

4th Quarter Emissions Testing Report 2020

Infrabuild Recycling Hexham



NATA ACCREDITATION No. 2778 (14391)
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4th Quarter Emissions Testing Report 2020

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 4 December 2020 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 23291-0-M & 23291-0-P:
 - Total Particulate (TP);
 - Fine Particulates (PM₁₀); and
 - Moisture.
- SGS Australia Pty Ltd, NATA accreditation number 2562, performed the following analysis detailed in report number ME317835 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 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 4 December 2020.

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 ¹	Yes

¹ 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 results represent. The measurement of uncertainty has been calculated at $\pm 13.6\%$.

Table 4 Shredder Baghouse Emission Results Summary, 4 December 2020

Parameter	Emission Concentration (EPL Point 1)	Emission Concentration Limit
Total Particulate (TP) (mg/m ³)	6.0	100
Fine Particulate (PM ₁₀) (mg/m ³)	0.52	N/A
Lead (mg/m ³)	0.0045	5.0
Mercury (mg/m ³)	0.00026	1.0
Total Hazardous Substances (Metals) (mg/m ³)	0.092	N/A

Results from testing conducted on EPL Point 1 on 4 December 2020 are below the regulatory limits listed in EPL 5345.

Table 5 Fine Particulate (PM₁₀), Total Particulate and Hazardous Substance (Metals) Results, 4 December 2020

Sampling Conditions:		
Stack internal diameter at test location	760 mm	306.7 K
Stack gas temperature (average)	33.5 °C	
Stack pressure (average)	1015 hPa	
Stack gas velocity (average, stack conditions)	6.6 m/s	
Stack gas flowrate (stack conditions)	3 m ³ /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	2.6 m ³ /s	
Fine Particulate (PM₁₀) Testing		
Test Period	9:48 -	11:24
Fine Particulate (PM ₁₀) Mass	0.6 mg	
Gas Volume Sampled	1.15 m ³	
Fine Particulate (PM ₁₀) Emission* ¹	0.52 mg/m ³	
Fine Particulate (PM ₁₀) Mass Emission Rate* ²	1.4 mg/s	
Regulatory Limit	N/A	
Total Particulate Testing		
Test Period	9:48 -	11:24
Total Particulate Mass	8.7 mg	
Gas Volume Sampled	1.46 m ³	
Total Particulate Emission* ¹	6.0 mg/m ³	
Total Particulate Mass Emission Rate* ²	16 mg/s	
Regulatory Limit	100 mg/m ³	
Hazardous Substances (Metals) Testing		
Test Period	9:48 -	11:24
Hazardous Substances (Metals) Mass	0.108 mg	
Gas Volume Sampled	1.17 m ³	
Hazardous Substances (Metals) Emission* ¹	0.092 mg/m ³	
Hazardous Substances (Metals) Mass Emission Rate* ²	0.24 mg/s	
Regulatory Limit	N/A	
Moisture Content (%)	1.4	
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, 4 December 2020

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	<0.00010	<0.000086	0.00015	0.00013			0.00015	0.00013	0.00034
Arsenic	0.000090	0.000077	<0.00010	<0.000086			0.000090	0.000077	0.00020
Beryllium	<0.00010	<0.000086	<0.00010	<0.000086			<0.00010	<0.000086	<0.00022
Cadmium	0.067	0.057	0.0015	0.0012			0.068	0.058	0.15
Chromium	0.00070	0.00060	0.00040	0.00034			0.0011	0.00094	0.0025
Cobalt	0.00013	0.00011	0.00025	0.00021			0.00038	0.00033	0.00085
Copper	0.0095	0.0081	0.0013	0.0011			0.011	0.0094	0.025
Lead	0.0044	0.0038	0.00080	0.00069			0.0052	0.0045	0.012
Magnesium	0.020	0.017	0.0037	0.0032			0.024	0.021	0.054
Manganese	0.0031	0.0027	0.026	0.022			0.029	0.025	0.065
Mercury	<0.00010	<0.000086	<0.00010	<0.000086	0.00030	0.00026	0.00030	0.00026	0.00067
Nickel	0.0011	0.00090	0.0020	0.0017			0.0031	0.0027	0.0070
Selenium	0.000010	0.0000086	0.00015	0.00013			0.00016	0.00014	0.00036
Thallium	<0.0001	<0.000086	<0.00010	<0.000086			<0.00010	<0.000086	<0.00022
Tin	0.00035	0.00030	<0.0073	<0.00625			0.00035	0.00030	0.00079
Vanadium	<0.00025	<0.00021	<0.00010	<0.000086			<0.00025	<0.00021	<0.00056
Zinc	0.60	0.51	0.020	0.017			0.62	0.53	1.4
Total Hazardous Metals*	0.077	0.066	0.031	0.027	0.00030	0.00026	0.11	0.092	0.24
Total Metals	0.71	0.61	0.056	0.048			0.76	0.65	1.7

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

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Appendix A

Field Sheets (19 pages)

Appendix A Field Sheets (19 pages)

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

Infrabuild Recycling Hexham

AECOM's Project Number: 60493017

Emission Source: Shredder Stack

Date Sampled: 4-Dec-20

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:

Sampling Performed By:


Sam Hamilton


Nick Stanning

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 4-Dec-20
 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 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		
		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 traverse/port = 6		
Downstream (m) = 2		PM2.5/10= 6		
No. Diameters = 2.6				
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			General Comments:	
20				
Signed: <i>G. Burdland</i>		Checked: <i>[Signature]</i>		

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 4-Dec-20
 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: 9:48		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O ₂ (%), (dry)	CO ₂ (%), (dry)
1	9:48	0	20.9	0.0
2	9:49	0	20.9	0.0
3	9:50	0	20.9	0.0
4	9:51	0	20.9	0.0
5	9:52	0	20.9	0.0
6	9:53	0	20.9	0.0
7	9:54	0	20.9	0.0
8	9:55	0	20.9	0.0
Averages:		0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
 Moisture percentage (M2): 1.60 %

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 : 77.8 %,(wet)
CO ₂ : 0.0 %,(wet)	O ₂ : 20.6 %,(wet)
H ₂ O: 1.60 % (=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)	

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 4-Dec-20
 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: 11:11		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O ₂ (%), (dry)	CO ₂ (%), (dry)
1	11:11	0	20.9	0.0
2	11:12	0	20.9	0.0
3	11:13	0	20.9	0.0
4	11:14	0	20.9	0.0
5	11:15	0	20.9	0.0
6	11:16	0	20.9	0.0
7	11:17	0	20.9	0.0
8	11:18	0	20.9	0.0
Averages:		0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
 Moisture percentage (M2): 1.37 %

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 : 78.0 %,(wet)
CO ₂ : 0.0 %,(wet)	O ₂ : 20.6 %,(wet)
H ₂ O: 1.37 % (=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 - Pre Sampling Pitot Tube and Temperature Traverses

Date: 4-Dec-20
 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 : 9:40		Barometric Pressure : 1015 hPa			
Page No. : 1 of 1		Pitot Correction Factor : 0.84			
Sampling Port No: 1 to 2		Stack Gas Density: 1.28 kg/m ³			
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	0.021	32.0	305.2	5.0
1/2	81	0.053	32.0	305.2	8.1
1/3	195	0.035	32.0	305.2	6.6
1/4	505	0.024	32.0	305.2	5.4
1/5	619	0.025	32.0	305.2	5.5
1/6	697	0.021	32.0	305.2	5.0
2/1	3	0.030	32.0	305.2	6.1
2/2	81	0.034	32.0	305.2	6.5
2/3	195	0.037	32.0	305.2	6.8
2/4	505	0.040	32.0	305.2	7.0
2/5	619	0.046	32.0	305.2	7.5
2/6	697	0.037	32.0	305.2	6.8
Average			32.0	305.2	6.4

Static Pressure (Dwyer) (Pa): kPa
 Static Pressure (U-tube, if required) : -4.1 mm
 Absolute pressure in stack (hPa) : 1014.60 hPa

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 4-Dec-20
 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 :		11:34		Barometric Pressure :	1015	hPa
Page No. :		1 of 1		Pitot Correction Factor :	0.84	
Sampling Port No:		1 to 2		Stack Gas Density:	1.28	kg/m ³
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	0.050	35.0	308.2	7.9	
1/2	81	0.045	35.0	308.2	7.5	
1/3	195	0.033	35.0	308.2	6.4	
1/4	505	0.034	35.0	308.2	6.5	
1/5	619	0.026	35.0	308.2	5.7	
1/6	697	0.021	35.0	308.2	5.1	
2/1	3	0.039	35.0	308.2	7.0	
2/2	81	0.040	35.0	308.2	7.1	
2/3	195	0.035	35.0	308.2	6.6	
2/4	505	0.040	35.0	308.2	7.1	
2/5	619	0.042	35.0	308.2	7.2	
2/6	697	0.039	35.0	308.2	7.0	
Average			35.0	308.2	6.8	

Static Pressure (Dwyer) (Pa): kPa
 Static Pressure (U-tube, if required) : -3.7 mm
 Absolute pressure in stack (hPa) : 1014.64 hPa

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

Stack Analysis - Hazardous Substances Elemental Analysis Results

Date: 4-Dec-20 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 ₄ /H ₂ SO ₄ + Rinses (mg) (5B)	Residue Rinse 8N HCl (mg) (If Required) (5C)
Antimony	<0.0001	0.00015			
Arsenic	0.00009	<0.0001			
Beryllium	<0.0001	<0.0001			
Cadmium	0.067	0.00145			
Chromium	0.0007	0.0004			
Cobalt	0.00013	0.00025			
Copper	0.0095	0.0013			
Lead	0.0044	0.0008			
Magnesium	0.0202	0.0037			
Manganese	0.0031	0.026			
Mercury	<0.0001	<0.0001	<0.0001	0.0003	NA
Nickel	0.00105	0.002			
Selenium	0.00001	0.00015			
Thallium	<0.0001	<0.0001			
Tin	0.00035	<0.0073			
Vanadium	<0.00025	<0.0001			
Zinc	0.6	0.0196			

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: 4-Dec-20 Client: Infrabuild Recycling 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	<0.0001	<0.0000857	0.00015	0.00013			0.00015	0.00013	0.00034
Arsenic	0.000090	0.000077	<0.0001	<0.0000857			0.000090	0.000077	0.00020
Beryllium	<0.0001	<0.0000857	<0.0001	<0.0000857			<0.0001	<0.0000857	<0.000224
Cadmium	0.067	0.057	0.0015	0.0012			0.068	0.058	0.15
Chromium	0.00070	0.00060	0.00040	0.00034			0.0011	0.00094	0.0025
Cobalt	0.00013	0.00011	0.00025	0.00021			0.00038	0.00033	0.00085
Copper	0.0095	0.0081	0.0013	0.0011			0.011	0.0094	0.025
Lead	0.0044	0.0038	0.00080	0.00069			0.0052	0.0045	0.012
Magnesium	0.020	0.017	0.0037	0.0032			0.024	0.021	0.054
Manganese	0.0031	0.0027	0.026	0.022			0.029	0.025	0.065
Mercury	<0.0001	<0.0000857	<0.0001	<0.0000857	0.00030	0.00026	0.00030	0.00026	0.00067
Nickel	0.0011	0.00090	0.0020	0.0017			0.0031	0.0027	0.0070
Selenium	0.000010	0.0000086	0.00015	0.00013			0.00016	0.00014	0.00036
Thallium	<0.0001	<0.0000857	<0.0001	<0.0000857			<0.0001	<0.0000857	<0.000224
Tin	0.00035	0.00030	<0.0073	<0.00625			0.00035	0.00030	0.00079
Vanadium	<0.00025	<0.000214	<0.0001	<0.0000857			<0.00025	<0.000214	<0.00056
Zinc	0.60	0.51	0.020	0.017			0.62	0.53	1.4
Total Hazardous Metals*	0.077	0.066	0.031	0.027	0.00030	0.00026	0.11	0.092	0.24
Total Metals	0.71	0.61	0.056	0.048			0.76	0.65	1.7

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

STACK ANALYSIS - PM10 CALCULATIONS

Date: 4-Dec-20 Client: Infrabuild Recycling Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

1. Gas Analysis

%
 %CO₂ 0.0
 %O₂ 20.9
 %N₂+%CO 79.1
 Fraction Moisture Content, Bws 0.01 M₃= 0.99

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry) 28.84
 Mol. Wt. of Stack Gas (wet) 28.66

3. Absolute Stack Pressure

Pascals in. Hg
 Barometric Pressure (Pbar) 101500 29.96
 Stack Static Pressure (Pg) 101464 29.95

Absolute Stack Pressure 29.95

4. Viscosity of Stack Gas

°C °F
 Average Stack Temp. 35.0 95.0
 Average Meter Temperature: 32.1
 Stack Gas Viscosity 187.0

5. Cyclone Flow Rate

ft³/min m³/min L/min L/s
 Cyclone Flow Rate 0.47 0.0165 16.47 0.27

6. Nozzle Velocity, Rmin and Rmax

Nozzle Number	Nozzle Diameter (inches)	Nozzle Velocity		Rmin	Rmax	Vmin	Vmin	Vmax	Vmax
		ft/sec	m/s	-	-	ft/sec	m/s	ft/sec	m/s
0	0.128	86.90	28.60	0.762	1.227	66.18	21.71	106.60	34.97
1	0.136	76.83	25.29	0.753	1.232	57.89	18.99	94.66	31.05
2	0.159	56.17	18.49	0.723	1.251	40.63	13.33	70.24	23.05
3	0.184	42.23	13.90	0.677	1.276	28.59	9.38	53.91	17.69
4	0.177	45.28	14.91	0.691	1.269	31.28	10.26	57.47	18.86
5	0.211	31.93	10.51	0.596	1.314	19.04	6.25	41.95	13.76
6	0.217	30.40	10.01	0.576	1.322	17.50	5.74	40.18	13.18
7	0.236	25.61	8.43	0.471	1.354	12.80	4.20	34.68	11.38
8	0.275	18.84	6.20	#NUM!	1.433	9.42	3.09	27.01	8.86
9	0.304	15.43	5.08	#NUM!	1.503	7.72	2.53	23.15	7.59
10	0.345	12.00	3.95	#NUM!	1.615	6.00	1.97	18.01	5.91
11	0.394	9.16	3.02	#NUM!	1.775	4.58	1.50	13.74	4.51
	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate					
Selected Nozzle	(inches)	(m)	(m ²)	(L/min)					
7	0.236	0.006	0.000028	13.8					

STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 4-Dec-20 Client: Infrabuild Recycling Hexham
AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

7.Sampling Time Total Run Time 96 Number of points 12

Table with columns: Velocity Head (pitot) Pa, Vel Head in H2O, Sqr Root, Dwell time mins. It contains 12 rows of data representing individual sampling points.

Table with columns: Total time min, Full hours, Full minutes, Seconds. It contains 12 rows of data representing the timing for each sampling point.

Average 0.38 96.00
Square 0.15

Aerodynamic Cut Size (u_cnc) 187.9
PM10 Flow rate at actual cyclone conditions (Q_a) 0.0127
Actual D_50 10.3

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 4-Dec-20 Client: Infrabuild Recycling Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV₃): 1.2792 m³ Average barometric pressure (P_{BARO}) 1015 hPa
 Average gas meter temp. (T_{M,2}): 32.1 °C
 305.3 K Average pressure at meter (P_{M,2}) 1015.00 hPa
 Sample gas volume (MV₄); (0°C, dry gas, 1 atm pressure): 1.1467 m³

(B) PM10 concentration at standard conditions

Blank thimble No.: 0 Blank weight: g
 Thimble No. used: SLR 20 PM10 Weight: 0.0006 g
 Final PM10 Weight (Mp1): 0.00060 g
 PM10 Concentration (C1): =M_{p1}/MV₄= 0.00052 g/m³ (0°C, dry gas, 1atm pressure)

;and C₂ = 0.52 mg/m³ (0°C, dry gas, 1atm pressure)
 CO₂ Basis 12 %
 Average CO₂%: 0.0 %

Therefore, C_c: = C_a x 12/CO₂% = 0.00052 g/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)
 ;and C_{c1} = 0.52 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}%) 0.073 g/m³ (0°C, dry gas, 1atm pressure, 7% O₂)
 ;and C_{b1} = 73 mg/m³ (0°C, dry gas, 1atm pressure, 7% O₂)

(C) Moisture content

Silica Gel Number: O16
 V_v = 8.4 g (from laboratory report) V_w = 4 mL (=grams)
 Volume of Water Vapour Condensed (V_{wc(std)}) = 0.0053 (recorded on Laboratory Form 108)
 Volume of Water Vapour Condensed (V_{wsg(std)}) = 0.0112

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

B_{ws} = 1.42 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.28 kg/m³ (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c):
 1.28 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) x $\frac{(273.2)}{(273.2+T_s)}$ x $\frac{(P_s)}{(1013.25)}$
 = 1.142 kg/m³ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 6.36 m/s

(ii) Average of post-sampling velocities: 6.76 m/s

(iii) Average of while-sampling velocities: N/A m/s

(iv) Overall average of pre-sampling and post-sampling velocities (Vs):
 6.56 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 = 2.98 m³/s (stack conditions)

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

Q_{std} = 2.6 m³/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

R _m =	C _{1a} x Q _{std} =	0.0014	g/s (0°C, dry gas, 1 atm pressure)	
	=	1.4	mg/s (0°C, dry gas, 1 atm pressure)	
	C _{1a} x Q _{std} =	0.0014	g/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	=	1.4	mg/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	C _{1a} x Q _{std} =	0.19	g/s (0°C, dry gas, 1 atm pressure	7% O ₂)
	=	190	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: 4-Dec-20 Client: Infrabuild Recycling Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV ₃):	1.6195 m ³	Average barometric pressure (P _{BARO}):	1015 hPa
Average gas meter temp. (T _{M,2}):	31.0 °C	Average pressure at meter (P _{M,2}):	1015.00 hPa
	304.2 K		
Sample gas volume (MV ₄); (0°C, dry gas, 1 atm pressure):	1.4570 m ³		

(B) Total Particulate concentration at standard conditions

Blank thimble No.:		Blank weight:	g
Thimble No. used:	M34	Total Particulate Weight:	0.0087 g
Final Total Particulate Weight (Mp1):	0.00870 g		
Total Particulate Concentration (C1):	=M _{p1} /MV ₄ =		0.006 g/m ³ (0°C, dry gas, 1atm pressure)

		;and C ₂ =	6 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/CO ₂ % =	0.006 g/m ³ (0°C, dry gas, 1atm pressure, 12% CO ₂)
	;and C _{c1} =	6 mg/m ³ (0°C, dry gas, 1atm pressure, 12% CO ₂)

O ₂ Basis	7 %
Average O ₂ %:	20.9 %

Therefore, C _b :	=C _a x (21 - O _{2ref} %)/(21 - O _{2mea} %)	0.84 g/m ³ (0°C, dry gas, 1atm pressure, 7% O ₂)
	;and C _{b1} =	840 mg/m ³ (0°C, dry gas, 1atm pressure, 7% O ₂)

(C) Moisture content

Silica Gel Number:	108		
V _v =	13.8 g (from laboratory report)	V _w =	0 mL (=grams) (recorded on Laboratory Form 108)
Volume of Water Vapour Condensed (V _{wc(std)}) =	0.0000		
Volume of Water Vapour Condensed (V _{wsg(std)}) =	0.0184		

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

B_{ws} = 1.25 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

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

(i) Initial gas density for sampling: 1.28 kg/m³ (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c):
 1.28 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) x $\frac{(273.2)}{(273.2+T_s)}$ x $\frac{(P_s)}{(1013.25)}$
 = 1.142 kg/m³ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 6.36 m/s

(ii) Average of post-sampling velocities: 6.76 m/s

(iii) Average of while-sampling velocities: N/A m/s

(iv) Overall average of pre-sampling and post-sampling velocities (Vs):
 6.56 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 = 2.98 m³/s (stack conditions)

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

Q_{std} = 2.6 m³/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

R _m =	C _{1a} x Q _{std} =	0.016	g/s (0°C, dry gas, 1 atm pressure)		
	=	16	mg/s (0°C, dry gas, 1 atm pressure)		
	C _{1a} x Q _{std} =	0.016	g/s (0°C, dry gas, 1 atm pressure)	12%	CO ₂
	=	16	mg/s (0°C, dry gas, 1 atm pressure)	12%	CO ₂
	C _{1a} x Q _{std} =	2.2	g/s (0°C, dry gas, 1 atm pressure)	7%	O ₂
	=	2200	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: 4-Dec-20 Client: Infrabuild Recycling Hexham
 AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume (MV ₃):	1.2833 m ³	Average barometric pressure (P _{BARO}):	1015 hPa
Average gas meter temp. (T _{M,2}):	27.7 °C	Average pressure at meter (P _{M,2}):	1015.00 hPa
	300.9 K		
Sample gas volume (MV ₄); (0°C, dry gas, 1 atm pressure):	1.1672 m ³		

(B) Metals concentration at standard conditions

Blank thimble No.:		Blank weight:	g
Thimble No. used:	0	Metals Weight:	0.00011 g
Final Metals Weight (Mp1):	0.00011 g		
Metals Concentration (C1):	=M _{p1} /MV ₄ =		0.000092 g/m ³ (0°C, dry gas, 1atm pressure)
			;and C ₂ = 0.092 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% = 0.000092 g/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)
 ;and C_{c1} = 0.092 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}%) = 0.013 g/m³ (0°C, dry gas, 1atm pressure, 7% O₂)
 ;and C_{b1} = 13 mg/m³ (0°C, dry gas, 1atm pressure, 7% O₂)

(C) Moisture content

Silica Gel Number: SC2

V _v =	2.9 g (from laboratory report)	V _w =	10 mL (=grams)
Volume of Water Vapour Condensed (V _{wc(std)}) =	0.0133		(recorded on Laboratory Form 108)
Volume of Water Vapour Condensed (V _{wsg(std)}) =	0.0039		
Therefore, B _{ws} =	$\frac{(V_{wc(std)}+V_{wsg(std)})}{(V_{wc(std)}+V_{wsg(std)}+V_{m(std)})}$		
B _{ws} =	1.45 %		

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hazardous Substances (Metals)

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

- (i) Initial gas density for sampling: 1.28 kg/m³ (from Laboratory Form 107)
- (ii) Re-calculated gas density based on moisture content in (c):
 - 1.28 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) x $\frac{(273.2)}{(273.2+T_s)} \times \frac{(P_s)}{(1013.25)}$
 = 1.142 kg/m³ (stack conditions, wet)

(E) Gas Velocities

- (i) Average of pre-sampling velocities: 6.36 m/s
 - (ii) Average of post-sampling velocities: 6.76 m/s
 - (iii) Average of while-sampling velocities: N/A m/s
 - (iv) Overall average of pre-sampling and post-sampling velocities (Vs):
 - 6.56 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 = 2.98 m³/s (stack conditions)

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

Qstd = 2.6 m³/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C _{1a} x Qstd =	0.00024	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.24	mg/s (0°C, dry gas, 1 atm pressure)		
	C _{1a} x Qstd =	0.00024	g/s (0°C, dry gas, 1 atm pressure	12%	CO ₂)
	=	0.24	mg/s (0°C, dry gas, 1 atm pressure	12%	CO ₂)
	C _{1a} x Qstd =	0.034	g/s (0°C, dry gas, 1 atm pressure	7%	O ₂)
	=	34	mg/s (0°C, dry gas, 1 atm pressure	7%	O ₂)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, SHREDDER STACK INFRABUILD RECYCLING HEXHAM 4-Dec-20 FINE PARTICULATE (PM10) TOTAL PARTICULATE HAZARDOUS SUBSTANCES (METALS)		
Sampling Conditions:		
Stack internal diameter at test location	760 mm	
Stack gas temperature (average)	33.5 °C	306.7 K
Stack pressure (average)	1015 hPa	
Stack gas velocity (average, stack conditions)	6.6 m/s	
Stack gas flowrate (stack conditions)	3 m ³ /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	2.6 m ³ /s	
Fine Particulate (PM10) Testing		
Test Period	9:48	- 11:24
Fine Particulate (PM10) Mass	0.6 mg	
Gas Volume Sampled	1.15 m ³	
Fine Particulate (PM10) Emission*1	0.52 mg/m ³	
Fine Particulate (PM10) Mass Emission Rate*2	1.4 mg/s	
Regulatory Limit	N/A	
Total Particulate Testing		
Test Period	9:48	- 11:24
Total Particulate Mass	8.7 mg	
Gas Volume Sampled	1.46 m ³	
Total Particulate Emission*1	6.0 mg/m ³	
Total Particulate Mass Emission Rate*2	16 mg/s	
Regulatory Limit	100 mg/m ³	
Hazardous Substances (Metals) Testing		
Test Period	9:48	- 11:24
Hazardous Substances (Metals) Mass	0.108 mg	
Gas Volume Sampled	1.17 m ³	
Hazardous Substances (Metals) Emission*1	0.092 mg/m ³	
Hazardous Substances (Metals) Mass Emission Rate*2	0.24 mg/s	
Regulatory Limit	N/A	
Moisture Content (%)		
	1.4	
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
(9 pages)

Appendix B Laboratory Results (9 pages)

CLIENT DETAILS

LABORATORY DETAILS

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 Project **60493017/5.1**
 Order Number **60493017/5.1**
 Samples **12**

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 SGS Reference **ME317835 R0**
 Date Received **08 Dec 2020**
 Date Reported **14 Dec 2020**


COMMENTS

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

SIGNATORIES



Adam Atkinson
Business Manager



Christopher BENNETT
Laboratory Technician



Ryan ZHANG
Inorganics Team Leader

Sample Number	ME317835.001	ME317835.002	ME317835.003	ME317835.004
Sample Matrix	Filter	Impinger	Impinger	Impinger
Sample Date	05 Dec 2020	05 Dec 2020	05 Dec 2020	05 Dec 2020
Sample Name	Shred_Metals 1	Shred_Metals 3	Shred_Metals 4	Shred_Metals 5A

Parameter	Units	LOR				
Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 9/12/2020						
Sb	µg total	0.05	<0.05	-	-	-
As	µg total	0.05	0.94	-	-	-
Be	µg total	0.05	0.05	-	-	-
Cd	µg total	0.05	67	-	-	-
Cr	µg total	0.05	3.5	-	-	-
Co	µg total	0.05	0.18	-	-	-
Cu	µg total	0.05	10	-	-	-
Pb	µg total	0.05	5.8	-	-	-
Mg	µg total	0.05	280	-	-	-
Mn	µg total	0.05	9.7	-	-	-
Hg	µg total	0.05	<0.05	-	-	-
Ni	µg total	0.05	1.4	-	-	-
Se	µg total	0.05	0.13	-	-	-
Tl	µg total	0.05	<0.05	-	-	-
Sn	µg total	0.05	0.41	-	-	-
V	µg total	0.25	<0.25	-	-	-
Zn	µg total	0.05	8000	-	-	-

Parameter	Units	LOR				
Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 9/12/2020						
Sb	µg total	0.1	-	<0.1	0.2	-
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	1.5	-
Cr	µg total	0.1	-	0.2	1.1	-
Co	µg total	0.1	-	<0.1	0.3	-
Cu	µg total	0.1	-	0.3	2.4	-
Pb	µg total	0.1	-	0.3	1.3	-
Mg	µg total	0.1	-	0.6	4.8	-
Mn	µg total	0.1	-	0.4	38	-
Hg	µg total	0.1	-	<0.1	<0.1	<0.1
Ni	µg total	0.1	-	0.2	2.6	-
Se	µg total	0.1	-	<0.1	0.2	-
Tl	µg total	0.1	-	<0.1	<0.1	-
Sn	µg total	0.1	-	<0.1	6.9	-
V	µg total	0.1	-	<0.1	<0.1	-
Zn	µg total	0.1	-	2.2	23	-
Sample Volume*	mL	-	-	100	300	100

Sample Number	ME317835.005	ME317835.006	ME317835.007	ME317835.008
Sample Matrix	KMN04	Impinger	Impinger	Impinger
Sample Date	05 Dec 2020	05 Dec 2020	05 Dec 2020	05 Dec 2020
Sample Name	Shred_Metals 5B	Shred_Metals 5C	Metals 8A	Metals 8B

Parameter	Units	LOR				
Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 11/12/2020						
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	-	-	-	-

Parameter	Units	LOR				
Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 8/12/2020						
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	-	-	0.5	-
Pb	µg total	0.1	-	-	0.1	-
Mg	µg total	0.1	-	-	0.4	-
Mn	µg total	0.1	-	-	5.1	-
Hg	µg total	0.1	0.3	<0.1	<0.1	<0.1
Ni	µg total	0.1	-	-	0.3	-
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	-	-	2.1	-
Sample Volume*	mL	-	390	250	300	100

Sample Number	ME317835.009	ME317835.010	ME317835.011	ME317835.012
Sample Matrix	Impinger	KMN04	Impinger	Filter
Sample Date	05 Dec 2020	05 Dec 2020	05 Dec 2020	05 Dec 2020
Sample Name	Metals 9	Metals 10	Metals 11	Metals 12
Parameter	Units	LOR		

Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 11/12/2020

Sb	µg total	0.05	-	-	-	<0.05
As	µg total	0.05	-	-	-	0.85
Be	µg total	0.05	-	-	-	<0.05
Cd	µg total	0.05	-	-	-	<0.05
Cr	µg total	0.05	-	-	-	2.9
Co	µg total	0.05	-	-	-	<0.05
Cu	µg total	0.05	-	-	-	0.30
Pb	µg total	0.05	-	-	-	1.6
Mg	µg total	0.05	-	-	-	260
Mn	µg total	0.05	-	-	-	1.9
Hg	µg total	0.05	-	-	-	<0.05
Ni	µg total	0.05	-	-	-	0.25
Se	µg total	0.05	-	-	-	0.12
Tl	µg total	0.05	-	-	-	<0.05
Sn	µg total	0.05	-	-	-	0.06
V	µg total	0.25	-	-	-	<0.25
Zn	µg total	0.05	-	-	-	7400

Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 8/12/2020

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	0.6	-	-	-
Co	µg total	0.1	<0.1	-	-	-
Cu	µg total	0.1	0.6	-	-	-
Pb	µg total	0.1	0.4	-	-	-
Mg	µg total	0.1	0.7	-	-	-
Mn	µg total	0.1	6.9	-	-	-
Hg	µg total	0.1	<0.1	<0.1	<0.1	-
Ni	µg total	0.1	0.3	-	-	-
Se	µg total	0.1	<0.1	-	-	-
Tl	µg total	0.1	<0.1	-	-	-
Sn	µg total	0.1	7.3	-	-	-
V	µg total	0.1	<0.1	-	-	-
Zn	µg total	0.1	1.3	-	-	-
Sample Volume*	mL	-	200	92	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 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 Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILTER

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Sb	LB037603	µg total	0.05	<0.05	105%
As	LB037603	µg total	0.05	<0.05	106%
Be	LB037603	µg total	0.05	<0.05	89%
Cd	LB037603	µg total	0.05	<0.05	98%
Cr	LB037603	µg total	0.05	<0.05	96%
Co	LB037603	µg total	0.05	<0.05	98%
Cu	LB037603	µg total	0.05	<0.05	96%
Pb	LB037603	µg total	0.05	<0.05	100%
Mg	LB037603	µg total	0.05	<0.05	110%
Mn	LB037603	µg total	0.05	<0.05	98%
Hg	LB037603	µg total	0.05	<0.05	100%
Ni	LB037603	µg total	0.05	<0.05	95%
Se	LB037603	µg total	0.05	<0.05	108%
Tl	LB037603	µg total	0.05	<0.05	102%
Sn	LB037603	µg total	0.05	<0.05	104%
V	LB037603	µg total	0.25	<0.25	98%
Zn	LB037603	µg total	0.05	<0.05	94%

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

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Sb	LB037593	µg total	0.1	<0.1	105%
As	LB037593	µg total	0.1	<0.1	105%
Be	LB037593	µg total	0.1	<0.1	94%
Cd	LB037593	µg total	0.1	<0.1	101%
Cr	LB037593	µg total	0.1	<0.1	98%
Co	LB037593	µg total	0.1	<0.1	103%
Cu	LB037593	µg total	0.1	<0.1	101%
Pb	LB037593	µg total	0.1	<0.1	102%
Mg	LB037593	µg total	0.1	<0.1	109%
Mn	LB037593	µg total	0.1	<0.1	100%
Hg	LB037593	µg total	0.1	<0.1	
Ni	LB037593	µg total	0.1	<0.1	97%
Se	LB037593	µg total	0.1	<0.1	104%
Tl	LB037593	µg total	0.1	<0.1	106%
Sn	LB037593	µg total	0.1	<0.1	106%
V	LB037593	µg total	0.1	<0.1	100%
Zn	LB037593	µg total	0.1	<0.1	99%
Sample Volume*	LB037593	mL	-	100	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
***	Indicates that both * and ** apply.	-	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/en-gb/environment-health-and-safety.

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Steel River Testing

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

STACK EMISSION - MOISTURE REPORT

Origin: AECOM - Newcastle
Project: 60493017 / 5.1
Report : 23291-0-M Page 1 of 1
Description : Stack Emission Samples
Received: 04-Dec-20
Date : 10-Dec-20
Report To : Cye Buckland
17 Warabrook Blvd, Warabrook NSW 2304
Copy to: FILE

Jar ID	Moisture (g)
108	13.8
O16	8.4
SC2	2.9



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

Note : Sampled by Client - Analysed as Received

Reported By: M. Campbell
Michael Campbell - Director

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

Steel River Testing

5/11 McIntosh Drive, Mayfield West, NSW 2304

Phone: 02 49677880

STACK EMISSION - PARTICULATES REPORT

Origin: AECOM - Newcastle

Report : 23291-0-P

Page 1 of 1

Project: 60493017 / 5.1

Description : Stack Emission Samples

Date : 10-Dec-20

Received: 04-Dec-20

Report To : Cye Buckland

Copy to: FILE

17 Warabrook Blvd, Warabrook NSW 2304

Thimble ID		Volume (mL)	Total Particulate Matter (g)
M34	Thimble	-	0.0087
SLR20	Thimble	-	0.0006



NATA Accredited Laboratory 18079

Accredited for compliance with
ISO/IEC 17025 - Testing

Note : Sampled by Client - Analysed as Received

Reported By: M. Campbell

Michael Campbell - Director

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

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