

2nd Quarter Emissions Testing Report 2017

OneSteel Recycling Hexham



NATA ACCREDITATION No. 2778 (14391)
Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards
This document may not be reproduced except in full.

2nd Quarter Emissions Testing Report 2017

OneSteel Recycling Hexham

Client: OneSteel Recycling Pty Ltd

ABN: 28 002 707 262

Prepared by

AECOM Australia Pty Ltd
17 Warabrook Boulevard, Warabrook NSW 2304, PO Box 73, Hunter Region MC NSW 2310, Australia
T +61 2 4911 4900 F +61 2 4911 4999 www.aecom.com
ABN 20 093 846 925

20-Jun-2017

Job No.: 60493017

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.


Quality Information

Document 2nd Quarter Emissions Testing Report 2017

Ref 60493017

Date 20-Jun-2017

Prepared by Colin Clarke

Reviewed by Chad Whitburn Approved Signatory 

Revision History


Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	20-Jun-2017	Report for Issue	Chad Whitburn Associate Director - Compliance Services	

Table of Contents

1.0	Introduction	1
2.0	Sampling Plane Requirements	2
3.0	Methodology	3
	3.1 NATA Accredited Methods	3
	3.2 Equipment Calibration	3
4.0	Sampling Location	4
	4.1 Sampling Location Summary	4
5.0	Results	5
Appendix A		
	Field Sheets (19 pages)	A
Appendix B		
	Laboratory Results (8 pages)	B

List of Tables

Table 1	Criteria for Selection of Sampling Planes (AS 4323.1)	2
Table 2	AECOM NATA Endorsed Methods	3
Table 3	Sampling Location Summary	4
Table 4	Shredder Baghouse Emission Results Summary, 5 April 2017	5
Table 5	Fine Particulate (PM ₁₀), Total Particulate and Hazardous Substance (Metals) Results, 5 April 2017	6
Table 6	Hazardous Substances (Metals) Elemental Analysis Results, 5 April 2017	7

1.0 Introduction

AECOM was appointed by OneSteel Recycling Pty Ltd to conduct a series of measurements to determine air emissions from the Shredder Bag house Stack (EPL Point 1) at the Hexham facility. Measurements were required for NSW EPA licence compliance (EPL No. 5345).

Testing was undertaken on 5 April 2017 to investigate emission concentrations for the following parameters:

- Fine Particulates (PM₁₀);
- Total Particulate (TP); and
- Hazardous Substances (Metals) including Lead and Mercury.

Laboratory analysis was undertaken by the following laboratories which hold NATA accreditation for the specified tests:

- Steel River Testing, laboratory NATA accreditation number 18079, performed the following analysis detailed in report number 13347-0-M & 13347-0-P:
 - Total Particulate (TP);
 - Fine Particulates (PM₁₀); and
 - Moisture.
- SGS Australia laboratory NATA accreditation number 2562, performed the following analysis detailed in report number ME302438:
 - Hazardous Substances (Metals).

2.0 Sampling Plane Requirements

The criteria for sampling planes are specified in AS 4323.1-1995 (R2014).

Table 1 Criteria for Selection of Sampling Planes (AS 4323.1)

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.

- a. *The gas flow 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 a cyclonic 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 with the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1; and*
- f. *The gas temperature at the sampling plane should preferably be above the dewpoint.*

With the exception of point 'b', the sampling plane was in accordance with AS4323.1. The gas stream velocities at each sampling point were found to be 2.4 m/s. Please note that the bag house was not running at full capacity at the time of testing.

3.0 Methodology

3.1 NATA Accredited Methods

The following methods are accredited with the National Association of Testing Authorities (NATA) (accreditation number 2778 (14391)) and are approved for the sampling and analysis of gases. Specific details of the methods are available on request.

All sampling and analysis is conducted according to the methods in **Table 2**.

Table 2 AECOM NATA Endorsed Methods

NSW EPA Approved Methods	USEPA Methods	Method Title
AS4323.1 (NSW EPA TM-1)	USEPA (2000) Method 1	Selection of sampling positions
AS4323.2 (NSW EPA TM-15)	USEPA (2000) Method 5 under approved circumstances	Determination of total particulate matter – isokinetic manual sampling – gravimetric method
NSW EPA TM-2	USEPA (2000) Method 2 or 2C or USEPA (1999) Method 2F or 2G or 2H (as appropriate)	Determination of stack gas velocity and volumetric flow rate (type s pitot tube)
NSW EPA TM-22	USEPA (2000) Method 4	Determination of moisture content in stack gases
NSW EPA TM-23	USEPA (2000) Method 3	Gas analysis for the determination of dry molecular weight
NSW EPA OM-5	USEPA (1997) Method 201 or 201A (as appropriate)	Determination of PM ₁₀ emissions
NSW EPA TM-12,13 and 14	USEPA Method 29	Determination of metal emissions from stationary sources

All parameters are reported adjusted to 0°C at 1 atmosphere and dry gas.

3.2 Equipment Calibration

AECOM has a calibration schedule to ensure the emission testing equipment is maintained in good order and with known calibration. Equipment used in this project was calibrated according to the procedures and frequency identified in the AECOM calibration schedule. Details of the schedule and the calibration calculations are available on request.

4.0 Sampling Location

4.1 Sampling Location Summary

Table 3 provides a summary of the location sampled by AECOM on 5 April 2017.

Table 3 Sampling Location Summary

Discharge Description	Shredder Baghouse Stack (EPL Point 1)
Duct Shape	Circular
Construction Material	Metal
Duct Diameter (mm)	760
Minimum No. Sampling Points	12
Sampling Ports	2
Min. Points/Traverse	6
Disturbance	No
Distance from Upstream Disturbance	6.6D
Type of Disturbance	Bend
Distance from Downstream Disturbance	2.6D
Type of Disturbance	Stack Exit
Ideal Sampling Location	Yes ²
Correction Factors Applied	No
Total No. Points Sampled	12
Points/Traverse	6
Sampling Performed to Standard ¹	Yes ²

¹ AS 4323.1 Section 4.1

² The sampling location was ideal in terms of flow disturbances, but did not comply with AS 4323.1 point b) as the corrected velocity of the gas at all sampling points was found to be 2.5 m/s (minimum 3m/s).
D = Diameters

5.0 Results

A summary of air emission test results is shown in **Table 4**. Detailed results along with gas stream properties during the testing period can be found in **Table 5**. Speciated Hazardous Substances (Metals) results are presented in **Table 6**. Emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atm pressure for comparison with regulatory limits.

Field sheets and final calculations recorded during the project are attached as **Appendix A**. Laboratory reports can be referred to in **Appendix B**.

AECOM has a calculated limit of uncertainty in regards to results. The estimation of measurement uncertainty in source testing is conducted to provide an indication of the precision of the measurement result and a degree of confidence in the range of values the reported result may represent. The measurement of uncertainty has been calculated at $\pm 13.6\%$.

Table 4 Shredder Baghouse Emission Results Summary, 5 April 2017

Parameter	Emission Concentration (EPL Point 1)	Emission Concentration Limit
Total Particulate (TP) (mg/m ³)	1.2	100
Fine Particulate (PM ₁₀) (mg/m ³)	6.0	NA
Lead (mg/m ³)	<0.00017	5.0
Mercury (mg/m ³)	<0.00017	1.0
Total Hazardous Substances (Metals) (mg/m ³)	0.031	NA

Results from testing conducted on EPL Point 1 on 5 April 2017 are below the regulatory limits listed in EPL 5345.

Table 5 Fine Particulate (PM₁₀), Total Particulate and Hazardous Substance (Metals) Results, 5 April 2017

Sampling Conditions:			
Stack internal diameter at test location	760	mm	
Stack gas temperature (average)	22.0	°C	295.2 K
Stack pressure (average)	1025	hPa	
Stack gas velocity (average, stack conditions)	2.4	m/s	
Stack gas flowrate (stack conditions)	1.1	m ³ /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	1	m ³ /s	
Fine Particulate (PM₁₀) Testing			
Test Period	10:05	-	12:52
Fine Particulate (PM ₁₀) Mass	5.8	mg	
Gas Volume Sampled	0.962	m ³	
Fine Particulate (PM ₁₀) Emission* ¹	6.0	mg/m ³	
Fine Particulate (PM ₁₀) Mass Emission Rate* ²	6.0	mg/s	
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	10:05	-	12:52
Total Particulate Mass	1.3	mg	
Gas Volume Sampled	1.05	m ³	
Total Particulate Emission* ¹	1.2	mg/m ³	
Total Particulate Mass Emission Rate* ²	1.2	mg/s	
Regulatory Limit	100	mg/m ³	
Hazardous Substances (Metals) Testing			
Test Period	10:05	-	12:52
Hazardous Substances (Metals) Mass	0.036	mg	
Gas Volume Sampled	1.17	m ³	
Hazardous Substances (Metals) Emission* ¹	0.031	mg/m ³	
Hazardous Substances (Metals) Mass Emission Rate* ²	0.031	mg/s	
Regulatory Limit	N/A		
Moisture Content (%)	1.7		
Gas Density (dry at 1 atmosphere)	1.29	kg/m³	
Dry Molecular Weight	28.8	g/g-mole	

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas
*2 Mass emission rate determined from pre and post-test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Table 6 Hazardous Substances (Metals) Elemental Analysis Results, 5 April 2017

Sample	Total Particulate Metals (mg)	Total Particulate Metals (mg/m ³)	Total Gaseous Metals (mg)	Total Gaseous Metals (mg/m ³)	Total Oxidisable Mercury (mg)	Total Oxidisable Mercury (mg/m ³)	Total (mg)	Total (mg/m ³)	Mass Emission Rate (mg/s)
Antimony	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Arsenic	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Beryllium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Cadmium	0.024	0.021	0.0013	0.0011			0.03	0.026	0.026
Chromium	0.0009	0.00077	0.00035	0.0003			0.001	0.00086	0.00086
Cobalt	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Copper	0.0012	0.001	0.00048	0.00041			0.002	0.0017	0.0017
Lead	<0.3	<0.26	<0.399	<0.34			<0.0002	<0.00017	<0.00017
Magnesium	0.025	0.021	0.004	0.0034			0.03	0.026	0.026
Manganese	0.0027	0.0023	0.0012	0.001			0.004	0.0034	0.0034
Mercury	<0.0002	<0.00017	<0.0001	<0.000086	<0.0001	<0.000086	<0.0002	<0.00017	<0.00017
Nickel	0.001	0.00086	0.00008	0.000069			0.001	0.00086	0.00086
Selenium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Thallium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Tin	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Vanadium	<0.0008	<0.00069	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Zinc	0.22	0.19	0.0055	0.0047			0.2	0.17	0.17
Total Hazardous Metals*	0.029	0.025	0.0029	0.0025	<0.0001	<0.000086	0.036	0.031	0.031
Total Metals	0.27	0.24	0.013	0.011			0.27	0.23	0.23

* Total does not include Copper, Magnesium and Zinc as they are classed non-hazardous

This page has been left blank intentionally.



Appendix A

Field Sheets (19 pages)

Appendix A Field Sheets (19 pages)

Emission Measurement Calculations Spreadsheet**OneSteel Hexham**

AECOM's Project Number: 60493017

Emission Source: Shredder Stack


Date Sampled: 5-Apr-17

ANALYTE(S)	METHOD
Fine Particulate (PM10)	NSW EPA OM - 5
Total Particulate	NSW EPA TM - 15
Hazardous Substances (Metals)	NSW EPA TM - 12, 13 & 14

Observations made during testing period:

Long pause in test due to plant shut down

Sampling Performed By:


James Lang
Dylan Turnbull



ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 5-Apr-17
 Client: OneSteel Hexham
 AECOM's Project No: 60493017
 Stack/Duct Description: Shredder Stack
 Test 1: Fine Particulate (PM10)
 Test 2: Total Particulate
 Test 3: Hazardous Substances (Metals)

Measurement/Observations				
Stack Internal Dimensions:				
Diameter	760 mm		Cross Sectional Area :	0.45 m ²
OR	Length	Width		
Length/Width (mm)			Minimum No. of	
Equivalent Diameter	N/A	mm	sampling points=	12
Distance from sampling plane to nearest disturbances:			Total No. of sampling points =	12
Upstream (m) =	5		PM2.5/10=	12
No. Diameters =	6.6		No. of sampling traverses/ports sampled =	2
Type of Upstream Disturbance:	Fan Entry		PM2.5/10=	2
Downstream (m) =	2		No. of sampling points on each traverse/port =	6
No. Diameters =	2.6		PM2.5/10=	6
Type of Down Stream Disturbance:	Stack Exit			
Position of each sampling point, for each traverse:			Exclusion of any sample point numbers - comments:	
A		B	PM10/2.5 A	PM2.5/10 B
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot distances
1	33	3	33	3
2	111	81	111	81
3	225	195	225	195
4	535	505	535	505
5	649	619	649	619
6	727	697	727	697
7				
8				
9				
10				
11			Check of total points against minimum, (yes/no) - comments:	
12				
13				
14				
15				
16				
17				
18				
19			General Comments:	
20				
Signed: 			Checked: 	

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 5-Apr-17
 Client: OneSteel Hexham
 AECOM's Project No: 60493017
 Stack/Duct Description: Shredder Stack
 Test 1: Fine Particulate (PM10)
 Test 2: Total Particulate
 Test 3: Hazardous Substances (Metals)

Sampling time start: 9:30		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm), (dry)	O ₂ (%), (dry)	CO ₂ (%), (dry)
1	9:30	0	20.9	0.0
2	9:31	0	20.9	0.0
3	9:32	0	20.9	0.0
4	9:33	0	20.9	0.0
5	9:34	0	20.9	0.0
6	9:35	0	20.9	0.0
7	9:36	0	20.9	0.0
8	9:37	0	20.9	0.0
Averages:		0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.97
 Moisture percentage (M2): 2.90 %

Measurements

CO: 0.0000 %,(dry)	N ₂ : 79.1 %,(dry)
CO ₂ : 0.0 %,(dry)	O ₂ : 20.9 %,(dry)
Gas Compositions converted to wet basis:	
CO: 0.0000 %,(wet)	N ₂ : 76.8 %,(wet)
CO ₂ : 0.0 %,(wet)	O ₂ : 20.3 %,(wet)
H ₂ O: 2.90 % (=M2)	
Therefore, stack gas density (GD) =	1.27 kg/m ³ (0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.29 kg/m ³ (0°C, dry, 1 atm pressure)

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 5-Apr-17
 Client: OneSteel Hexham
 AECOM's Project No: 60493017
 Stack/Duct Description: Shredder Stack
 Test 1: Fine Particulate (PM10)
 Test 2: Total Particulate
 Test 3: Hazardous Substances (Metals)

Sampling time start: 12:45		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm), (dry)	O ₂ (%), (dry)	CO ₂ (%), (dry)
1	12:45	0	20.9	0.0
2	12:46	0	20.9	0.0
3	12:47	0	20.9	0.0
4	12:48	0	20.9	0.0
5	12:49	0	20.9	0.0
6	12:50	0	20.9	0.0
7	12:51	0	20.9	0.0
8	12:52	0	20.9	0.0
Averages:		0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
 Moisture percentage (M2): 1.57 %

Measurements

CO: 0.0000 %,(dry)	N ₂ : 79.1 %,(dry)
CO ₂ : 0.0 %,(dry)	O ₂ : 20.9 %,(dry)
Gas Compositions converted to wet basis:	
CO: 0.0000 %,(wet)	N ₂ : 77.9 %,(wet)
CO ₂ : 0.0 %,(wet)	O ₂ : 20.6 %,(wet)
H ₂ O: 1.57 % (=M2)	
Therefore, stack gas density (GD) =	1.28 kg/m ³ (0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.29 kg/m ³ (0°C, dry, 1 atm pressure)

Emission Measurement Calculations Spreadsheet

Stack Analysis - Hazardous Substances Elemental Analysis Results

Date: 5-Apr-17 Client: OneSteel Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

Metal	Particulate Metals Results	Gaseous Metals Results	Oxidisable Mercury Results		
	Front Half, Filter, Acetone Rinses and Acid Rinses (mg). Containers 1, 2 and 3	Back Half, Impingers + Acid Rinses (mg) Container 4	KO Impinger + Acid Rinses (mg) (5A)	KMnO ₄ /H ₂ SO ₄ + Rinses (mg) (5B)	Residue Rinse 8N HCl (mg) (If Required) (5C)
Antimony	<0.0002	<0.0001			
Arsenic	<0.0002	<0.0001			
Beryllium	<0.0002	<0.0001			
Cadmium	0.024	0.0013			
Chromium	0.0009	0.00035			
Cobalt	<0.0002	<0.0001			
Copper	0.0012	0.00048			
Lead	<0.3	<0.399			
Magnesium	0.025	0.004			
Manganese	0.0027	0.0012			
Mercury	<0.0002	<0.0001	<0.0001	NA	NA
Nickel	0.001	0.00008			
Selenium	<0.0002	<0.0001			
Thallium	<0.0002	<0.0001			
Tin	<0.0002	<0.0001			
Vanadium	<0.0008	<0.0001			
Zinc	0.22	0.0055			

Note: Where the blank has returned a less than value, half of this value was subtracted from the sample result as a blank correction ie for a blank value of <0.0005, 0.00025 was subtracted from the sample result.

* Total does not include Copper, Magnesium and Zinc as they are classed non-hazardous

Stack Analysis - Hazardous Substances Elemental Analysis Results Continued

Date: 5-Apr-17 Client: OneSteel Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

Sample	Total Particulate Metals (mg)	Total Particulate Metals (mg/m ³)	Total Gaseous Metals (mg)	Total Gaseous Metals (mg/m ³)	Total Oxidisable Mercury (mg)	Total Oxidisable Mercury (mg/m ³)	Total (mg)	Total (mg/m ³)	Mass Emission Rate (mg/s)
Antimony	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Arsenic	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Beryllium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Cadmium	0.024	0.021	0.0013	0.0011			0.03	0.026	0.026
Chromium	0.0009	0.00077	0.00035	0.0003			0.001	0.00086	0.00086
Cobalt	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Copper	0.0012	0.001	0.00048	0.00041			0.002	0.0017	0.0017
Lead	<0.3	<0.26	<0.399	<0.34			<0.0002	<0.00017	<0.00017
Magnesium	0.025	0.021	0.004	0.0034			0.03	0.026	0.026
Manganese	0.0027	0.0023	0.0012	0.001			0.004	0.0034	0.0034
Mercury	<0.0002	<0.00017	<0.0001	<0.000086	<0.0001	<0.000086	<0.0002	<0.00017	<0.00017
Nickel	0.001	0.00086	0.00008	0.000069			0.001	0.00086	0.00086
Selenium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Thallium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Tin	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Vanadium	<0.0008	<0.00069	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Zinc	0.22	0.19	0.0055	0.0047			0.2	0.17	0.17
Total Hazardous Metals*	0.029	0.025	0.0029	0.0025	<0.0001	<0.000086	0.036	0.031	0.031
Total Metals	0.27	0.24	0.013	0.011			0.27	0.23	0.23

* Total does not include Copper, Magnesium and Zinc as they are classed non-hazardous

STACK ANALYSIS - PM10 CALCULATIONS

Date: 5-Apr-17 Client: OneSteel Hexham
AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

1. Gas Analysis

	%		
%CO ₂	0.0		
%O ₂	20.9		
%N ₂ +%CO	79.1		
Fraction Moisture Content, Bws	0.01	M ₁ =	0.99

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	28.84
Mol. Wt. of Stack Gas (wet)	28.52

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	102500	30.26
Stack Static Pressure (Pg)	102505	30.26

Absolute Stack Pressure 30.26

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	23.0	73.4
Average Meter Temperature:	27.8	
Stack Gas Viscosity		181.5

5. Cyclone Flow Rate

	ft ³ /min	m ³ /min	L/min	L/s
Cyclone Flow Rate	0.45	0.0158	15.78	0.26

6. Nozzle Velocity, Rmin and Rmax

Nozzle Number	Nozzle Diameter (inches)	Nozzle Velocity		Rmin [-]	Rmax [-]	Vmin ft/sec	Vmin m/s	Vmax ft/sec	Vmax m/s
		ft/sec	m/s						
0	0.124	88.78	29.22	0.765	1.225	67.89	22.27	108.72	35.67
1	0.133	77.10	25.38	0.756	1.230	58.30	19.13	94.86	31.12
2	0.146	64.34	21.18	0.742	1.240	47.72	15.66	79.76	26.17
3	0.163	51.15	16.84	0.716	1.255	36.60	12.01	64.20	21.06
4	0.177	43.50	14.32	0.690	1.270	30.00	9.84	55.23	18.12
5	0.186	39.37	12.96	0.669	1.280	26.35	8.64	50.41	16.54
6	0.216	29.33	9.66	0.575	1.322	16.87	5.53	38.78	12.72
7	0.224	27.11	8.92	0.535	1.336	14.50	4.76	36.22	11.88
8	0.263	19.74	6.50	#NUM!	1.410	9.87	3.24	27.83	9.13
9	0.299	15.25	5.02	#NUM!	1.494	7.63	2.50	22.79	7.48
10	0.341	11.75	3.87	#NUM!	1.609	5.87	1.93	17.62	5.78
11	0.392	8.88	2.92	#NUM!	1.773	4.44	1.46	13.32	4.37
	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate					
Selected Nozzle	(inches)	(m)	(m ²)	(L/min)					
3	0.163	0.004	0.000014	13.7					

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

(Calculations performed in accordance with relevant test method as defined on cover page)

Date: 5-Apr-17 Client: OneSteel Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV₃): 1.0478 m³ Average barometric pressure (P_{BARO}) 1025 hPa
 Average gas meter temp. (T_{M,2}): 27.8 °C
 301.0 K Average pressure at meter (P_{M,2}) 1025.00 hPa

Sample gas volume (MV₄); (0°C, dry gas, 1 atm pressure): 0.9621 m³

(B) PM10 concentration at standard conditions

Blank thimble No.: 0 Blank weight: g
 Thimble No. used: T474 PM10 Weight: 0.0058 g
 Final PM10 Weight (Mp1): 0.00580 g
 PM10 Concentration (C1): =M_{p1}/MV₄= 0.0060 g/m³ (0°C, dry gas, 1atm pressure)
 ;and C₂ = 6.0 mg/m³ (0°C, dry gas, 1atm pressure)

CO₂ Basis 12 %
 Average CO₂%: 0.0 %

Therefore, C_c: = C_a x 12/CO₂% = 0.0060 g/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)
 ;and C_{c1} = 6.0 mg/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)

O₂ Basis 7 %
 Average O₂%: 20.9 %

Therefore, C_b: =C_a x (21 - O_{2ref}%)/(21 - O_{2mea}%) 0.84 g/m³ (0°C, dry gas, 1atm pressure, 7% O₂)
 ;and C_{b1} = 840 mg/m³ (0°C, dry gas, 1atm pressure, 7% O₂)

(C) Moisture content

Silica Gel Number: P26
 V_v = 7.2 g (from laboratory report) V_w = 2 mL (=grams) (recorded on Laboratory Form 108)
 Volume of Water Vapour Condensed (V_{wc(std)}) = 0.0027
 Volume of Water Vapour Condensed (V_{wsg(std)}) = 0.0096

Therefore, B_{ws} = $\frac{(V_{wc(std)}+V_{wsg(std)})}{(V_{wc(std)}+V_{wsg(std)}+V_{m(std)})}$

B_{ws} = 1.26 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

(D) Gas Composition and Density (Re-calculation)

(i) Initial gas density for sampling:	1.27 kg/m ³ (from Laboratory Form 107)
(ii) Re-calculated gas density based on moisture content in (c):	1.26 kg/m ³ (0°C, wet, 1 atm pressure) 1.29 kg/m ³ (0°C, dry, 1 atm pressure)
(iii) Gas density at stack conditions =	(ii) x $\frac{(273.2)}{(273.2+T_s)} \times \frac{(P_s)}{(1013.25)}$
=	1.180 kg/m ³ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities:	2.40 m/s
(ii) Average of post-sampling velocities:	2.40 m/s
(iii) Average of while-sampling velocities:	N/A m/s
(iv) Overall average of pre-sampling and post-sampling velocities (Vs):	2.40 m/s (stack conditions, wet) N/A m/s (stack conditions, wet)
(Note: (Vs) is from all individual data, not from (i) and (ii) alone.)	

(F) Volumetric Flowrates (Reference Method US-EPA Method 2, NSW-EPA TM-2)

Qstack =	Vs x A =	1.09 m ³ /s (stack conditions)
Qstd =	Qstack x $\frac{P_s}{(P_{std})} \times \frac{(T_{std})}{(T_s)} \times \frac{(100 - B_w)}{100}$	
Qstd =	1.0 m ³ /s (0°C, dry gas, 1 atm pressure)	

(G) Mass Emission Rate

Rm =	C _{1a} x Qstd =	0.0060	g/s (0°C, dry gas, 1 atm pressure)	
	=	6.0	mg/s (0°C, dry gas, 1 atm pressure)	
	C _{1a} x Qstd =	0.0060	g/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	=	6.0	mg/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	C _{1a} x Qstd =	0.85	g/s (0°C, dry gas, 1 atm pressure	7% O ₂)
	=	850	mg/s (0°C, dry gas, 1 atm pressure	7% O ₂)

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

(Calculations performed in accordance with relevant test method as defined on cover page)

Date: 5-Apr-17 Client: OneSteel Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV ₃):	1.1410 m ³	Average barometric pressure (P _{BARO}):	1025 hPa
Average gas meter temp. (T _{M,2}):	26.3 °C	Average pressure at meter (P _{M,2}):	1025.00 hPa
	299.5 K		
Sample gas volume (MV ₄); (0°C, dry gas, 1 atm pressure):	1.0529 m ³		

(B) Total Particulate concentration at standard conditions

Blank thimble No.:		Blank weight:	g
Thimble No. used:	T476	Total Particulate Weight:	0.0013 g
Final Total Particulate Weight (Mp1):	0.00130 g		
Total Particulate Concentration (C1):	=M _{p1} /MV ₄ =		0.0012 g/m ³ (0°C, dry gas, 1atm pressure)
			1.2 mg/m ³ (0°C, dry gas, 1atm pressure)

CO₂ Basis 12 % ;and C₂ = 1.2 mg/m³ (0°C, dry gas, 1atm pressure)
 Average CO₂%: 0.0 %

Therefore, C_c: = C_a x 12/CO₂% = 0.0012 g/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)
 ;and C_{c1} = 1.2 mg/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)

O₂ Basis 7 %
 Average O₂%: 20.9 %

Therefore, C_b: =C_a x (21 - O_{2ref}%)/(21 - O_{2mea}%) = 0.17 g/m³ (0°C, dry gas, 1atm pressure, 7% O₂)
 ;and C_{b1} = 170 mg/m³ (0°C, dry gas, 1atm pressure, 7% O₂)

(C) Moisture content

Silica Gel Number: G100
 V_v = 7.3 g (from laboratory report) V_w = 4 mL (=grams) (recorded on Laboratory Form 108)
 Volume of Water Vapour Condensed (V_{wc(std)}) = 0.0053
 Volume of Water Vapour Condensed (V_{wsg(std)}) = 0.0097

Therefore, B_{ws} =
$$\frac{(V_{wc(std)} + V_{wsg(std)})}{(V_{wc(std)} + V_{wsg(std)} + V_{m(std)})}$$

B_{ws} = 1.41 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

(D) Gas Composition and Density (Re-calculation)

- (i) Initial gas density for sampling: 1.27 kg/m³ (from Laboratory Form 107)
- (ii) Re-calculated gas density based on moisture content in (c):
 - 1.26 kg/m³ (0°C, wet, 1 atm pressure)
 - 1.29 kg/m³ (0°C, dry, 1 atm pressure)
- (iii) Gas density at stack conditions = $(ii) \times \frac{(273.2)}{(273.2+T_s)} \times \frac{(P_s)}{(1013.25)}$
 = 1.180 kg/m³ (stack conditions, wet)

(E) Gas Velocities

- (i) Average of pre-sampling velocities: 2.40 m/s
 - (ii) Average of post-sampling velocities: 2.40 m/s
 - (iii) Average of while-sampling velocities: N/A m/s
 - (iv) Overall average of pre-sampling and post-sampling velocities (Vs):
 - 2.40 m/s (stack conditions, wet)
 - N/A m/s (stack conditions, wet)
- (Note: (Vs) is from all individual data, not from (i) and (ii) alone.)**

(F) Volumetric Flowrates (Reference Method US-EPA Method 2, NSW-EPA TM-2)

Q_{stack} = V_s x A = 1.09 m³/s (stack conditions)

Q_{std} = Q_{stack} x $\frac{P_s}{(P_{std})} \times \frac{(T_{std})}{(T_s)} \times \frac{(100 - B_w)}{100}$

Q_{std} = 1.0 m³/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

R _m =	C _{1a} x Q _{std} =	0.0012	g/s (0°C, dry gas, 1 atm pressure)	
	=	1.2	mg/s (0°C, dry gas, 1 atm pressure)	
	C _{1a} x Q _{std} =	0.0012	g/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	=	1.2	mg/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	C _{1a} x Q _{std} =	0.17	g/s (0°C, dry gas, 1 atm pressure	7% O ₂)
	=	170	mg/s (0°C, dry gas, 1 atm pressure	7% O ₂)

STACK ANALYSIS - FINAL CALCULATIONS

Hazardous Substances (Metals)

(Calculations performed in accordance with relevant test method as defined on cover page)

Date: 5-Apr-17 Client: OneSteel Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV ₃):	1.2716 m ³	Average barometric pressure (P _{BARO}):	1025 hPa
Average gas meter temp. (T _{M,2}):	27.8 °C	Average pressure at meter (P _{M,2}):	1025.00 hPa
	301.0 K		
Sample gas volume (MV ₄); (0°C, dry gas, 1 atm pressure):	1.1675 m ³		

(B) Metals concentration at standard conditions

Blank thimble No.:		Blank weight:	g
Thimble No. used:	NA	Metals Weight:	0.000036 g
Final Metals Weight (Mp1):	0.00004 g		
Metals Concentration (C1):	=M _{p1} /MV ₄ =		0.000031 g/m ³ (0°C, dry gas, 1atm pressure)
			and C ₂ = 0.031 mg/m ³ (0°C, dry gas, 1atm pressure)
CO ₂ Basis	12 %		
Average CO ₂ %:	0.0 %		

Therefore, C_c: = C_a x 12/CO₂% = 0.000031 g/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)
 ;and C_{c1} = 0.031 mg/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)

O₂ Basis 7 %
 Average O₂%: 20.9 %

Therefore, C_b: = C_a x (21 - O_{2ref}%)/(21 - O_{2mea}%) = 0.0043 g/m³ (0°C, dry gas, 1atm pressure, 7% O₂)
 ;and C_{b1} = 4.3 mg/m³ (0°C, dry gas, 1atm pressure, 7% O₂)

(C) Moisture content

Silica Gel Number: JL352
 V_v = 13.3 g (from laboratory report) V_w = 5 mL (=grams) (recorded on Laboratory Form 108)
 Volume of Water Vapour Condensed (V_{wc(std)}) = 0.0067
 Volume of Water Vapour Condensed (V_{wsg(std)}) = 0.0178

Therefore, B_{ws} =
$$\frac{(V_{wc(std)} + V_{wsg(std)})}{(V_{wc(std)} + V_{wsg(std)} + V_{m(std)})}$$

B_{ws} = 2.05 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hazardous Substances (Metals)

(D) Gas Composition and Density (Re-calculation)

- (i) Initial gas density for sampling: 1.27 kg/m³ (from Laboratory Form 107)
- (ii) Re-calculated gas density based on moisture content in (c):
 - 1.27 kg/m³ (0°C, wet, 1 atm pressure)
 - 1.29 kg/m³ (0°C, dry, 1 atm pressure)
- (iii) Gas density at stack conditions =

$$(ii) \times \frac{(273.2)}{(273.2+T_s)} \times \frac{(P_s)}{(1013.25)}$$

= 1.189 kg/m³ (stack conditions, wet)

(E) Gas Velocities

- (i) Average of pre-sampling velocities: 2.40 m/s
- (ii) Average of post-sampling velocities: 2.40 m/s
- (iii) Average of while-sampling velocities: N/A m/s
- (iv) Overall average of pre-sampling and post-sampling velocities (Vs):
 - 2.40 m/s (stack conditions, wet)
 - N/A m/s (stack conditions, wet)

(Note: (Vs) is from all individual data, not from (i) and (ii) alone.)

(F) Volumetric Flowrates (Reference Method US-EPA Method 2, NSW-EPA TM-2)

Qstack = Vs x A = 1.09 m³/s (stack conditions)

$$Q_{std} = Q_{stack} \times \frac{P_s}{(P_{std})} \times \frac{(T_{std})}{(T_s)} \times \frac{(100 - B_w)}{100}$$

Qstd = 1.0 m³/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C _{1a} x Qstd =	0.000031	g/s (0°C, dry gas, 1 atm pressure)	
	=	0.031	mg/s (0°C, dry gas, 1 atm pressure)	
	C _{1a} x Qstd =	0.000031	g/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	=	0.031	mg/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	C _{1a} x Qstd =	0.0043	g/s (0°C, dry gas, 1 atm pressure	7% O ₂)
	=	4.3	mg/s (0°C, dry gas, 1 atm pressure	7% O ₂)

EMISSION MONITORING RESULTS, SHREDDER STACK ONESTEEL HEXHAM 5-Apr-17 FINE PARTICULATE (PM10) TOTAL PARTICULATE HAZARDOUS SUBSTANCES (METALS)		
Sampling Conditions:		
Stack internal diameter at test location	760 mm	
Stack gas temperature (average)	22.0 °C	295.2 K
Stack pressure (average)	1025 hPa	
Stack gas velocity (average, stack conditions)	2.4 m/s	
Stack gas flowrate (stack conditions)	1.1 m ³ /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	1 m ³ /s	
Fine Particulate (PM10) Testing		
Test Period	10:05	- 12:52
Fine Particulate (PM10) Mass	5.8 mg	
Gas Volume Sampled	0.962 m ³	
Fine Particulate (PM10) Emission*1	6.0 mg/m ³	
Fine Particulate (PM10) Mass Emission Rate*2	6.0 mg/s	
Regulatory Limit	N/A	
Total Particulate Testing		
Test Period	10:05	- 12:52
Total Particulate Mass	1.3 mg	
Gas Volume Sampled	1.05 m ³	
Total Particulate Emission*1	1.2 mg/m ³	
Total Particulate Mass Emission Rate*2	1.2 mg/s	
Regulatory Limit	100 mg/m ³	
Hazardous Substances (Metals) Testing		
Test Period	10:05	- 12:52
Hazardous Substances (Metals) Mass	0.036 mg	
Gas Volume Sampled	1.17 m ³	
Hazardous Substances (Metals) Emission*1	0.031 mg/m ³	
Hazardous Substances (Metals) Mass Emission Rate*2	0.031 mg/s	
Regulatory Limit	N/A	
Moisture Content (%)	1.7	
Gas Density (dry at 1 atmosphere)	1.29 kg/m ³	
Dry Molecular Weight	28.8 g/g-mole	

Notes *1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

*2 Mass emission rate determined from pre and post test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.



Appendix B

Laboratory Results
(8 pages)

Appendix B Laboratory Results (8 pages)

Steel River Testing

5/11 McIntosh Drive, Mayfield West, NSW 2304
Phone: 02 49677880

STACK EMISSION - PARTICULATES REPORT

Origin: AECOM - Newcastle

Report : 13347-0-P

Page 1 of 1

Project: 60493017

Description : Stack Emission Samples

Date : 12-Apr-17

Received: 06-Apr-17

Report To : Cye Buckland

Copy to: FILE

17 Warabrook Blvd, Warabrook NSW 2304

Thimble ID		Volume (mL)	Total Particulate Matter (g)
T474	Filter	-	0.0004
T476	Filter	-	0.0002
Shredder_PM10	Acetone Rinse	10	0.0054
Shredder_TP	Acetone Rinse	13	0.0011



NATA Accredited Laboratory 18079

Accredited for compliance with
ISO/IEC 17025 - Testing

Note : *Sampled by Client*

Reported By: J. Campbell

Jason Campbell

Determined in Accordance With:
Particulate matter - total in stack gases by
gravimetric using in-house M300;
Acetone/Water Rinse using AS4323.2

Steel River Testing

5/11 McIntosh Drive, Mayfield West, NSW 2304
Phone: 02 49677880

STACK EMISSION - MOISTURE REPORT

Origin: AECOM - Newcastle

Report : 13347-0-M Page 1 of 1

Project: 60493017

Description : Stack Emission Samples

Date : 12-Apr-17

Received: 06-Apr-17

Report To : Cye Buckland

Copy to: FILE

17 Warabrook Blvd, Warabrook NSW 2304

Jar ID	Moisture (g)
G100	7.3
JL352	13.3
P26	7.2



NATA Accredited Laboratory 18079
Accredited for compliance with
ISO/IEC 17025 - Testing

Reported By: J Campbell

Jason Campbell

Determined in Accordance With:
Moisture content in stack gases by gravimetric
using in-house M301

CLIENT DETAILS

Contact **Cye Buckland**
 Client **AECOM Australia Pty Ltd**
 Address **Level 21, 420 George Street
 (PO BOX Q410, QVB Post Office SYDNEY NSW
 1230)
 SYDNEY NSW 2000**
 Telephone **02 8295 3600**
 Facsimile **02 8934 0001**
 Email **cye.buckland@aecom.com**
 Project **(Not specified)**
 Order Number **60493017/1.1**
 Samples **12**

LABORATORY DETAILS

Manager **Adam Atkinson**
 Laboratory **SGS Melbourne EH&S**
 Address **10/585 Blackburn Road
 Notting Hill Victoria 3168**
 Telephone **+61395743200**
 Facsimile **+61395743399**
 Email **Au.SampleReceipt.Melbourne@sgs.com**
 SGS Reference **ME302438 R0**
 Date Received **07 Apr 2017**
 Date Reported **13 Apr 2017**

COMMENTS

Accredited for compliance with ISO/IEC 17025-Testing. NATA accredited laboratory 2562(14420).

SIGNATORIES

MING

Weiming Dai
 Inorganic Supervisor

Sample Number	ME302438.001	ME302438.002	ME302438.003	ME302438.004
Sample Matrix	Filter	Filter	Impinger	Impinger
Sample Date	05 Apr 2017	05 Apr 2017	05 Apr 2017	05 Apr 2017
Sample Name	Metals 1	Metals 12	Metals 3	Metals 4
Parameter	Units	LOR		

Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 12/4/2017

Parameter	Units	LOR	ME302438.001	ME302438.002	ME302438.003	ME302438.004
Sb	µg total	0.2	<0.2	<0.2	-	-
As	µg total	0.2	<0.2	<0.2	-	-
Be	µg total	0.2	<0.2	<0.2	-	-
Cd	µg total	0.2	23	<0.2	-	-
Cr	µg total	0.2	0.5	0.3	-	-
Co	µg total	0.2	<0.2	<0.2	-	-
Cu	µg total	0.2	0.7	0.5	-	-
Pb	µg total	0.2	0.2	<0.2	-	-
Mg	µg total	2	31	16	-	-
Mn	µg total	0.2	0.5	3.5	-	-
Hg	µg total	0.2	<0.2	<0.2	-	-
Ni	µg total	0.2	0.3	<0.2	-	-
Se	µg total	0.2	<0.2	<0.2	-	-
Tl	µg total	0.2	<0.2	<0.2	-	-
Sn	µg total	0.2	<0.2	<0.2	-	-
V	µg total	0.2	0.7	0.8	-	-
Zn	µg total	0.2	280	100	-	-

Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (µg total) Method: EPA29_METIMP Tested: 12/4/2017

Parameter	Units	LOR	ME302438.001	ME302438.002	ME302438.003	ME302438.004
Sb	µg total	0.1	-	-	0.1	<0.1
As	µg total	0.1	-	-	<0.1	<0.1
Be	µg total	0.1	-	-	<0.1	<0.1
Cd	µg total	0.1	-	-	1.4	1.4
Cr	µg total	0.1	-	-	0.7	0.4
Co	µg total	0.1	-	-	<0.1	<0.1
Cu	µg total	0.1	-	-	1.0	1.0
Pb	µg total	0.1	-	-	97	310
Mg	µg total	0.1	-	-	11	4.9
Mn	µg total	0.1	-	-	7.2	5.1
Hg	µg total	0.1	-	-	<0.1	<0.1
Ni	µg total	0.1	-	-	0.8	0.7
Se	µg total	0.1	-	-	<0.1	<0.1
Tl	µg total	0.1	-	-	<0.1	<0.1
Sn	µg total	0.1	-	-	<0.1	<0.1
V	µg total	0.1	-	-	<0.1	<0.1
Zn	µg total	0.1	-	-	43	6.2
Sample Volume*	mL	-	-	-	97	310

Sample Number	ME302438.005	ME302438.006	ME302438.007	ME302438.008
Sample Matrix	Impinger	Impinger	Impinger	Impinger
Sample Date	05 Apr 2017	05 Apr 2017	05 Apr 2017	05 Apr 2017
Sample Name	Metals 8A	Metals 9	Metals 5A	Metals 5C

Parameter	Units	LOR				
-----------	-------	-----	--	--	--	--

Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 12/4/2017

Sb	µg total	0.2	-	-	-	-
As	µg total	0.2	-	-	-	-
Be	µg total	0.2	-	-	-	-
Cd	µg total	0.2	-	-	-	-
Cr	µg total	0.2	-	-	-	-
Co	µg total	0.2	-	-	-	-
Cu	µg total	0.2	-	-	-	-
Pb	µg total	0.2	-	-	-	-
Mg	µg total	2	-	-	-	-
Mn	µg total	0.2	-	-	-	-
Hg	µg total	0.2	-	-	-	-
Ni	µg total	0.2	-	-	-	-
Se	µg total	0.2	-	-	-	-
Tl	µg total	0.2	-	-	-	-
Sn	µg total	0.2	-	-	-	-
V	µg total	0.2	-	-	-	-
Zn	µg total	0.2	-	-	-	-

Metals in Impingers M29 ETC MA-1400.JMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 11/4/2017

Sb	µg total	0.1	<0.1	<0.1	-	-
As	µg total	0.1	<0.1	<0.1	-	-
Be	µg total	0.1	<0.1	<0.1	-	-
Cd	µg total	0.1	<0.1	<0.1	-	-
Cr	µg total	0.1	<0.1	<0.1	-	-
Co	µg total	0.1	<0.1	<0.1	-	-
Cu	µg total	0.1	<0.1	0.5	-	-
Pb	µg total	0.1	300	99	-	-
Mg	µg total	0.1	0.6	0.3	-	-
Mn	µg total	0.1	1.5	2.3	-	-
Hg	µg total	0.1	<0.1	<0.1	<0.1	<0.1
Ni	µg total	0.1	<0.1	0.6	-	-
Se	µg total	0.1	<0.1	<0.1	-	-
Tl	µg total	0.1	<0.1	<0.1	-	-
Sn	µg total	0.1	<0.1	<0.1	-	-
V	µg total	0.1	<0.1	<0.1	-	-
Zn	µg total	0.1	0.2	0.5	-	-
Sample Volume*	mL	-	300	99	100	250

Sample Number	ME302438.009	ME302438.010	ME302438.011	ME302438.012
Sample Matrix	Impinger	Impinger	KMnO4	KMnO4
Sample Date	05 Apr 2017	05 Apr 2017	05 Apr 2017	05 Apr 2017
Sample Name	Metals 8B	Metals 11	Metals 5B	Metals 10
Parameter	Units	LOR		

Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 12/4/2017

Element	Units	LOR	ME302438.009	ME302438.010	ME302438.011	ME302438.012
Sb	µg total	0.2	-	-	-	-
As	µg total	0.2	-	-	-	-
Be	µg total	0.2	-	-	-	-
Cd	µg total	0.2	-	-	-	-
Cr	µg total	0.2	-	-	-	-
Co	µg total	0.2	-	-	-	-
Cu	µg total	0.2	-	-	-	-
Pb	µg total	0.2	-	-	-	-
Mg	µg total	2	-	-	-	-
Mn	µg total	0.2	-	-	-	-
Hg	µg total	0.2	-	-	-	-
Ni	µg total	0.2	-	-	-	-
Se	µg total	0.2	-	-	-	-
Tl	µg total	0.2	-	-	-	-
Sn	µg total	0.2	-	-	-	-
V	µg total	0.2	-	-	-	-
Zn	µg total	0.2	-	-	-	-

Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 11/4/2017

Element	Units	LOR	ME302438.009	ME302438.010	ME302438.011	ME302438.012
Sb	µg total	0.1	-	-	-	-
As	µg total	0.1	-	-	-	-
Be	µg total	0.1	-	-	-	-
Cd	µg total	0.1	-	-	-	-
Cr	µg total	0.1	-	-	-	-
Co	µg total	0.1	-	-	-	-
Cu	µg total	0.1	-	-	-	-
Pb	µg total	0.1	-	-	-	-
Mg	µg total	0.1	-	-	-	-
Mn	µg total	0.1	-	-	-	-
Hg	µg total	0.1	<0.1	<0.1	<0.1	<0.1
Ni	µg total	0.1	-	-	-	-
Se	µg total	0.1	-	-	-	-
Tl	µg total	0.1	-	-	-	-
Sn	µg total	0.1	-	-	-	-
V	µg total	0.1	-	-	-	-
Zn	µg total	0.1	-	-	-	-
Sample Volume*	mL	-	99	250	400	100

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

Metals in Fillers M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Sb	LB012668	µg total	0.2	<0.2	NA
As	LB012668	µg total	0.2	<0.2	NA
Be	LB012668	µg total	0.2	<0.2	NA
Cd	LB012668	µg total	0.2	<0.2	NA
Cr	LB012668	µg total	0.2	<0.2	NA
Co	LB012668	µg total	0.2	<0.2	NA
Cu	LB012668	µg total	0.2	<0.2	NA
Pb	LB012668	µg total	0.2	<0.2	NA
Mg	LB012668	µg total	2	<2	NA
Mn	LB012668	µg total	0.2	<0.2	NA
Hg	LB012668	µg total	0.2	<0.2	NA
Ni	LB012668	µg total	0.2	<0.2	NA
Se	LB012668	µg total	0.2	<0.2	NA
Tl	LB012668	µg total	0.2	<0.2	NA
Sn	LB012668	µg total	0.2	<0.2	NA
V	LB012668	µg total	0.2	<0.2	NA
Zn	LB012668	µg total	0.2	<0.2	NA

Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (µg total) Method: EPA29_METIMP

Parameter	QC Reference	Units	LOR	MB
Sb	LB012671	µg total	0.1	<0.1
As	LB012671	µg total	0.1	<0.1
Be	LB012671	µg total	0.1	<0.1
Cd	LB012671	µg total	0.1	<0.1
Cr	LB012671	µg total	0.1	<0.1
Co	LB012671	µg total	0.1	<0.1
Cu	LB012671	µg total	0.1	<0.1
Pb	LB012671	µg total	0.1	<0.1
Mg	LB012671	µg total	0.1	<0.1
Mn	LB012671	µg total	0.1	<0.1
Hg	LB012671	µg total	0.1	<0.1
Ni	LB012671	µg total	0.1	<0.1
Se	LB012671	µg total	0.1	<0.1
Tl	LB012671	µg total	0.1	<0.1
Sn	LB012671	µg total	0.1	<0.1
V	LB012671	µg total	0.1	<0.1
Zn	LB012671	µg total	0.1	<0.1

METHOD

METHODOLOGY SUMMARY

EPA29

Metals in Impinger Solutions by ICP MS.

FOOTNOTES

- IS Insufficient sample for analysis.
- LNR Sample listed, but not received.
- * NATA accreditation does not cover the performance of this service.
- ** Indicative data, theoretical holding time exceeded.

- LOR Limit of Reporting
- ↑↓ Raised or Lowered Limit of Reporting
- QFH QC result is above the upper tolerance
- QFL QC result is below the lower tolerance
- The sample was not analysed for this analyte
- NVL Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- a. 1 Bq is equivalent to 27 pCi
- b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-GU-022%20QA%20QC%20Plan.pdf>

This document is issued by the Company under its General Conditions of Service accessible at www.sgs.com/en/Terms-and-Conditions.aspx. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client only. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law .

This report must not be reproduced, except in full.

End of Report

17 Warabrook Boulevard, Warabrook, NSW 2304
PO Box 73 Hunter Region MC NSW 2310
T +61 2 4911 4900 F +61 2 4911 4999

www.aecom.com