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Emission Monitoring Review
Clingcast Metals, Kirrawee

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Table of Contents

1	Executive Summary	4
	Baghouse stack discharge compliance table	4
	Dust monitor service	4
	Ambient dust monitoring	5
	Dust deposition gauge summary of results	5
	DustTrak summary of results	6
2	Emission Limit Discussion	7
2.1	Non-scheduled premises	7
2.2	Non-scheduled premises part 1- test methods	7
2.3	Non-scheduled premises part 2- averaging periods	7
2.4	Non-scheduled premises part 3- reference conditions	8
2.5	Assessment against scheduled premises criteria	8
3	Sampling Methodology	10
4	Graphed Results	11
5	Plant Operating Conditions	13
6	Quality Assurance/Quality Control Information	14
7	Definitions	15
8	Appendices	16

1 EXECUTIVE SUMMARY

Ektimo was engaged to conduct a consolidation of recent air emission monitoring conducted at the site of Clingcast Metals Pty Ltd, located at 98 Bath Road, Kirrawee, NSW, 2232.

The consolidation of testing results from the following reports have been included as appendices.

- EML Air Pty Ltd - *Emission Testing Report N92850*, 24 July 2014
- Ektimo Pty Ltd - *Emission Testing Report R001920r*, 24 December 2015
- Ektimo Pty Ltd - *Emission Testing Report R003551*, 1 December 2016
- Ektimo Pty Ltd - *Emission Testing Report R003731*, 26 June 2017
- Ektimo Pty Ltd - *Goyen EMP6 Service Report R003731-1*, 26 June 2017
- Todoroski Air Sciences Pty Ltd - *Ambient Dust Monitoring Report 17060713*, 21 December 2017

Ektimo has been requested to provide comment on the compliance of the recent air emission testing measurements conducted onsite. The stack emission testing results recorded annually have been demonstrated to be significantly below the requirements of Group C for non-scheduled premises according to the *Protection of Environment Operations (Clean Air) Regulation 2010* (hereafter "The POEO Regulation").

Baghouse stack discharge compliance table

Ektimo has provided comparison of results from the Baghouse Stack discharge against the POEO Regulation. During each of the sampling occasions Ektimo found that Clingcast Metals was compliant with the requirements of the relevant standards for the site. The following result summary table shows that all analytes highlighted in **green** are below the regulation limits.

Report Identity					N92850	R001920r	R003551	R003731
Location Description	Pollutant	Units	POEO Reg Group C Limits ¹	POEO Reg Group 6 Limits ²	Detected values 30/06/14	Detected values 3/11/15	Detected values 09/11/16	Detected values 11/05/17
Baghouse Stack	Total solid particles	mg/m ³	100	50	1.7	<0.73	2	2.3
	Smoke	Ringelmann	1	1	*	*	*	0
	Type 1 & 2 substances in aggregate	mg/m ³	-	1	0.0024 ⁽³⁾	0.0082	≤0.016	≤0.016
	Cadmium	mg/m ³	-	0.2	<0.00029	0.00069	<0.0003	<0.0003
	Mercury	mg/m ³	-	0.2	0.00003	<0.00022	<0.0002	<0.0002
	Nitrogen oxides	mg/m ³	-	350	<4.1	<4.1	<4	<3
	Volatile organic compounds	mg/m ³	-	40	0.0016	0.39	4.7	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".
 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 and have been displayed in this table for comparison purposes only.
 3. Results for Type 1 & type 2 substances in aggregate was not reported in EML Air Report N92850, results have been calculated retrospectively.
- * Smoke determination was not conducted as part of the scope of works for reports identified as N92850, R001920r & R003551

Dust monitor service

Ektimo provided a dust monitor service of the onsite particulate monitor *Goyen EMP6* on the 11 May 2017. Detailed in Ektimo report R003731-1. At the time of service, no apparent issues with the instrument were recorded, and the monitor was operational. Service of this instrument was conducted in accordance with the maintenance requirements specified in the *Goyen EMP6* operating manual.

Ambient dust monitoring

Ektimo has provided a concise review of the short-term ambient dust monitoring report conducted by Todoroski Air Sciences Pty Ltd, detailed in report 17060713 *Clingcast AQ monitoring_results*. This program consisted of dust deposition gauges & DustTrak (PM₁₀ & PM_{2.5}) monitoring. The sampling locations were identified as D1 & D2. For the purposes of identifying the locations a detailed description is outlined below;

D1- Within the carpark at the north-western corner of the project boundary.

D2- On the corner of a flat roof building located at the north-eastern area of the project site, adjacent to the baghouse.

The method chosen for determining deposited dust appears to be performed according to the relevant method specified in NSW Office of Environment and Heritage: *Approved Methods, Sampling and Analysis of Air Pollutants in New South Wales* (hereafter "the approved methods"). The method chosen for determining PM₁₀ and PM_{2.5} concentrations was not performed as specified by the approved methods, and as such, the results obtained are indicative only.

Todoroski Air Sciences provided the following conclusions contained within the report 17060713 'PM₁₀ & PM_{2.5} levels were low and well below the relevant criteria and are generally lower than many parts of Sydney. The results do not indicate any issue with particulate emissions attributable to the project at this location. The recorded dust levels at the D1 & D2 monitoring sites were low, and given a full year of monitoring, are likely to remain below the applicable criterion'.

The indicative monitoring results for PM₁₀ and PM_{2.5} suggest that the ambient concentrations of PM₁₀ and PM_{2.5} were below the *National Environment Protection Measure of Ambient Air Quality*, as also set out in the *Approved Methods for the modelling and assessment of air pollutants in New South Wales*.

The monitoring results summarised from the Todoroski Air Sciences report in the tables below suggest that the recorded results at the time of measurement were below the most applicable criterion for the methodologies chosen.

The following result summary tables shows that all results highlighted in green are below the proposed limits, results highlighted. In red are above the proposed limits.

Dust deposition gauge summary of results

Species	D1				D2			
	Criteria ¹	Sep-17	Oct-17	Nov-17	Criteria ¹	Sep-17	Oct-17	Nov-17
Units	g/m ² /month				g/m ² /month			
Total Insoluble Matter	4	2	2.3	1.6	4	1.4	1.3	0.8

- Criteria limit is adopted from the *Approved Methods for the modelling and Assessment of Air pollutants in New South Wales* (NSW, EPA 2017)
-monitoring of deposited dust appears to have been conducted in accordance with the requirements of AS3850.10.1 -2016

DustTrak summary of results

Date	Criteria ²	D1	D2	Criteria ²	D1	D2
Units	24 - hour average PM _{2.5} level (µg/m ³)			24 - hour average PM ₁₀ level (µg/m ³)		
Round 1						
1/09/17	25	2.4	5.2	50	6.5	14.1
2/09/17	25	10.6*	9.3*	50	28.4*	24.9*
3/09/17	25	20.3*	17.9*	50	54.6*	47.8*
4/09/17	25	1.4	1.3	50	4.5	3.6
5/09/17	25	1.0	0.9	50	3.0	2.4
6/09/17	25	1.2	1.3	50	3.9	3.7
7/09/17	25	1.3	1.4	50	3.9	3.8
8/09/17	25	1.0	1.3	50	3.2	3.4
9/09/17	25	1.8	1.3	50	5.1	3.3
10/09/17	25	3.1	2.2	50	8.4	5.8
11/09/17	25	8.8	4.4	50	23.9	11.7
Round 2						
24/10/17	25	4.4	4.4	50	12.5	13.2
25/10/17	25	5.7	5.3	50	16.4	15.5
26/10/17	25	3.5	3.4	50	10.3	10.9
27/10/17	25	4.6	4.3	50	13.0	12.9
28/10/17	25	7.4	6.8	50	20.4	19.2
29/10/17	25	6.3	5.9	50	17.3	16.4
30/10/17	25	5.1	4.4	50	15.5	14
31/10/17	25	3.0	2.3	50	10.7	8.4

2. Criteria limit is adopted from the *National Environment Protection (Ambient Air Quality) Measure, 2016*

* Particulate levels attributed to smoke from hazard reduction burn, (RFS,2017)

2 EMISSION LIMIT 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 scheduled limits detailed within the POEO Regulation.

2.1 Non-scheduled premises

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 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 1 – test methods, Part 2 - averaging periods & Part 3 - Reference conditions*. Accordingly Ektimo has applied the following test methods, test duration (averaging period) and reference conditions.

2.2 Non-scheduled premises part 1- test methods

Test methods and monitoring methods		
Air impurity	Test Method	Monitoring method
Solid particles (Total)	TM-15	Not applicable
Smoke (if determining whether a specified Ringelmann standard of concentration has been exceeded)	TM-16	Not applicable

2.3 Non-scheduled premises part 2- averaging periods

Averaging periods	
Air impurity	Averaging period
Solid particles (Total)	1 hour, or the minimum sampling period specified in the relevant test method referred to in Part 1, whichever is the greater
Smoke (if determining whether a specified Ringelmann standard of concentration has been exceeded)	6 minutes rolling

2.4 Non-scheduled premises part 3- reference conditions

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.

2.5 Assessment against scheduled premises criteria

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 Any smelting or refining process Any alloying or casting process Any fuel burning equipment	Group 1	400 mg/m ³
		Group 2, 3 or 4	250 mg/m ³
		Group 5	100 mg/m ³
		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 Any alloying or casting process Any sinter plant Any fuel burning equipment	Group 1, 2, 3 or 4	2,500 mg/m ³
		Group 5	2,000 mg/m ³
		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.

3 SAMPLING METHODOLOGY

The sampling methodologies adopted for the stack emission testing 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 2010: Schedule 5 Test methods, averaging periods, and reference conditions for scheduled premises*.

The stack emission testing that has been conducted meets the minimum requirements set out in the sampling methodologies 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*).

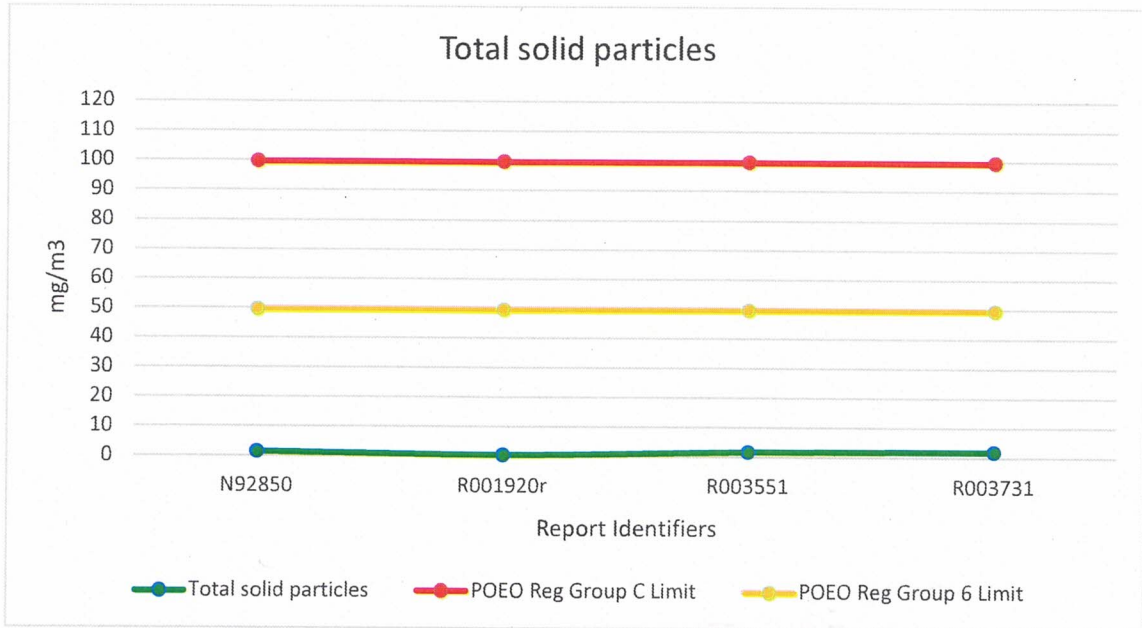
The minimum standard test length for particulates and type 1 & type 2 substances (isokinetic testing) is a 60 minute time period, according to TM-1 (Australian Standard 4323.1 -1995). In the case of Clingcast Metals' Baghouse stack, the sampling plane is considered non-ideal. NSW TM-1 calls for increasing the number of sampling points to achieve a greater representative sample. The isokinetic testing of the baghouse stack was conducted over a minimum of an 80 minute period per occasion.

The minimum standard in NSW for speciated volatile organic compounds according to TM-34 is 60 minutes, similarly combustion gases according to the following methods TM-11, TM-24, TM-25 & TM-32 also have a minimum requirement of 60 minutes of sampling. Smoke testing according to TM-16 is conducted over a 6 minute period.

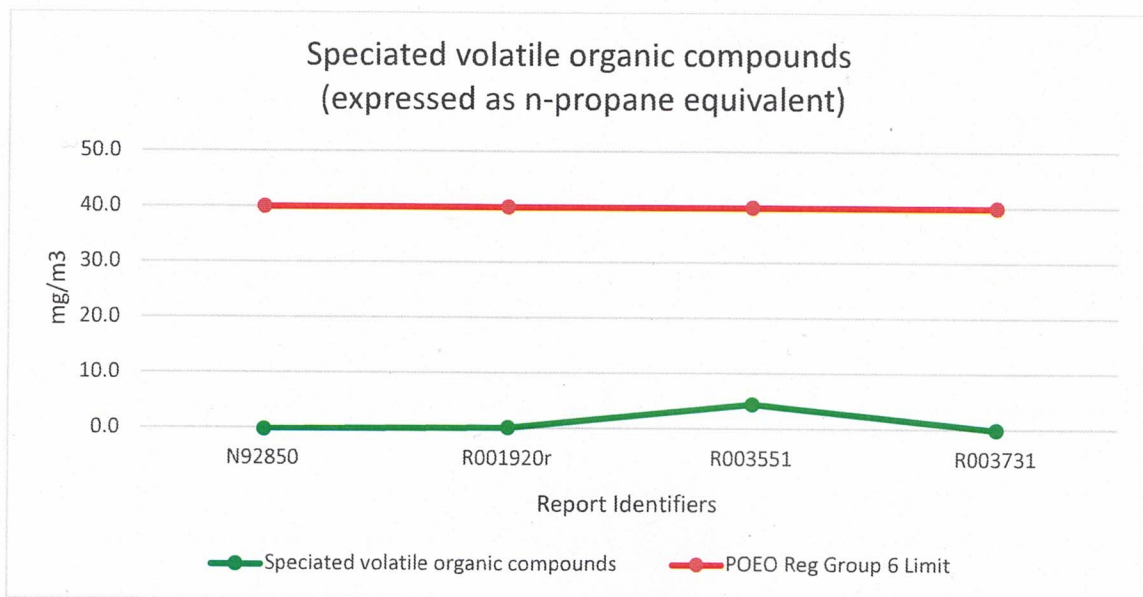
The sampling methodology adopted by Todoroski Air Sciences for the determination of deposited dust appears to be conducted with the requirements within the approved methods- specifically AM-19 (AS 3580.10.1 – 2016). The sampling method for the determination of PM₁₀ and PM_{2.5} concentrations was not performed according to the approved methods, DustTrak monitoring is more frequently adopted for dust management purposes.

4 GRAPHED RESULTS

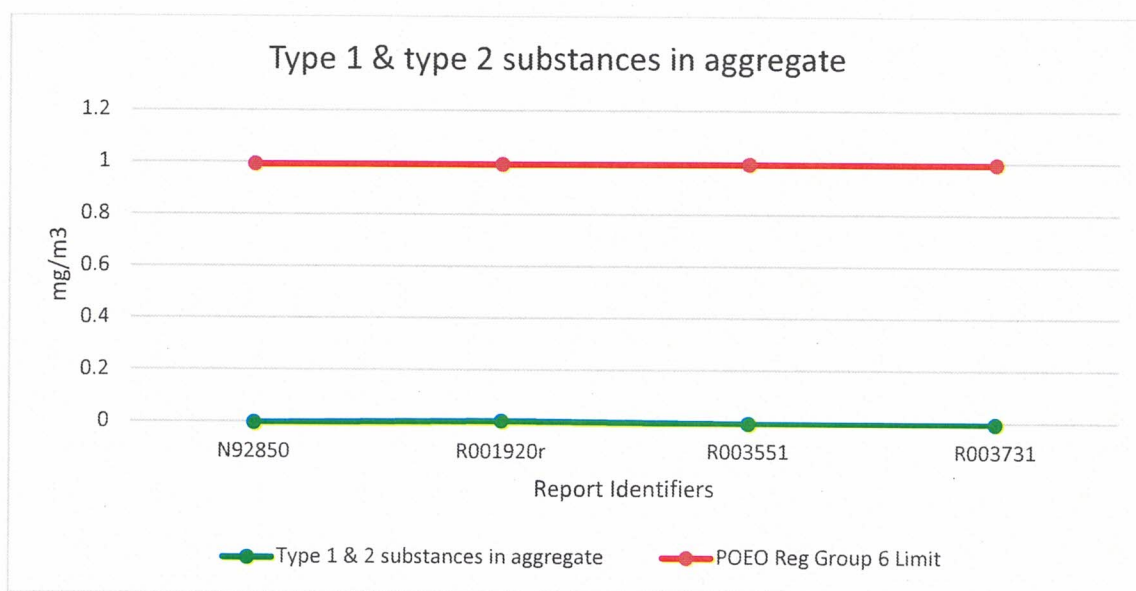
The graphed results below demonstrate the results measured at the time of testing from the Clingcast Metals baghouse discharge stack have consistently been measured on each testing occasion to be well below the applicable POEO guidelines.



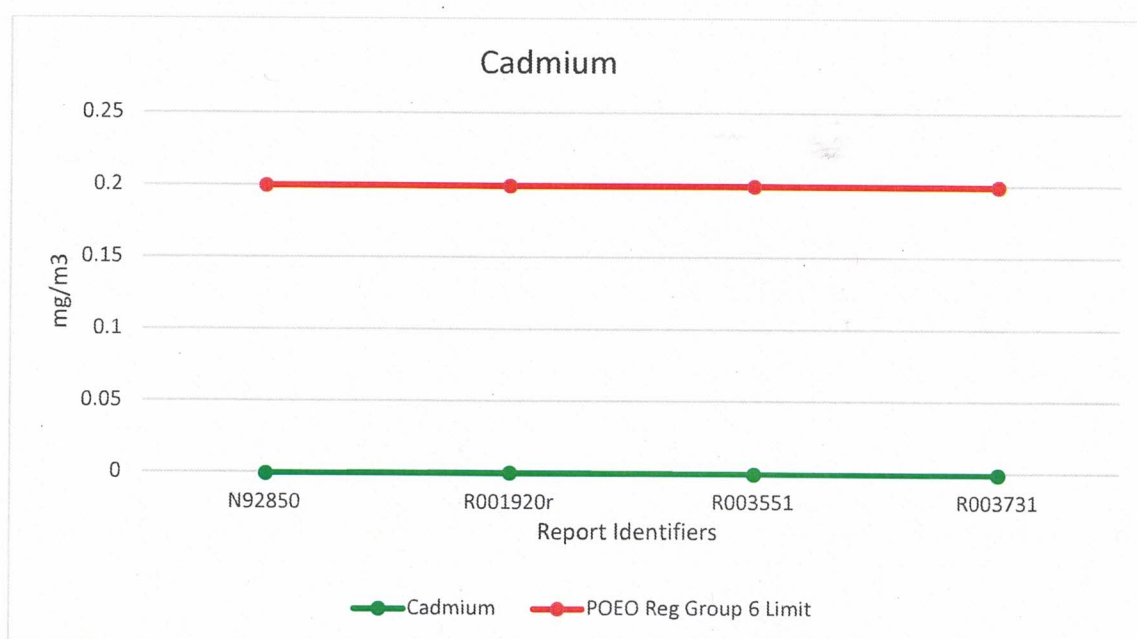
1 - Total solid particles results compared to relevant limits



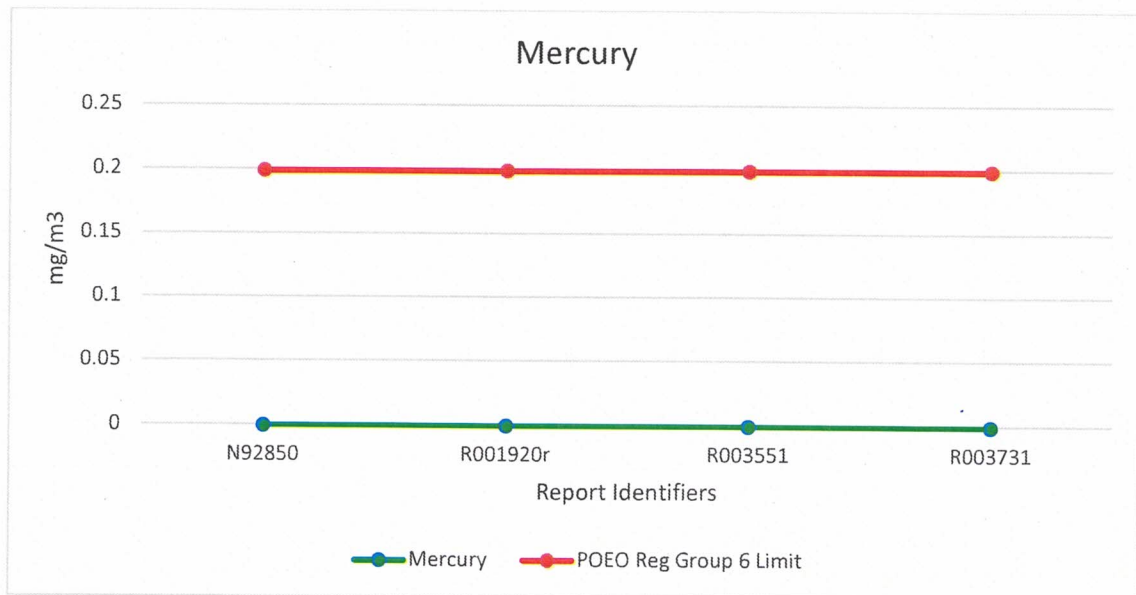
2 - Speciated volatile organic (as n-propane) results compared to relevant limit



3 - Type 1 & type 2 substances in aggregate results compared to relevant limit



4 - Cadmium results compared to relevant limit



5 - Mercury results compared to relevant limit

5 PLANT OPERATING CONDITIONS

In the reports provided by EML Air and Ektimo production data was not submitted, a generic comment was proposed *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.* Ektimo has been provided production data retrospectively from Clingcast Metals for the following testing occasions.

- EML Air Pty Ltd - Emission Testing Report N92850
Production data was not logged by Clingcast Metals
- Ektimo Pty Ltd - Emission Testing Report R001920r
Date: 03/11/15
Product: Copper Alloy G1 Gunmetal (1000kg), Cast Iron (900kg)
Duration: 0700-1145
- Ektimo Pty Ltd - Emission Testing Report R003551
Date: 09/11/16
Product: RM441 Phos Bronze Ingot (1000kg), SG Iron (600kg)
Duration: 0700-1430
- Ektimo Pty Ltd - Emission Testing Report R003731 & Goyen EMP6 Service Report R003731-1
Date: 11/05/17
Product: RM522 Lead Bronze Ingot (1000kg), Casting Iron (900kg)
Duration: 0700-1430

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.

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

8 APPENDICES

- EML Air Pty Ltd - Emission Testing Report N92850, 24 July 2014
- Ektimo Pty Ltd - Emission Testing Report R001920r, 24 December 2015
- Ektimo Pty Ltd - Emission Testing Report R003551, 1 December 2016
- Ektimo Pty Ltd - Emission Testing Report R003731, 26 June 2017
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