

**Clingcast Metals, Kirrawee
Emission Testing Report
Report Number R013734**

Document Information

Template Version 190722

Client Name: Clingcast Metals
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NATA Accredited Laboratory
No. 14601

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Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

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1 Executive Summary

1.1 Background

Ektimo was engaged by Clingcast Metals to perform emission testing at their Kirrawee plant in accordance with Environmental Licence 21514. Testing was performed during the ~80-minute period after the completion of casting, whilst the baghouse stack was continuing to exhaust to atmosphere. Once the casting process was completed, the Ektimo team began to initiate the sampling of test parameters outlined in the following section.

Testing was performed over two separate dates due to contamination identified during the analysis of speciated volatile organic compounds (VOCs). The retest for VOCs was successfully performed on November 17th, 2022.

1.2 Project Objective & Overview

The objective of the project was to conduct a programme to quantify emissions from one (1) discharge point to determine compliance with Clingcast Metals' Environmental Licence.

Emission testing was performed as follows:

Location	Test Date	Test Parameters*
Baghouse Stack	20 October 2022	Solid particles Carbon dioxide, oxygen Metals type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, Sn, V) Odour and character
	17 November 2022	Speciated volatile organic compounds (VOCs)

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP (except odour wet – STP).

Plant operating conditions have been noted in the report.

1.3 Licence Comparison

The following licence comparison table shows that all analytes highlighted in green are within the licence limit set by the NSW EPA as per licence 21514 (last amended on 5 May 2021).

Location Description	Pollutant	Units	Licence Limit	Detected values
Baghouse Stack	Total solid particles	mg/m ³	5	<2
	Type 1 & 2 substances in aggregate	mg/m ³	0.1	≤0.025
	Volatile organic compounds (as n-propane)	mg/m ³	5	1.4

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 Baghouse Stack

Date	20/10/2022	Client	Clingcast Metals
Report	R013734	Stack ID	Baghouse Stack
Licence No.	21514	Location	Kirrawee
Ektimo Staff	Graham Edwards, Breandan Scholand	State	NSW
Process Conditions	Please refer to client records.		220920

Sampling Plane Details	
Sampling plane dimensions	1355 mm
Sampling plane area	1.44 m ²
Sampling port size, number & depth	4" Flange (x2), 335 mm
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 conformance to AS 4323.1	Conforming but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
 The highest to lowest gas velocity ratio exceeds 1.6:1
 The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters	
Moisture content, %v/v	1.4
Gas molecular weight, g/g mole	28.9 (wet) 29.0 (dry)
Gas density at STP, kg/m ³	1.29 (wet) 1.30 (dry)
Gas density at discharge conditions, kg/m ³	1.15

Gas Flow Parameters	
Flow measurement time(s) (hhmm)	1320 & 1610
Temperature, °C	30
Temperature, K	304
Velocity at sampling plane, m/s	11
Volumetric flow rate, actual, 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
Sampling time		1421 - 1602	1421 - 1602	1421 - 1602
		Concentration	Concentration	Concentration
		%v/v	%v/v	%v/v
Carbon dioxide		<0.4	<0.4	<0.4
Oxygen		21	20.7	21.1

Odour		Average		Test 1		Test 2	
Sampling time				1417 - 1436		1436 - 1516	
		Concentration	Odourant	Concentration	Odourant	Concentration	Odourant
		ou	oum ³ /min	ou	oum ³ /min	ou	oum ³ /min
Results		37	31000	28	24000	45	39000
Lower uncertainty limit		37		28		45	
Upper uncertainty limit		37		28		45	
Analysis date & time				21/10/22, 0831		21/10/22, 0831	
Holding time				18 hours		17 hours	
Dilution factor				1		1	
Bag material				Nalophan		Nalophan	
Butanol threshold (ppb)		70					
Laboratory temp (°C)		22					

Date	20/10/2022	Client	Clingcast Metals
Report	R013734	Stack ID	Baghouse Stack
Licence No.	21514	Location	Kirrawee
Ektimo Staff	Graham Edwards, Breandan Scholand	State	NSW
Process Conditions	Please refer to client records.		220920

Isokinetic Results	Sampling time	Results	
		1426-1546	
		Concentration mg/m ³	Mass Rate g/min
Solid Particles		<2	<2
Antimony		<0.004	<0.003
Arsenic		<0.002	<0.001
Beryllium		<0.0005	<0.0004
Cadmium		<0.0006	<0.0005
Chromium		0.0011	0.00094
Cobalt		<0.0005	<0.0005
Lead		0.0046	0.0039
Manganese		0.0026	0.0022
Mercury		<0.0004	<0.0003
Nickel		<0.002	<0.001
Selenium		<0.004	<0.004
Tin		<0.003	<0.002
Vanadium		<0.0009	<0.0008
Type 1 & 2 Substances			
Upper Bound			
Total Type 1 Substances		≤0.011	≤0.0094
Total Type 2 Substances		≤0.014	≤0.012
Total Type 1 & 2 Substances		≤0.025	≤0.022
Isokinetic Sampling Parameters			
Sampling time, min		80	
Isokinetic rate, %		101	
Gravimetric analysis date (total particulate)		27-10-2022	

Date	17/11/2022	Client	Clingcast Metals
Report	R013734	Stack ID	Baghouse Stack
Licence No.	21514	Location	Kirrawee
Ektimo Staff	Adnan Latif / Ahmad Ramiz	State	NSW
Process Conditions	Please refer to client records.		22 1110

Sampling Plane Details	
Sampling plane dimensions	1355 mm
Sampling plane area	1.44 m ²
Sampling port size, number & depth	4" Flange (x2), 335 mm
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 conformance to AS 4323.1	Conforming but non-ideal
Comments	
The discharge is assumed to be composed of dry air and moisture	
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	1.2	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m ³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m ³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1415 & 1546	
Temperature, °C	31	
Temperature, K	304	
Velocity at sampling plane, m/s	11	
Volumetric flow rate, actual, 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	66000	

Total VOCs (as n-Propane)	Results	
	Concentration mg/m ³	Mass Rate g/min
Total	1.4	1.2

VOC (speciated)	Sampling time	Results 1439-1539	
		Concentration mg/m ³	Mass Rate g/min
Detection limit ⁽¹⁾		<0.1	<0.08
Ethanol		0.59	0.5
Acetone		0.27	0.23
Benzene		0.94	0.79
Toluene		0.22	0.19

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

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

3 Plant Operating Conditions

During the sampling times on October 20th and November 17th, 2022, the cast iron furnace was operating normally (charging), melting, and casting of ductile iron/SG and cast iron. The copper furnace was operating normally (charging)

4 Test Methods

All sampling and analysis 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
Sampling points - Selection	NSW EPA TM-1 (USEPA Method 1)	NA	NA	✓	NA
Flow rate, temperature & velocity	NSW EPA TM-2 (USEPA Method 2)	NSW EPA TM-2 (USEPA Method 2)	8%, 2%, 7%	NA	✓
Moisture content	NSW EPA TM-22 (USEPA Method 4)	NSW EPA TM-22 (USEPA Method 4)	8%	✓	✓
Molecular weight	NA	NSW EPA TM-23 (USEPA Method 3)	not specified	NA	✓
Dry gas density	NA	NSW EPA TM-23 (USEPA Method 3)	not specified	NA	✓
Carbon dioxide	NSW EPA TM-24 (USEPA Method 3A)	NSW EPA TM-24 (USEPA Method 3A)	13%	✓	✓
Oxygen	NSW EPA TM-25 (USEPA Method 3A)	NSW EPA TM-25 (USEPA Method 3A)	13%	✓	✓
Speciated volatile organic compounds (VOCs)	NSW EPA TM-34 ^d (USEPA Method 18)	Ektimo 344	19%	✓	✓ [†]
Solid particles (total)	NSW EPA TM-15 (AS 4323.2)	NSW EPA TM-15 (AS 4323.2)	3%	✓	✓ ^{††}
Total (gaseous & particulate) metals & metallic compounds	NSW EPA TM-12, NSW EPA TM-13, NSW EPA TM-14 (USEPA Method 29)	Envirolab in-house methods Metals-006, Metals-022 & Metals-021	15%	✓	✓ [‡]
Type 1 substances (As, Cd, Hg, Pb, Sb)	NSW EPA TM-12 (USEPA Method 29)	Envirolab in-house methods Metals-006, Metals-022 & Metals-021	15%	✓	✓ [‡]
Type 2 substances (Be, Cr, Co, Mn, Ni, Se, Sn, V)	NSW EPA TM-13 (USEPA Method 29)	Envirolab in-house methods Metals-006, Metals-022 & Metals-021	15%	✓	✓ [‡]
Odour	NSW EPA OM-7 (AS 4323.3)	The Odour Unit method AS 4323.3	refer to results	✓	✓ [¥]
Odour characterisation	NA	direct observation	NA	NA	✘

220914

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

† Analysis performed by Ektimo. Result was reported to Ektimo on 28 November 2022 in report LV-003621.

†† Gravimetric analysis conducted at the Ektimo, NSW laboratory, NATA accreditation number 14601.

¥ Odour analysis performed by The Odour Unit, Mascot, NSW by forced choice olfactometry, NATA accreditation number 14974. Results was reported on 21 October 2022 in report SYD20221021_076.

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Result was reported to Ektimo on 9 November 2022 in report 309627-[R00].

^d Excludes recovery study as specified in Section 8.4.3 of USEPA Test Method 18.

4.1 Deviations to Test Methods

NSW EPA TM-34 (USEPA 18)

Ektimo notes that the sampling and analysis of Volatile Organic Compounds (VOCs), per USEPA Method 18 has excluded the recovery study as specified in Section 8.4.3. Performing the recovery study described in Section 8.4.3 of USEPA Method 18 for analytes present at low levels is problematic. Given this, Ektimo applies a threshold of 50µg as a lower-bound mass, below which the 'spiking' of specific volatile organic compounds is not performed. For the purposes of this round of monitoring, all compounds (outlined below) were below 50µg. Therefore, recovery studies were not performed.

- Ethanol (12 µg)
- Acetone (5.4 µg)
- Benzene (19 µg)
- Toluene (4.5 µg)

5 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 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 APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

6 Definitions

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

% v/v	Volume to volume ratio, dry or wet basis
~	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/CEMS	Continuous emission monitoring/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 is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. 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 (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
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	Odour unit. One OU is that concentration of odourant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM ₁₀	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
PM _{2.5}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
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.
TM	Test method
TOC	Total organic carbon. This is 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)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

7 Appendix 1: Site Photo



Figure 1 - Baghouse Stack

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