50	2.3
	Smoke	Ringelmann	1	1	0
	Type 1 & 2 substances in aggregate	mg/m ³	-	1	≤0.016
	Cadmium	mg/m ³	-	0.2	<0.0003
	Mercury	mg/m ³	-	0.2	<0.0002
	Nitrogen oxides	mg/m ³	-	350	<3
	Volatile organic compounds	mg/m ³	-	40	0.21

1. The standards shown are derived from the *Protection of the Environment Operations (Clean Air) Regulation NSW 2010* Schedule 6 "Standards of concentration for non-scheduled premises". It is considered that these standards apply to Clingcast Metals Baghouse Stack.
2. The standards shown are derived from the *Protection of the Environment Operations (Clean Air) Regulation NSW 2010* Schedule 4 "Standards of concentration for scheduled premises: general activities and plant", Group 6. These represent the most stringent standards that are routinely applied in NSW for new plant. It is considered that these standards do not apply to the Clingcast Baghouse and have been displayed in this table for comparison purposes only.

3 EMISSION LIMIT COMPARISON & DISCUSSION

Clingcast Metals Pty Ltd does not have an environmental protection licence prescribed by the NSW Environmental Protection Authority. Ektimo have provided an emission limit comparison based on the *Protection of Environment Operations (Clean Air) Regulation 2010* (hereafter "The POEO Regulation").

Pursuant to the POEO Regulation (*Division 3 - Standards for non - scheduled premises, Section 43 - Grouping of activities and plant*) Ektimo understands that the Baghouse stack emission point as to be classified as belonging to group C as the plant commenced operations on or after 1 September 2005 as a result of development consent granted pursuant to a development application made on or after 1 September 2005.

The emission limits outlined below are drawn directly from the POEO Regulation (*Schedule 6 – Standards of Concentration for non-scheduled premises*)

Air impurity	Activity or plant	Group	Concentration
Solid particles	Any activity or plant (except as listed below)	Group A	400 mg/m ³
		Group B	250 mg/m ³
		Group C	100 mg/m ³
Smoke	Any activity or plant in connection with which liquid or gaseous fuel is burnt	Group A, B or C in relation to marine vessels or premises, in approved circumstances	Ringelmann 3 or 60% opacity
		Group A, B or C, in relation to marine vessels or premises, in other circumstances	Ringelmann 1 or 20% opacity

In accordance with *Schedule 7 – Test methods, averaging periods and reference conditions for non - scheduled premises*, stacks classified as belonging to group C are required to comply with *part 3 - Reference conditions*. Accordingly Ektimo has applied reference conditions on the understanding that the Baghouse stack and system is not serving an activity that is considered to be a process of combustion.

Reference conditions relating to Group B or C		
Air impurity	Activity or plant	Reference conditions
Solid particles (Total)	Any activity or plant (except as listed below)	Dry, 273 K, 101.3 kPa
	Fuel burning equipment using solid fuel	Dry, 273 K, 101.3 kPa, 7% O ₂
	Fuel burning equipment using liquid or gaseous fuel	Dry, 273 K, 101.3 kPa, 3% O ₂
Smoke (if determining whether a specified standard of concentration of opacity has been exceeded)	Any activity or plant	Gas stream temperature above dew point. Path length corrected to stack exit diameter as per CEM-1.

In addition Ektimo have applied a more rigorous approach when reviewing the baghouse stack emissions and thus have applied further limits pertaining to the POEO Regulation (*Division 2 - Standards for Scheduled Premises, Section 32 - General Grouping of Activities and Plant*). In this approach the baghouse stack is classified as belonging to Group 6 as defined by commencing operations after 1 September 2005, as a result of an environment protection licence granted under the *Protection of the Environment Operations Act 1997* pursuant to an application made on or after 1 September 2005.

The emission limits outlined below are drawn directly from the POEO Regulation (*Schedule 3 – Standards of concentration for scheduled premises: activities and plant used for specific purposes*). Ektimo have applied appropriate limits associated with non-ferrous metals (excluding aluminium): primary production.

Non-ferrous metals (excluding aluminium): primary production			
Air impurity	Activity or plant	Standard of concentration	
Solid particles (Total)	Any sinter plant	Group 1	400 mg/m ³
	Any smelting or refining process	Group 2, 3 or 4	250 mg/m ³
	Any alloying or casting process	Group 5	100 mg/m ³
	Any fuel burning equipment	Group 6	50 mg/m ³
Nitrogen dioxide (NO ₂) or nitric oxide (NO) or both, as NO ₂ equivalent	Any smelting or refining process	Group 1, 2, 3 or 4	2,500 mg/m ³
	Any alloying or casting process	Group 5	2,000 mg/m ³
	Any sinter plant	Group 6	350 mg/m ³
	Any fuel burning equipment	Group 6	350 mg/m ³
Volatile organic compounds (VOCs), as n-propane equivalent	Any activity or plant using a non-standard fuel	Group 1, 2, 3, 4 or 5	—
		Group 6	40 mg/m ³ VOCs or 125 mg/m ³ CO
Type 1 substances and Type 2 substances (in aggregate)	Any smelting or refining process Any alloying or casting process Any sinter plant	Group 1, 2, 3 or 4	—
		Group 5	5 mg/m ³
		Group 6	1 mg/m ³
Cadmium (Cd) or mercury (Hg) individually	Any smelting or refining process Any alloying or casting process Any sinter plant	Group 1, 2 or 3	—
		Group 4	3 mg/m ³
		Group 5	1 mg/m ³
		Group 6	0.2 mg/m ³
Smoke	Any sinter plant Any smelting or refining process Any alloying or casting process Any fuel burning equipment	Group 1, in approved circumstances	Ringelmann 3 or 60% opacity
		Group 1, in other circumstances	Ringelmann 2 or 40% opacity
		Group 2, 3, 4, 5 or 6, in approved circumstances	Ringelmann 3 or 60% opacity
		Group 2, 3, 4, 5 or 6, in other circumstances	Ringelmann 1 or 20% opacity

In accordance with *Schedule 5 - Test methods, averaging periods and reference conditions for scheduled premises*, stacks classified as belonging to group 6 are required to comply with *part 3 - Reference conditions*. Accordingly Ektimo has applied reference conditions on the understanding that the baghouse stack and system is not serving an activity that is considered to be a process of combustion.

Reference conditions relating to Group 5 or 6		
Air impurity	Activity or plant	Reference conditions
All air impurities (except as listed below)	Any activity or plant (except as listed below)	Dry, 273 K, 101.3 kPa
	Any fuel burning equipment using solid fuel	Dry, 273 K, 101.3 kPa, 7% O ₂
	Any fuel burning equipment using gas or liquid fuel	Dry, 273 K, 101.3 kPa, 3% O ₂
	Gas turbines	Dry, 273 K, 101.3 kPa, 15% O ₂
Smoke (if determining whether a specified standard of concentration of opacity has been exceeded)	Any activity or plant	Gas stream temperature above dew point. Path length corrected to stack exit diameter as per CEM-1.

4 TESTING METHODOLOGY AND SAMPLING PLANE COMPLIANCE DISCUSSION

The sampling methodologies chosen by Ektime are those recommended by the NSW Office of Environment and Heritage (as specified in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, January 2007*); which are prescribed within the *POEO Clean Air Regulation 2002: Part 4 – Emission of air impurities from activities and plant*. All sampling and analysis was performed by Ektime unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Method Detection Limit	Uncertainty*	NATA Accredited	
					Sampling	Analysis
Sample plane criteria	NSW TM-1	NA	NA	-	✓	NA
Moisture content	NSW TM-22	NSW TM-22	1.0%	19%	✓	✓
Molecular weight	NSW TM-23	NSW TM-23	-	not specified	✓	✓
Temperature	NSW TM-2	NA	0°C	2%	✓	NA
Flow rate	NSW TM-2	NA	Location specific	8%	✓	NA
Velocity	NSW TM-2	NA	2 m/s	7%	✓	NA
Particulate matter	NSW TM-15	NSW TM-15	0.001 g/m ³	5%	✓	✓
Type 1 substances (Sb, As, Cd, Pb, Hg)	NSW TM-12	EnviroLab inhouse	Analyte specific	15%	✓	✓ ¹
Type 2 substances (Be, Cr, Co, Mn, Ni, Se, Sn, V)	NSW TM-13	EnviroLab inhouse	Analyte specific	15%	✓	✓ ¹
Speciated volatile organic compounds	NSW TM-34	USEPA SW-846 8260	0.3 mg/m ³	19%	✓	✓
Nitrogen oxides (NOx)	NSW TM-11	NSW TM-11	4 mg/m ³	12%	✓	✓
Carbon dioxide	NSW TM-24	NSW TM-24	0.1%	13%	✓	✓
Carbon monoxide	NSW TM-32	NSW TM-32	0.003 g/m ³	12%	✓	✓
Oxygen	NSW TM-25	NSW TM-25	0.1%	13%	✓	✓
Smoke	NSW TM-16	NSW TM-16	NA	not specified	✓	✓

1. Analysis performed by EnviroLab, NATA accreditation number 2901. Results were reported to Ektime on 25 May 2017 in report number 167369.

Ektime assessed the baghouse stack sampling plane criteria and selection of sampling points outlined in NSW TM-1 (Australian Standard 4323.1 -1995). In this method the selection of sampling plane position calls for an Ideal sampling plane to be located in a straight, preferably vertical section of stack or duct away from any flow obstructions which may cause a disturbance or other instability to the gas flow. This position will be found to exist at 7-8 hydraulic diameters downstream and 2-3 hydraulic diameters upstream from a flow disturbance. In the case of the Clingcast Metals baghouse stack the sampling plane is located 8 hydraulic diameters downstream of a centrifugal fan and 1.5 hydraulic diameters from the stack exit. See table 1 for details.

TABLE 1
CRITERIA FOR SELECTION OF SAMPLING PLANES

Type of flow disturbance	Minimum distance upstream from disturbance, diameters (D)	Minimum distance downstream from disturbance, diameters (D)
Bend, connection, junction, direction change	$>2D$	$>6D$
Louvre, butterfly damper (partially closed or closed)	$>3D$	$>6D$
Axial fan	$>3D$	$>8D$ (see Note)
Centrifugal fan	$>3D$	$>6D$

NOTE: The plane should be selected as far as practicable from a fan. Flow straighteners may be required to ensure the position chosen meets the check criteria listed in Items (a) to (f) below.

In addition the following criteria must be met.

- a) *The gas velocity is basically in the same direction at all points along each sampling traverse.*
- b) *The gas velocity at all sampling points is greater than 3 m/s.*
- c) *The gas flow profile at the sampling plane shall be steady, evenly distributed and not have acyclonic component which exceeds an angle of 15° to the duct axis, when measured near the periphery of a circular sampling plane*
- d) *The temperature difference between adjacent points of the survey along each sampling traverse is less than 10% of the absolute temperature, and the temperature at any point differs by less than 10% from the mean.*
- e) *The ratio of the highest to lowest pitot pressure difference shall not exceed 9:1 and the ratio of highest to lowest gas velocities shall not exceed 3:1. For isokinetic testing the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1*
- f) *The gas temperature at the sampling plane should preferably be above the dewpoint.*

If the criteria of items (a) to (f) cannot be achieved a new sampling position shall be selected. The baghouse stack at Clingcast metals all criteria of (a) to (f) is met and is suitable therefore a new sampling position is not required, although an increased number of sampling points shall be used in accordance with clause 4.2 (non-ideal sampling positions) of AS 4323.1-1995.

Clause 4.2 proposes that if the criteria of table 1 cannot be met then a greater number of points shall be used in order to retain as much accuracy as is practicable, by applying the appropriate sampling point factors from *table 2*. The product of both the upstream and downstream factors multiplied by the total number of sampling points from *table 3* should then be raised to the next even number of sampling points for each sampling traverse.

TABLE 2
SAMPLING POINT FACTORS

Non-ideal situation	Sampling point factors
Sampling plane downstream from disturbance:	
Diameters less than Table 1	
0	1.00
1	1.05
2	1.10
3	1.15
4 or more	1.20
Sampling plane upstream from disturbance:	
Diameters less than Table 1	
0	1.00
0.5	1.05
1.0	1.10
1.5 or more	1.15

TABLE 3
MINIMUM NUMBER OF SAMPLING POINTS FOR CIRCULAR SAMPLING PLANES

Sampling plane diameter m	Minimum number of sampling traverses	Minimum number of access holes	Minimum number of sampling points per radius	Minimum total number of sampling points
>0.20 ≤0.35	2	2	1	4
>0.35 ≤0.70	2	2	2	8
>0.70 ≤1.50	2	2	3	12
>1.50 ≤2.50	2	4	4	16
>2.50 ≤4.00	2	4	6	24
>4.00 ≤6.00	3	6	5	30
>6.00	3	6	6	36

By example the baghouse stack at Clingcast metals has a sampling plane diameter of 1355mm (1.355m). If an ideal sampling plane was available the total number of sampling points would equate to 12. Under clause 4.2 (non-ideal sampling positions) the sampling plane is 0.5 hydraulic diameters less than the downstream disturbance (stack exit) therefore an upstream factor of 1.05 is to be used. The sampling plane downstream factor is to be 1.00 as the criteria of *table 1* is met.

The equation is as follows; Increased number of sampling points = $1.00 \times 1.05 \times 6 = 6.3$, this result is rounded to the next even number: 8 points per sampling traverse. Thus the total number of sampling points has now become 16 rather than 12 because the sampling plane is non-ideal.

5 RESULTS

5.1 Baghouse Stack

Date	11/05/2017	Client	Cling Cast Metals
Report	R003731	Stack ID	Baghouse Stack
Licence No.	-	Location	Kirrawee
Ektime Staff	David Hill & Ryan Collins	State	NSW
Process Conditions	Please refer to client records.		

Sampling Plane Details

Sampling plane dimensions	1355 mm
Sampling plane area	1.44 m ²
Sampling port size, number	4" Flange (x2)
Access & height of ports	Fixed ladder 12 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 1.5 D
Upstream disturbance	Centrifugal fan 8 D
No. traverses & points sampled	2 16
Sample plane compliance to AS4323.1	Compliant but non-ideal

Comments

According to AS 4323.1 The sampling plane is deemed to be non-ideal due to the following reasons:

The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters

Moisture content, %v/v	0.51	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.29 (wet)	1.29 (dry)

Gas Flow Parameters

Temperature, °C	30
Velocity at sampling plane, m/s	11
Volumetric flow rate, discharge, m ³ /s	16
Volumetric flow rate (wet STP), m ³ /s	14
Volumetric flow rate (dry STP), m ³ /s	14
Mass flow rate (wet basis), kg/hour	67000

Gas Analyser Results	Average		Minimum		Maximum	
	1200-1325		1200-1325		1200-1325	
Sampling time						
	Concentration	Mass Rate	Concentration	Mass Rate	Concentration	Mass Rate
	mg/m ³	g/min	mg/m ³	g/min	mg/m ³	g/min
Combustion Gases						
Nitrogen oxides (as NO ₂)	<3	<3	<3	<3	<3	<3
Carbon monoxide	18	16	<2	<2	62	54
	Concentration		Concentration		Concentration	
	%		%		%	
Carbon dioxide	<0.3		<0.3		<0.3	
Oxygen	20.9		20.9		20.9	

Smoke Obscuration	Result
Time of assessment	1112 - 1118
Smoke Obscuration	0

Report	R003731	Stack ID	Baghouse Stack
Licence No.	-	Location	Kirrawee
Ektime Staff	David Hill & Ryan Collins	State	NSW
Process Conditions	Please refer to client records.		

Isokinetic Results	Sampling time	Results	
		1159-1325	
		Concentration mg/m ³	Mass Rate g/min
Solid Particles		2.3	2
Antimony		<0.003	<0.003
Arsenic		<0.001	<0.001
Beryllium		<0.0007	<0.0006
Cadmium		<0.0003	<0.0003
Chromium		<0.0004	<0.0004
Cobalt		<0.0004	<0.0004
Lead		0.0022	0.0019
Manganese		<0.001	<0.0009
Mercury		<0.0002	<0.0002
Nickel		<0.0007	<0.0006
Selenium		<0.003	<0.003
Tin		<0.001	<0.001
Vanadium		<0.0007	<0.0006
Type 1 & 2 Substances			
Upper Bound			
Total Type 1 Substances		≤0.0073	≤0.0063
Total Type 2 Substances		<0.009	<0.007
Total Type 1 & 2 Substances		≤0.016	≤0.014
Isokinetic Sampling Parameters			
Sampling time, min		80	
Isokinetic rate, %		105	
Gas Flow Parameters			
Final flow measurement time (hhmm)		1328	
Temperature, °C		30	
Temperature, K		303	
Velocity at sampling plane, m/s		11	
Volumetric flow rate, discharge, m ³ /s		16	
Volumetric flow rate (wet STP), m ³ /s		14	
Volumetric flow rate (dry STP), m ³ /s		14	
Mass flow rate (wet basis), kg/hour		67000	
Velocity difference, %		<1	

Total VOCs* (as n-Propane)	Sampling time	Results	
		1200-1300	
		Concentration mg/m ³	Mass Rate g/min
Total		0.21	0.18

*Total VOC's does not include methane

VOC (speciated)	Sampling time	Results	
		1200-1300	
		Concentration mg/m ³	Mass Rate g/min
Detection limit ⁽¹⁾		<0.03	<0.02
Benzene		0.25	0.22
Toluene		0.15	0.13

(1) Unless otherwise reported, the following target compounds were found to be below detection:

Ethanol, Isopropanol, 1,1-Dichloroethene, Dichloromethane, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethene, Toluene, 1,1,2-trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-trimethylbenzene, tert-Butylbenzene, 1,2,4-trimethylbenzene, 1,2,3-trimethylbenzene, Acetone, Pentane, Acrylonitrile, n-Hexane, Methyl ethyl ketone, Ethyl acetate, Cyclohexane, 2-Methylhexane, 2,3-Dimethylpentane, Isopropyl acetate, 3-Methylhexane, Ethyl acrylate, Heptane, Methyl methacrylate, Propyl acetate, Methylcyclohexane, MIBK, 2-Hexanone, Octane, Butyl acetate, 1-methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, Decane, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

6 CONCLUSIONS & RECOMONDATIONS

The methodologies chosen by Ektimo are suitable for air pollution emission monitoring of a baghouse exhaust for a foundry melting process. The results of the emission testing were found to be below the POEO Regulation group C and group 6 emission limits. Based on the uncertainty percentages cited in *Section 4 – Testing methodology and sampling plane compliance discussion* of this report Ektimo has great confidence in the results. If upper bound levels are to be calculated it would indicate that the results would still be below the proposed conservative limits of the POEO regulation Group 6 limits. Although workplace exposure standards cannot be directly compared with stack emission discharges, it should be noted that the reported benzene discharges are well below the Safe Work Australia time weighted average exposure limit of 3.2mg/m³.

The sampling plane compliance requirements are primarily in place to ensure that testing for gas flowrate and particulate matter (solid particles) is satisfactorily precise. As discussed in *Section 4 –Testing methodology and sampling plane compliance discussion* of this report Ektimo have taken samples at a greater number of points to account for the potential uncertainties.

Ektimo observed the Kirrawee site of Clingcast Metals Pty Ltd during normal operations. Ektimo staff members observed the furnace hoods in operation and noted effective fume capture from the furnaces as well as from the newly installed casting fume hood. The mini fogger odour suppressant located along the apex of the roofline was in operation during the entire time Ektimo staff were present onsite. In addition Ektimo staff members observed the mobile mini-fogger systems in place once castings had been poured. It is of Ektimo's opinion that these systems are adequate for minimising dust and odour at the site and are operating effectively to divert potential fugitive emissions into the baghouse system.

Ektimo understands that Clingcast now operates a continuous particulate monitor *Goyen EMP 6B* on the baghouse emissions. This monitor is an effective process control to determine when or if bags within the baghouse have broken or are at capacity. Ektimo recommends that annual maintenance and an active head self-test (zero & span) of the *Goyen EMP 6B* monitor be performed in addition to annual air emission monitoring of the stack emissions for the following compounds; total solid particles, type 1 & 2 substances (metals or metal compounds), smoke, nitrogen oxides, carbon dioxide, oxygen, carbon monoxide, volatile organic compounds (VOC's).

Ektimo also proposes in an effort to minimise the potential for escape of fugitive emissions that wherever possible Clingcast staff are to keep all access doors including roller doors closed as often as practicably possible. This system improvement will assist in containment of dust/fume and allow these emissions to be captured by the baghouse system.

7 PLANT OPERATING CONDITIONS

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

8 QUALITY ASSURANCE/ QUALITY CONTROL INFORMATION

Ektimo (EML) and Ektimo (ETC) are 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 (EML) and Ektimo (ETC) are accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025. – General Requirements for the Competence of Testing and Calibration Laboratories. ISO/IEC 17025 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 Compliance Manager.

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 world –wide.

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.

9 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

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