

# 4th Quarter Emissions Testing Report 2019

Infrabuild Recycling Hexham



NATA ACCREDITATION No. 2778 (14391)  
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## 4th Quarter Emissions Testing Report 2019

Infrabuild Recycling Hexham

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## 1.0 Introduction

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

Testing was undertaken on 19 November 2019 to investigate emission concentrations for the following parameters:

- Fine Particulates (PM<sub>10</sub>);
- 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 20285-0-M & 20285-0-P:
  - Total Particulate (TP);
  - Fine Particulates (PM<sub>10</sub>); and
  - Moisture.
- SGS Australia Pty Ltd, NATA accreditation number 2562, performed the following analysis detailed in report number ME312795 R0:
  - 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.*

The sampling plane for EPL Point 1 was compliant with the AS4323.1.

## 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	N/A	Selection of sampling positions
AS4323.2	N/A	Determination of total particulate matter – isokinetic manual sampling – gravimetric method
NSW EPA TM-2	USEPA (2000) Method 2	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 201A	Determination of PM <sub>10</sub> 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 19 November 2019.

**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
Correction Factors Applied	No
Total No. Points Sampled	12
Points/Traverse	6
Sampling Performed to Standard <sup>1</sup>	Yes

<sup>1</sup> AS 4323.1 Section 4.1  
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 November represent. The measurement of uncertainty has been calculated at  $\pm 13.6\%$ .

**Table 4 Shredder Baghouse Emission Results Summary, 19 November 2019**

Parameter	Emission Concentration (EPL Point 1)	Emission Concentration Limit
Total Particulate (TP) (mg/m <sup>3</sup> )	22	100
Fine Particulate (PM <sub>10</sub> ) (mg/m <sup>3</sup> )	1.8	N/A
Lead (mg/m <sup>3</sup> )	0.0043	5.0
Mercury (mg/m <sup>3</sup> )	0.00012	1.0
Total Hazardous Substances (Metals) (mg/m <sup>3</sup> )	0.0095	N/A

Results from testing conducted on EPL Point 1 on 19 November 2019 are below the regulatory limits listed in EPL 5345.

**Table 5 Fine Particulate (PM<sub>10</sub>), Total Particulate and Hazardous Substance (Metals) Results, 19 November 2019**

<b>Sampling Conditions:</b>		
Stack internal diameter at test location	760 mm	
Stack gas temperature (average)	33.0 °C	306.2 K
Stack pressure (average)	1013 hPa	
Stack gas velocity (average, stack conditions)	6.9 m/s	
Stack gas flowrate (stack conditions)	3.1 m <sup>3</sup> /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	2.8 m <sup>3</sup> /s	
<b>Fine Particulate (PM<sub>10</sub>) Testing</b>		
Test Period	10:35 -	11:59
Fine Particulate (PM <sub>10</sub> ) Mass	1.8 mg	
Gas Volume Sampled	1.0 m <sup>3</sup>	
Fine Particulate (PM <sub>10</sub> ) Emission* <sup>1</sup>	1.8 mg/m <sup>3</sup>	
Fine Particulate (PM <sub>10</sub> ) Mass Emission Rate* <sup>2</sup>	5 mg/s	
Regulatory Limit	N/A	
<b>Total Particulate Testing</b>		
Test Period	10:35 -	11:59
Total Particulate Mass	20.6 mg	
Gas Volume Sampled	0.93 m <sup>3</sup>	
Total Particulate Emission* <sup>1</sup>	22 mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate* <sup>2</sup>	61 mg/s	
Regulatory Limit	100 mg/m <sup>3</sup>	
<b>Hazardous Substances (Metals) Testing</b>		
Test Period	10:35 -	11:59
Hazardous Substances (Metals) Mass	0.0115 mg	
Gas Volume Sampled	1.2 m <sup>3</sup>	
Hazardous Substances (Metals) Emission* <sup>1</sup>	0.0095 mg/m <sup>3</sup>	
Hazardous Substances (Metals) Mass Emission Rate* <sup>2</sup>	0.026 mg/s	
Regulatory Limit	N/A	
<b>Moisture Content (%)</b>	<b>0.3</b>	
<b>Gas Density (dry at 1 atmosphere)</b>	<b>1.29 kg/m<sup>3</sup></b>	
<b>Dry Molecular Weight</b>	<b>28.8 g/g-mole</b>	

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<sub>std</sub> in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Table 6 Hazardous Substances (Metals) Elemental Analysis Results, 19 November 2019

Sample	Total Particulate Metals (mg)	Total Particulate Metals (mg/m <sup>3</sup> )	Total Gaseous Metals (mg)	Total Gaseous Metals (mg/m <sup>3</sup> )	Total Oxidisable Mercury (mg)	Total Oxidisable Mercury (mg/m <sup>3</sup> )	Total (mg)	Total (mg/m <sup>3</sup> )	Mass Emission Rate (mg/s)
Antimony	<0.00016	<0.000132	0.000393	0.000325			0.00039	0.000322	0.000887
Arsenic	<0.00066	<0.000545	<0.0001	<0.0000826			<0.0001	<0.0000826	<0.000228
Beryllium	<0.00006	<0.0000496	<0.0001	<0.0000826			<0.0001	<0.0000826	<0.000228
Cadmium	0.00027	0.000223	0.0000483	0.0000399			0.00032	0.000264	0.000728
Chromium	0.0008	0.000661	0.000297	0.000245			0.0011	0.000909	0.00251
Cobalt	0.00008	0.0000661	<0.0001	<0.0000826			0.00008	0.0000661	0.000182
Copper	0.00146	0.00121	0.000248	0.000205			0.0017	0.0014	0.00386
Lead	0.00414	0.00342	0.0011	0.000909			0.0052	0.0043	0.0119
Magnesium	<0.32	<0.264	0.00425	0.00351			0.0043	0.00355	0.00978
Manganese	0.0025	0.00207	0.000548	0.000453			0.003	0.00248	0.00683
Mercury	<0.0001	<0.0000826	<0.0001	<0.0000826	0.00015	0.000124	0.00015	0.000124	0.000342
Nickel	0.00085	0.000702	0.000248	0.000205			0.0011	0.000909	0.00251
Selenium	<0.00007	<0.0000578	<0.0001	<0.0000826			<0.0001	<0.0000826	<0.000228
Thallium	<0.0001	<0.0000826	<0.0001	<0.0000826			<0.0001	<0.0000826	<0.000228
Tin	0.00011	0.0000909	<0.013	<0.0107			0.00011	0.0000909	0.000251
Vanadium	<0.00025	<0.000207	<0.00025	<0.000207			<0.0001	<0.0000826	<0.000228
Zinc	<7.3	<6.03	0.0159	0.0131			0.016	0.0132	0.0364
<b>Total Hazardous Metals*</b>	<b>0.0086</b>	<b>0.0071</b>	<b>0.0026</b>	<b>0.0022</b>	<b>0.00015</b>	<b>0.00012</b>	<b>0.012</b>	<b>0.0095</b>	<b>0.026</b>
<b>Total Metals</b>	<b>0.010</b>	<b>0.0084</b>	<b>0.023</b>	<b>0.019</b>			<b>0.034</b>	<b>0.028</b>	<b>0.076</b>

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

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# Appendix A

Field Sheets (17 pages)

## Appendix A Field Sheets (17 pages)

**Infrabuild Recycling Hexham**

AECOM's Project Number: 60493017

Emission Source: Shredder Stack

Date Sampled: 19-Nov-19

<b>ANALYTE(S)</b>	<b>METHOD</b>
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:

Sampling Performed By:

  
for Sharn Crosdale  
Sam Hamilton



ANZ

**Emission Measurement Calculations Spreadsheet**

Q4AN(EV)-332-FM31

**STACK ANALYSIS - PRE-SAMPLING**

Date: 19-Nov-19  
 Client: Infrabuild Recycling 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 <sup>2</sup>
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		
		PM2.5/10= 12		
Upstream (m) =	5	No. of sampling traverses/ports sampled =		2
No. Diameters =	6.6	PM2.5/10=		2
Type of Upstream Disturbance:	Fan Entry	No. of sampling points on each		
Downstream (m) =	2	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			Check of total points against minimum, (yes/no) - comments:	
11				
12				
13				
14				
15				
16				
17				
18				
19				
20			General Comments:	
Signed: 		Checked: 		



ANZ

**Emission Measurement Calculations Spreadsheet**

Q4AN(EV)-332-FM31

**STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING**

Date: 19-Nov-19  
 Client: Infrabuild Recycling 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: 10:25		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm), (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (dry)
1	10:25	0	20.9	0.0
2	10:26	0	20.9	0.0
3	10:27	0	20.9	0.0
4	10:28	0	20.9	0.0
5	10:29	0	20.9	0.0
6	10:30	0	20.9	0.0
7	10:31	0	20.9	0.0
8	10:32	0	20.9	0.0
Averages:		0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 1.00  
 Moisture percentage (M2): 0.20 %

Measurements

CO: 0.0000 %,(dry)	N <sub>2</sub> : 79.1 %,(dry)
CO <sub>2</sub> : 0.0 %,(dry)	O <sub>2</sub> : 20.9 %,(dry)
Gas Compositions converted to wet basis:	
CO: 0.0000 %,(wet)	N <sub>2</sub> : 78.9 %,(wet)
CO <sub>2</sub> : 0.0 %,(wet)	O <sub>2</sub> : 20.9 %,(wet)
H <sub>2</sub> O: 0.20 % (=M2)	
Therefore, stack gas density (GD) =	1.29 kg/m <sup>3</sup> (0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.29 kg/m <sup>3</sup> (0°C, dry, 1 atm pressure)

ANZ

**Emission Measurement Calculations Spreadsheet**

Q4AN(EV)-332-FM31

**STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING**

Date: 19-Nov-19  
 Client: Infrabuild Recycling 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: 11:52		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm), (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (dry)
1	11:52	0	20.9	0.0
2	11:53	0	20.9	0.0
3	11:54	0	20.9	0.0
4	11:55	0	20.9	0.0
5	11:56	0	20.9	0.0
6	11:57	0	20.9	0.0
7	11:58	0	20.9	0.0
8	11:59	0	20.9	0.0
Averages:		0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 1.00  
 Moisture percentage (M2): 0.24 %

Measurements

CO: 0.0000 %,(dry)	N <sub>2</sub> : 79.1 %,(dry)
CO <sub>2</sub> : 0.0 %,(dry)	O <sub>2</sub> : 20.9 %,(dry)
Gas Compositions converted to wet basis:	
CO: 0.0000 %,(wet)	N <sub>2</sub> : 78.9 %,(wet)
CO <sub>2</sub> : 0.0 %,(wet)	O <sub>2</sub> : 20.9 %,(wet)
H <sub>2</sub> O: 0.24 % (=M2)	
Therefore, stack gas density (GD) =	1.29 kg/m <sup>3</sup> (0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.29 kg/m <sup>3</sup> (0°C, dry, 1 atm pressure)

**Emission Measurement Calculations Spreadsheet**

**Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses**

Date: 19-Nov-19  
 Client: Infrabuild Recycling 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)

Time : 10:28		Barometric Pressure : 1013 hPa			
Page No. : 1 of 1		Pitot Correction Factor : 0.84			
Sampling Port No: 1 to 2		Stack Gas Density: 1.29 kg/m <sup>3</sup>			
Pitot Tube Type : s					(0 °C, Wet, 1 Atm)
Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.045	33.0	306.2	7.5
1/2	81	0.045	33.0	306.2	7.5
1/3	195	0.046	33.0	306.2	7.5
1/4	505	0.045	33.0	306.2	7.5
1/5	619	0.045	33.0	306.2	7.5
1/6	697	0.047	33.0	306.2	7.6
2/1	3	0.042	33.0	306.2	7.2
2/2	81	0.042	33.0	306.2	7.2
2/3	195	0.032	33.0	306.2	6.3
2/4	505	0.032	33.0	306.2	6.3
2/5	619	0.034	33.0	306.2	6.5
2/6	697	0.034	33.0	306.2	6.5
Average			33.0	306.2	7.1

Static Pressure (Dwyer) (Pa): kPa  
 Static Pressure (U-tube, if required) : -5.4 mm  
 Absolute pressure in stack (hPa) : 1012.47 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 19-Nov-19
Client: Infrabuild Recycling Hexham
AECOM's Project No: 60493017
Stack Description No.: Shredder Stack
Sample Nozzle No.: fine7
Sample Nozzle Area (An): 2.89 x 10^-5 m^2
Sampling Port No.: 1 to 2
Thimble No: a13
Page No: 1 of 1
Blank thimble No: 0

Leak Check (Pre-Sampling)

Meter start: 224.6258 Meter finish: 224.6258
Time start: 10:21 Time finish: 10:22

Leak Check (Post Sampling)

Meter start: 225.7898 Meter finish: 225.7898
Time start: 12:05 Time finish: 12:06

Therefore, leakage rate = no leak L/min Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable) (>0.1 l/min. is unacceptable)

Repeat: Repeat:
Comments: Comments:

Sampling Record Table

Barometric Pressure: 1013 hPa (start); 1013 hPa (finish)
Meter start: 224.6276 Time start: 10:35
Meter correction factor (GMf) : 0.9965

Table with 8 columns: Sampling Position No., Stopwatch Time at Sampling Position, Distance from far wall (mm), Isokinetic Flowrate (L/min), Meter Inlet Temp. (°C), Meter Outlet Temp. (°C), Impinger Train Outlet Temp (°C), Flowrate Attained (Y/N). Rows 1/1 to 2/6 and an Averages row.

Meter Finish: 225.7882 Time Finish: 11:59
Total Condensate collected: -8 ml Silica gel No(s) used: G275





**Emission Measurement Calculations Spreadsheet****Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses**

Date: 19-Nov-19  
 Client: Infrabuild Recycling 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)

Time :		12:04		Barometric Pressure :	1013 hPa
Page No. :		1 of 1		Pitot Correction Factor :	0.84
Sampling Port No:		1 to 2		Stack Gas Density:	1.29 kg/m <sup>3</sup>
Pitot Tube Type :		s		(0 °C, Wet, 1 Atm)	
Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure $\Delta P$ , kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.042	33.0	306.2	7.2
1/2	81	0.040	33.0	306.2	7.0
1/3	195	0.037	33.0	306.2	6.8
1/4	505	0.033	33.0	306.2	6.4
1/5	619	0.031	33.0	306.2	6.2
1/6	697	0.029	33.0	306.2	6.0
2/1	3	0.031	33.0	306.2	6.2
2/2	81	0.035	33.0	306.2	6.6
2/3	195	0.034	33.0	306.2	6.5
2/4	505	0.029	33.0	306.2	6.0
2/5	619	0.045	33.0	306.2	7.5
2/6	697	0.040	33.0	306.2	7.0
Average			33.0	306.2	6.6

Static Pressure (Dwyer) (Pa): kPa  
 Static Pressure (U-tube, if required) : -4.1 mm  
 Absolute pressure in stack (hPa) : 1012.60 hPa

Emission Measurement Calculations Spreadsheet

Stack Analysis - Hazardous Substances Elemental Analysis Results

Date: 19-Nov-19 Client: Infrabuild Recycling 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 <sub>4</sub> /H <sub>2</sub> SO <sub>4</sub> + Rinses (mg) (5B)	Residue Rinse 8N HCl (mg) (If Required) (5C)
Antimony	<0.00016	0.000393			
Arsenic	<0.00066	<0.0001			
Beryllium	<0.00006	<0.0001			
Cadmium	0.00027	0.0000483			
Chromium	0.0008	0.000297			
Cobalt	0.00008	<0.0001			
Copper	0.00146	0.000248			
Lead	0.00414	0.0011			
Magnesium	<0.32	0.00425			
Manganese	0.0025	0.000548			
Mercury	<0.0001	<0.0001	<0.0001	0.00015	<0.0001
Nickel	0.00085	0.000248			
Selenium	<0.00007	<0.0001			
Thallium	<0.0001	<0.0001			
Tin	0.00011	<0.013			
Vanadium	<0.00025	<0.00025			
Zinc	<7.3	0.0159			

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: 19-Nov-19 Client: Infrabuild Recycling Hexham  
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

Sample	Total Particulate Metals (mg)	Total Particulate Metals (mg/m <sup>3</sup> )	Total Gaseous Metals (mg)	Total Gaseous Metals (mg/m <sup>3</sup> )	Total Oxidisable Mercury (mg)	Total Oxidisable Mercury (mg/m <sup>3</sup> )	Total (mg)	Total (mg/m <sup>3</sup> )	Mass Emission Rate (mg/s)
Antimony	<0.00016	<0.000132	0.000393	0.000325			0.00039	0.000322	0.000887
Arsenic	<0.00066	<0.000545	<0.0001	<0.0000826			<0.0001	<0.0000826	<0.000228
Beryllium	<0.00006	<0.0000496	<0.0001	<0.0000826			<0.0001	<0.0000826	<0.000228
Cadmium	0.00027	0.000223	0.0000483	0.0000399			0.00032	0.000264	0.000728
Chromium	0.0008	0.000661	0.000297	0.000245			0.0011	0.000909	0.00251
Cobalt	0.00008	0.0000661	<0.0001	<0.0000826			0.00008	0.0000661	0.000182
Copper	0.00146	0.00121	0.000248	0.000205			0.0017	0.0014	0.00386
Lead	0.00414	0.00342	0.0011	0.000909			0.0052	0.0043	0.0119
Magnesium	<0.32	<0.264	0.00425	0.00351			0.0043	0.00355	0.00978
Manganese	0.0025	0.00207	0.000548	0.000453			0.003	0.00248	0.00683
Mercury	<0.0001	<0.0000826	<0.0001	<0.0000826	0.00015	0.000124	0.00015	0.000124	0.000342
Nickel	0.00085	0.000702	0.000248	0.000205			0.0011	0.000909	0.00251
Selenium	<0.00007	<0.0000578	<0.0001	<0.0000826			<0.0001	<0.0000826	<0.000228
Thallium	<0.0001	<0.0000826	<0.0001	<0.0000826			<0.0001	<0.0000826	<0.000228
Tin	0.00011	0.0000909	<0.013	<0.0107			0.00011	0.0000909	0.000251
Vanadium	<0.00025	<0.000207	<0.00025	<0.000207			<0.0001	<0.0000826	<0.000228
Zinc	<7.3	<6.03	0.0159	0.0131			0.016	0.0132	0.0364
Total Hazardous Metals*	0.0086	0.0071	0.0026	0.0022	0.00015	0.00012	0.012	0.0095	0.026
Total Metals	0.010	0.0084	0.023	0.019			0.034	0.028	0.076

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



**STACK ANALYSIS - FINAL CALCULATIONS**

**Fine Particulate (PM10)**

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

Date: 19-Nov-19 Client: Infrabuild Recycling Hexham  
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV <sub>3</sub> ):	1.1565 m <sup>3</sup>	Average barometric pressure (P <sub>BARO</sub> ):	1013 hPa
Average gas meter temp. (T <sub>M,2</sub> ):	34.7 °C	Average pressure at meter (P <sub>M,2</sub> ):	1013.00 hPa
	307.9 K		

Sample gas volume (MV<sub>4</sub>); (0°C, dry gas, 1 atm pressure): 1.0259 m<sup>3</sup>

(B) PM10 concentration at standard conditions

Blank thimble No.:	0	Blank weight:	g
Thimble No. used:	a13	PM10 Weight:	0.0018 g
Final PM10 Weight (M <sub>p1</sub> ):	0.00180 g		
PM10 Concentration (C <sub>1</sub> ):	=M <sub>p1</sub> /MV <sub>4</sub> =		0.0018 g/m <sup>3</sup> (0°C, dry gas, 1atm pressure)

;and C<sub>2</sub> = 1.8 mg/m<sup>3</sup> (0°C, dry gas, 1atm pressure)

CO<sub>2</sub> Basis 12 %  
 Average CO<sub>2</sub> %: 0.0 %

Therefore, C<sub>c</sub>: = C<sub>a</sub> x 12/CO<sub>2</sub>% = 0.0018 g/m<sup>3</sup> (0°C, dry gas, 1atm pressure, 12% CO<sub>2</sub>)

;and C<sub>c1</sub> = 1.8 mg/m<sup>3</sup> (0°C, dry gas, 1atm pressure, 12% CO<sub>2</sub>)

O<sub>2</sub> Basis 7 %  
 Average O<sub>2</sub> %: 20.9 %

Therefore, C<sub>b</sub>: =C<sub>a</sub> x (21 - O<sub>2ref</sub>%)/(21 - O<sub>2mea</sub>%) = 0.25 g/m<sup>3</sup> (0°C, dry gas, 1atm pressure, 7% O<sub>2</sub>)

;and C<sub>b1</sub> = 250 mg/m<sup>3</sup> (0°C, dry gas, 1atm pressure, 7% O<sub>2</sub>)

(C) Moisture content

Silica Gel Number:	G275		
V <sub>v</sub> =	9.2 g (from laboratory report)	V <sub>w</sub> =	-8 mL (=grams) (recorded on Laboratory Form 108)
Volume of Water Vapour Condensed (V <sub>wc(std)</sub> ) =	-0.0107		
Volume of Water Vapour Condensed (V <sub>wsg(std)</sub> ) =	0.0123		

Therefore, B<sub>ws</sub> =  $\frac{(V_{wc(std)} + V_{wsg(std)})}{(V_{wc(std)} + V_{wsg(std)} + V_{m(std)})}$

B<sub>ws</sub> = 0.16 %

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

= 1.150 kg/m<sup>3</sup> (stack conditions, wet)

(E) Gas Velocities

- (i) Average of pre-sampling velocities: 7.09 m/s
- (ii) Average of post-sampling velocities: 6.62 m/s
- (iii) Average of while-sampling velocities: N/A m/s
- (iv) Overall average of pre-sampling and post-sampling velocities (Vs):
  - 6.85 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<sub>stack</sub> = V<sub>s</sub> x A = 3.11 m<sup>3</sup>/s (stack conditions)

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

Q<sub>std</sub> = 2.8 m<sup>3</sup>/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

R<sub>m</sub> = C<sub>1a</sub> x Q<sub>std</sub> = 0.005 g/s (0°C, dry gas, 1 atm pressure )

= 5 mg/s (0°C, dry gas, 1 atm pressure )

**STACK ANALYSIS - FINAL CALCULATIONS**

**Total Particulate**

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

Date: 19-Nov-19 Client: Infrabuild Recycling Hexham  
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV <sub>3</sub> ):	1.0405 m <sup>3</sup>	Average barometric pressure (P <sub>BARO</sub> ):	1013 hPa
Average gas meter temp. (T <sub>M,2</sub> ):	32.8 °C	Average pressure at meter (P <sub>M,2</sub> ):	1013.00 hPa
	306.0 K		
Sample gas volume (MV <sub>4</sub> ); (0°C, dry gas, 1 atm pressure):	0.9287 m <sup>3</sup>		

(B) Total Particulate concentration at standard conditions

Blank thimble No.:		Blank weight:	g
Thimble No. used:	t23	Total Particulate Weight	0.0206 g
Final Total Particulate Weight (Mp1):	0.02060 g		
Total Particulate Concentration (C1):	=M <sub>p1</sub> /MV <sub>4</sub> =		0.022 g/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
		;and C <sub>2</sub> =	22 mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
CO <sub>2</sub> Basis	12 %		
Average CO <sub>2</sub> %:	0.0 %		
Therefore, C <sub>c</sub> :	= C <sub>a</sub> x 12/CO <sub>2</sub> % =		0.022 g/m <sup>3</sup> (0°C, dry gas, 1atm pressure, 12% CO <sub>2</sub> )
		;and C <sub>c1</sub> =	22 mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure, 12% CO <sub>2</sub> )
O <sub>2</sub> Basis	7 %		
Average O <sub>2</sub> %:	20.9 %		
Therefore, C <sub>b</sub> :	=C <sub>a</sub> x (21 - O <sub>2ref</sub> %)/(21 - O <sub>2mea</sub> %)		3.1 g/m <sup>3</sup> (0°C, dry gas, 1atm pressure, 7% O <sub>2</sub> )
		;and C <sub>b1</sub> =	3100 mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure, 7% O <sub>2</sub> )

(C) Moisture content

Silica Gel Number:	G063		
V <sub>v</sub> =	6.2 g (from laboratory report)	V <sub>w</sub> =	-6 mL (=grams) (recorded on Laboratory Form 108)
Volume of Water Vapour Condensed (V <sub>wc(std)</sub> ) =	-0.0080		
Volume of Water Vapour Condensed (V <sub>wsg(std)</sub> ) =	0.0083		
Therefore, B <sub>ws</sub> =	$\frac{(V_{wc(std)} + V_{wsg(std)})}{(V_{wc(std)} + V_{wsg(std)} + V_{m(std)})}$		
B <sub>ws</sub> =	0.03 %		

**Emission Measurement Calculations Spreadsheet**

**STACK ANALYSIS - FINAL CALCULATIONS CONTINUED**

**Total Particulate**

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

- (i) Initial gas density for sampling: 1.29 kg/m<sup>3</sup> (from Laboratory Form 107)
- (ii) Re-calculated gas density based on moisture content in (c):
  - 1.29 kg/m<sup>3</sup> (0°C, wet, 1 atm pressure)
  - 1.29 kg/m<sup>3</sup> (0°C, dry, 1 atm pressure)
- (iii) Gas density at stack conditions =  $(ii) \times \frac{(273.2)}{(273.2+T_s)} \times \frac{(P_s)}{(1013.25)}$   
 = 1.150 kg/m<sup>3</sup> (stack conditions, wet)

(E) Gas Velocities

- (i) Average of pre-sampling velocities: 7.09 m/s
  - (ii) Average of post-sampling velocities: 6.62 m/s
  - (iii) Average of while-sampling velocities: N/A m/s
  - (iv) Overall average of pre-sampling and post-sampling velocities (Vs):
    - 6.85 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<sub>stack</sub> = V<sub>s</sub> x A = 3.11 m<sup>3</sup>/s (stack conditions)

Q<sub>std</sub> = Q<sub>stack</sub> x  $\frac{P_s}{(P_{std})} \times \frac{(T_{std})}{(T_s)} \times \frac{(100 - B_w)}{100}$

Q<sub>std</sub> = 2.8 m<sup>3</sup>/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

R<sub>m</sub> = C<sub>1a</sub> x Q<sub>std</sub> = 0.061 g/s (0°C, dry gas, 1 atm pressure )  
 = 61 mg/s (0°C, dry gas, 1 atm pressure )

**STACK ANALYSIS - FINAL CALCULATIONS**

**Hazardous Substances (Metals)**

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

Date: 19-Nov-19 Client: Infrabuild Recycling Hexham  
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV <sub>3</sub> ):	1.3767 m <sup>3</sup>	Average barometric pressure (P <sub>BARO</sub> ):	1013 hPa
Average gas meter temp. (T <sub>M,2</sub> ):	37.5 °C	Average pressure at meter (P <sub>M,2</sub> ):	1013.00 hPa
	310.7 K		
Sample gas volume (MV <sub>4</sub> ); (0°C, dry gas, 1 atm pressure):	1.2102 m <sup>3</sup>		

(B) Metals concentration at standard conditions

Blank thimble No.:		Blank weight:	g
Thimble No. used:	0	Metals Weight:	0.0000115 g
Final Metals Weight (Mp1):	0.00001 g		
Metals Concentration (C1):	=M <sub>p1</sub> /MV <sub>4</sub> =	0.0000095 g/m <sup>3</sup> (0°C, dry gas, 1atm pressure)	
		and C <sub>2</sub> =	0.0095 mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
CO <sub>2</sub> Basis	12 %		
Average CO <sub>2</sub> %:	0.0 %		
Therefore, C <sub>c</sub> :	= C <sub>a</sub> x 12/CO <sub>2</sub> % =	0.0000095 g/m <sup>3</sup> (0°C, dry gas, 1atm pressure, 12% CO <sub>2</sub> )	
		and C <sub>c1</sub> =	0.0095 mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure, 12% CO <sub>2</sub> )
O <sub>2</sub> Basis	7 %		
Average O <sub>2</sub> %:	20.9 %		
Therefore, C <sub>b</sub> :	=C <sub>a</sub> x (21 - O <sub>2ref</sub> %)/(21 - O <sub>2mea</sub> %)	0.0013 g/m <sup>3</sup> (0°C, dry gas, 1atm pressure, 7% O <sub>2</sub> )	
		and C <sub>b1</sub> =	1.3 mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure, 7% O <sub>2</sub> )

(C) Moisture content

Silica Gel Number:	42		
V <sub>v</sub> =	6.8 g (from laboratory report)	V <sub>w</sub> =	-2 mL (=grams) (recorded on Laboratory Form 108)
Volume of Water Vapour Condensed (V <sub>wc(std)</sub> ) =	-0.0027		
Volume of Water Vapour Condensed (V <sub>wsg(std)</sub> ) =	0.0091		
Therefore, B <sub>ws</sub> =	$\frac{(V_{wc(std)}+V_{wsg(std)})}{(V_{wc(std)}+V_{wsg(std)}+V_{m(std)})}$		
B <sub>vis</sub> =	0.53 %		

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

= 1.150 kg/m<sup>3</sup> (stack conditions, wet)

(E) Gas Velocities

- (i) Average of pre-sampling velocities: 7.09 m/s
  - (ii) Average of post-sampling velocities: 6.62 m/s
  - (iii) Average of while-sampling velocities: N/A m/s
  - (iv) Overall average of pre-sampling and post-sampling velocities (Vs):
    - 6.85 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<sub>stack</sub> = V<sub>s</sub> x A = 3.11 m<sup>3</sup>/s (stack conditions)

Q<sub>std</sub> = Q<sub>stack</sub> x  $\frac{P_s}{(P_{std})}$  x  $\frac{(T_{std})}{(T_s)}$  x  $\frac{(100 - B_w)}{100}$

Q<sub>std</sub> = 2.8 m<sup>3</sup>/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

R<sub>m</sub> = C<sub>1a</sub> x Q<sub>std</sub> = 0.000026 g/s (0°C, dry gas, 1 atm pressure )

= 0.026 mg/s (0°C, dry gas, 1 atm pressure )

<b>EMISSION MONITORING RESULTS, SHREDDER STACK</b> <b>INFRABUILD RECYCLING HEXHAM</b> 19-Nov-19 FINE PARTICULATE (PM10) TOTAL PARTICULATE HAZARDOUS SUBSTANCES (METALS)		
<b>Sampling Conditions:</b>		
Stack internal diameter at test location	760 mm	
Stack gas temperature (average)	33.0 °C	306.2 K
Stack pressure (average)	1013 hPa	
Stack gas velocity (average, stack conditions)	6.9 m/s	
Stack gas flowrate (stack conditions)	3.1 m <sup>3</sup> /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	2.8 m <sup>3</sup> /s	
<b>Fine Particulate (PM10) Testing</b>		
Test Period	10:35	- 11:59
Fine Particulate (PM10) Mass	1.8 mg	
Gas Volume Sampled	1.0 m <sup>3</sup>	
Fine Particulate (PM10) Emission*1	1.8 mg/m <sup>3</sup>	
Fine Particulate (PM10) Mass Emission Rate*2	5 mg/s	
Regulatory Limit	N/A	
<b>Total Particulate Testing</b>		
Test Period	10:35	- 11:59
Total Particulate Mass	20.6 mg	
Gas Volume Sampled	0.93 m <sup>3</sup>	
Total Particulate Emission*1	22 mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate*2	61 mg/s	
Regulatory Limit	100 mg/m <sup>3</sup>	
<b>Hazardous Substances (Metals) Testing</b>		
Test Period	10:35	- 11:59
Hazardous Substances (Metals) Mass	0.0115 mg	
Gas Volume Sampled	1.2 m <sup>3</sup>	
Hazardous Substances (Metals) Emission*1	0.0095 mg/m <sup>3</sup>	
Hazardous Substances (Metals) Mass Emission Rate*2	0.026 mg/s	
Regulatory Limit	N/A	
<b>Moisture Content (%)</b>		
	0.3	
<b>Gas Density (dry at 1 atmosphere)</b>		
	1.29 kg/m <sup>3</sup>	
<b>Dry Molecular Weight</b>		
	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<sub>std</sub> 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 :** 20285-0-P

Page 1 of 1

**Project:** 60493017

**Description :** Stack Emission Samples

**Date :** 26-Nov-19

Received: 21-Nov-19

**Report To :** Cye Buckland

**Copy to:** FILE

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Thimble ID		Volume (mL)	Total Particulate Matter (g)
A13	Thimble	-	0.0018
T23	Thimble	-	0.0206



NATA Accredited Laboratory 18079

Accredited for compliance with  
ISO/IEC 17025 - Testing

*Note : Sampled by Client*

**Reported By:** J. Campbell

Jason Campbell - Manager

Determined in Accordance With:  
Particulate matter - total in stack gases by  
gravimetric using in-house M300;  
Acetone/Water Rinse using AS4323.2  
Refer Form F422 - Measurement Uncertainty

# Steel River Testing



5/11 McIntosh Drive, Mayfield West, NSW 2304

Phone: 02 49677880

## STACK EMISSION - MOISTURE REPORT

**Origin:** AECOM - Newcastle

**Report :** 20285-0-M

Page 1 of 1

**Project:** 60493017

**Description :** Stack Emission Samples

**Date :** 26-Nov-19

Received: 21-Nov-19

**Report To :** Cye Buckland

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Jar ID	Moisture (g)
042	6.8
G063	6.2
G275	9.2



NATA Accredited Laboratory 18079

Accredited for compliance with  
ISO/IEC 17025 - Testing

**Reported By:** J. Campbell

Jason Campbell - Manager

Determined in Accordance With:  
Moisture content in stack gases by gravimetric  
using in-house M301  
Refer Form F422 - Measurement Uncertainty

CLIENT DETAILS

Contact **Cye Buckland**  
 Client **AECOM Australia Pty Ltd**  
 Address **17 Warabrook Boulevard  
 Warabrook  
 SYDNEY NSW 2304**

Telephone **02 8295 3600**  
 Facsimile **02 8934 0001**  
 Email **cye.buckland@aecom.com**

Project **60493017/4.1**  
 Order Number **60493017/4.1**  
 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 **ME312795 R0**  
 Date Received **21 Nov 2019**  
 Date Reported **27 Nov 2019**

COMMENTS

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

SIGNATORIES

**Adam Atkinson**  
 Business Manager

**Ryan ZHANG**  
 Team Leader

Sample Number	ME312795.001	ME312795.002	ME312795.003	ME312795.004
Sample Matrix	Filter	Impinger	Impinger	Impinger
Sample Date	19 Nov 2019	19 Nov 2019	19 Nov 2019	19 Nov 2019
Sample Name	I_Metals 1	I_Metals 3	I_Metals 4	I_Metals 5A

Parameter	Units	LOR				
<b>Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 22/11/2019</b>						
Sb	µg total	0.05	0.06	-	-	-
As	µg total	0.05	0.48	-	-	-
Be	µg total	0.05	<0.05	-	-	-
Cd	µg total	0.05	0.32	-	-	-
Cr	µg total	0.05	2.8	-	-	-
Co	µg total	0.05	0.13	-	-	-
Cu	µg total	0.05	1.5	-	-	-
Pb	µg total	0.05	4.6	-	-	-
Mg	µg total	0.05	290	-	-	-
Mn	µg total	0.05	3.5	-	-	-
Hg	µg total	0.05	<0.05	-	-	-
Ni	µg total	0.05	0.62	-	-	-
Se	µg total	0.05	<0.05	-	-	-
Tl	µg total	0.05	<0.05	-	-	-
Sn	µg total	0.05	0.43	-	-	-
V	µg total	0.25	<0.25	-	-	-
Zn	µg total	0.05	6900	-	-	-

<b>Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 25/11/2019</b>						
Sb	µg total	0.1	-	0.1	0.6	-
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	0.4	-
Co	µg total	0.1	-	<0.1	<0.1	-
Cu	µg total	0.1	-	0.3	0.3	-
Pb	µg total	0.1	-	0.3	1.2	-
Mg	µg total	0.1	-	0.8	4.3	-
Mn	µg total	0.1	-	0.3	0.6	-
Hg	µg total	0.1	-	<0.1	<0.1	<0.1
Ni	µg total	0.1	-	0.2	0.3	-
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	13	-
V	µg total	0.1	-	<0.1	<0.1	-
Zn	µg total	0.1	-	1.5	16	-
Sample Volume*	mL	-	-	99	310	98

Sample Number	ME312795.005	ME312795.006	ME312795.007	ME312795.008
Sample Matrix	KMn04	Impinger	Impinger	Impinger
Sample Date	19 Nov 2019	19 Nov 2019	19 Nov 2019	19 Nov 2019
Sample Name	I_Metals 5B	I_Metals 5C	Metals 8A	Metals 8B

Parameter	Units	LOR				
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Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29\_FILT Tested: 25/11/2019

Parameter	Units	LOR	ME312795.005	ME312795.006	ME312795.007	ME312795.008
Sb	µg total	0.05	-	-	-	-
As	µg total	0.05	-	-	-	-
Be	µg total	0.05	-	-	-	-
Cd	µg total	0.05	-	-	-	-
Cr	µg total	0.05	-	-	-	-
Co	µg total	0.05	-	-	-	-
Cu	µg total	0.05	-	-	-	-
Pb	µg total	0.05	-	-	-	-
Mg	µg total	0.05	-	-	-	-
Mn	µg total	0.05	-	-	-	-
Hg	µg total	0.05	-	-	-	-
Ni	µg total	0.05	-	-	-	-
Se	µg total	0.05	-	-	-	-
Tl	µg total	0.05	-	-	-	-
Sn	µg total	0.05	-	-	-	-
V	µg total	0.25	-	-	-	-
Zn	µg total	0.05	-	-	-	-

Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29\_METIMP Tested: 22/11/2019

Parameter	Units	LOR	ME312795.005	ME312795.006	ME312795.007	ME312795.008
Sb	µg total	0.1	-	-	0.1	-
As	µg total	0.1	-	-	<0.1	-
Be	µg total	0.1	-	-	<0.1	-
Cd	µg total	0.1	-	-	<0.1	-
Cr	µg total	0.1	-	-	<0.1	-
Co	µg total	0.1	-	-	<0.1	-
Cu	µg total	0.1	-	-	<0.1	-
Pb	µg total	0.1	-	-	0.1	-
Mg	µg total	0.1	-	-	<0.1	-
Mn	µg total	0.1	-	-	<0.1	-
Hg	µg total	0.1	0.2	<0.1	<0.1	<0.1
Ni	µg total	0.1	-	-	<0.1	-
Se	µg total	0.1	-	-	<0.1	-
Tl	µg total	0.1	-	-	<0.1	-
Sn	µg total	0.1	-	-	<0.1	-
V	µg total	0.1	-	-	<0.1	-
Zn	µg total	0.1	-	-	<0.1	-
Sample Volume*	mL	-	400	250	310	100

Sample Number	ME312795.009	ME312795.010	ME312795.011	ME312795.012
Sample Matrix	Impinger	KMn04	Impinger	Filter
Sample Date	19 Nov 2019	19 Nov 2019	19 Nov 2019	19 Nov 2019
Sample Name	Metals 9	Metals 10	Metals 11	Metals 12

Parameter	Units	LOR				
<b>Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 25/11/2019</b>						
Sb	µg total	0.05	-	-	-	0.06
As	µg total	0.05	-	-	-	0.66
Be	µg total	0.05	-	-	-	0.06
Cd	µg total	0.05	-	-	-	<0.05
Cr	µg total	0.05	-	-	-	2.1
Co	µg total	0.05	-	-	-	<0.05
Cu	µg total	0.05	-	-	-	0.34
Pb	µg total	0.05	-	-	-	0.66
Mg	µg total	0.05	-	-	-	320
Mn	µg total	0.05	-	-	-	1.3
Hg	µg total	0.05	-	-	-	<0.05
Ni	µg total	0.05	-	-	-	0.17
Se	µg total	0.05	-	-	-	0.07
Tl	µg total	0.05	-	-	-	<0.05
Sn	µg total	0.05	-	-	-	0.32
V	µg total	0.25	-	-	-	<0.25
Zn	µg total	0.05	-	-	-	7300

<b>Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 22/11/2019</b>						
Sb	µg total	0.1	0.1	-	-	-
As	µg total	0.1	<0.1	-	-	-
Be	µg total	0.1	<0.1	-	-	-
Cd	µg total	0.1	<0.1	-	-	-
Cr	µg total	0.1	0.1	-	-	-
Co	µg total	0.1	<0.1	-	-	-
Cu	µg total	0.1	<0.1	-	-	-
Pb	µg total	0.1	<0.1	-	-	-
Mg	µg total	0.1	<0.1	-	-	-
Mn	µg total	0.1	<0.1	-	-	-
Hg	µg total	0.1	<0.1	<0.1	<0.1	-
Ni	µg total	0.1	<0.1	-	-	-
Se	µg total	0.1	<0.1	-	-	-
Tl	µg total	0.1	<0.1	-	-	-
Sn	µg total	0.1	13	-	-	-
V	µg total	0.1	<0.1	-	-	-
Zn	µg total	0.1	<0.1	-	-	-
Sample Volume*	mL	-	210	85	250	-



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 to 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 Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29\_FILT

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Sb	LB029811	µg total	0.05	<0.05	107%
As	LB029811	µg total	0.05	<0.05	108%
Be	LB029811	µg total	0.05	<0.05	95%
Cd	LB029811	µg total	0.05	<0.05	102%
Cr	LB029811	µg total	0.05	<0.05	100%
Co	LB029811	µg total	0.05	<0.05	101%
Cu	LB029811	µg total	0.05	<0.05	100%
Pb	LB029811	µg total	0.05	<0.05	103%
Mg	LB029811	µg total	0.05	<0.05	107%
Mn	LB029811	µg total	0.05	<0.05	102%
Hg	LB029811	µg total	0.05	<0.05	101%
Ni	LB029811	µg total	0.05	<0.05	99%
Se	LB029811	µg total	0.05	<0.05	108%
Tl	LB029811	µg total	0.05	<0.05	109%
Sn	LB029811	µg total	0.05	<0.05	103%
V	LB029811	µg total	0.25	<0.25	100%
Zn	LB029811	µg total	0.05	<0.05	96%

Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29\_METIMP

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Sb	LB029812	µg total	0.1	<0.1	107%
As	LB029812	µg total	0.1	<0.1	108%
Be	LB029812	µg total	0.1	<0.1	98%
Cd	LB029812	µg total	0.1	<0.1	103%
Cr	LB029812	µg total	0.1	<0.1	101%
Co	LB029812	µg total	0.1	<0.1	103%
Cu	LB029812	µg total	0.1	<0.1	104%
Pb	LB029812	µg total	0.1	<0.1	103%
Mg	LB029812	µg total	0.1	<0.1	108%
Mn	LB029812	µg total	0.1	<0.1	103%
Hg	LB029812	µg total	0.1	<0.1	
Ni	LB029812	µg total	0.1	<0.1	100%
Se	LB029812	µg total	0.1	<0.1	106%
Tl	LB029812	µg total	0.1	<0.1	109%
Sn	LB029812	µg total	0.1	<0.1	103%
V	LB029812	µg total	0.1	<0.1	101%
Zn	LB029812	µg total	0.1	<0.1	97%
Sample Volume*	LB029812	mL	-	1.0	NA

METHOD

METHODOLOGY SUMMARY

EPA 29

Analysis of acid-leachable metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS). This method is based on USEPA 3051A, USEPA M29, and USEPA 6020A.  
 . Filters are digested using the appropriate sample preparation methods.  
 A representative sample is extracted in concentrated acid using microwave heating by the CEM -MarsXPress (with Built-in USEPA method) Microwave Digestion system. The sample and acid are placed in a microwave vessel (TFM), which is then capped and heated in the microwave unit. After cooling, the vessel contents are diluted with DI water, then filtered/settled/centrifuged and analysed by ICP MS.

EPA29

This method covers the analysis of acid-leachable metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS). This method is based on USEPA M29, USEPA 3015A and USEPA 6020A.  
 Prior to analysis, samples are be solubilised or digested using the appropriate sample preparation methods.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
		-	The sample was not analysed for this analyte
		NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been 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 and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: [www.sgs.com.au/pv.sgs/vr/en-gb/environment](http://www.sgs.com.au/pv.sgs/vr/en-gb/environment).

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