

1st Quarter Emissions Testing Report 2021

Infrabuild Recycling Hexham



NATA ACCREDITATION No. 2778 (14391)

Accredited for compliance with ISO/IEC 17025 – Testing

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

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1st Quarter Emissions Testing Report 2021

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).

Sampling was attempted on 26 & 29 March 2021, however on those days, testing was unable to be completed due to unscheduled plant downtime. Testing was undertaken on 9 April 2021 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:

- Australian Laboratory Services (ALS), laboratory NATA accreditation number 825, performed the following analysis detailed in report number EN2102943:
 - Total Particulate (TP);
 - Fine Particulates (PM₁₀); and
 - Moisture.
- SGS Australia Pty Ltd, NATA accreditation number 2562, performed the following analysis detailed in report number ME319991 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.

- The gas flow is basically in the same direction at all points along each sampling traverse;*
- The gas velocity at all sampling points is greater than 3 m/s;*
- 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;*
- 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;*
- 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*
- 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 9 April 2021.

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, 9 April 2021

Parameter	Emission Concentration (EPL Point 1)	Emission Concentration Limit
Total Particulate (TP) (mg/m ³)	5.8	100
Fine Particulate (PM ₁₀) (mg/m ³)	0.77	N/A
Lead (mg/m ³)	0.0028	5.0
Mercury (mg/m ³)	0.000043	1.0
Total Hazardous Substances (Metals) (mg/m ³)	0.087	N/A

Results from testing conducted on EPL Point 1 on 9 April 2021 are below the regulatory limits listed in EPL 5345.

Table 5 Fine Particulate (PM₁₀), Total Particulate and Hazardous Substance (Metals) Results, 9 April 2021

Sampling Conditions:		
Stack internal diameter at test location	760 mm	299.8 K
Stack gas temperature (average)	26.6 °C	
Stack pressure (average)	1006 hPa	
Stack gas velocity (average, stack conditions)	7.1 m/s	
Stack gas flowrate (stack conditions)	3.2 m³/s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	2.8 m³/s	
Fine Particulate (PM ₁₀) Testing		
Test Period	9:35 -	10:53
Fine Particulate (PM ₁₀) Mass	0.7 mg	
Gas Volume Sampled	0.906 m³	
Fine Particulate (PM ₁₀) Emission* ¹	0.77 mg/m³	
Fine Particulate (PM ₁₀) Mass Emission Rate* ²	2.2 mg/s	
Regulatory Limit	N/A	
Total Particulate Testing		
Test Period	9:35 -	10:53
Total Particulate Mass	5.2 mg	
Gas Volume Sampled	0.89 m³	
Total Particulate Emission* ¹	5.8 mg/m³	
Total Particulate Mass Emission Rate* ²	16 mg/s	
Regulatory Limit	100 mg/m³	
Hazardous Substances (Metals) Testing		
Test Period	9:35 -	10:53
Hazardous Substances (Metals) Mass	0.103 mg	
Gas Volume Sampled	1.18 m³	
Hazardous Substances (Metals) Emission* ¹	0.087 mg/m³	
Hazardous Substances (Metals) Mass Emission Rate* ²	0.25 mg/s	
Regulatory Limit	N/A	
Moisture Content (%)		
	2.1	
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, 9 April 2021

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	<0.000085	0.000050	0.000042			0.000050	0.000042	0.00012
Arsenic	0.00017	0.00014	<0.00010	<0.000085			0.00017	0.00014	0.00041
Beryllium	0.000010	0.0000085	<0.00010	<0.000085			0.000010	0.0000085	0.000024
Cadmium	0.00020	0.00017	0.0019	0.0016			0.0021	0.0018	0.0051
Chromium	0.0012	0.0010	0.019	0.016			0.021	0.01780	0.051
Cobalt	0.000020	0.000017	0.00025	0.00021			0.00027	0.00023	0.00066
Copper	0.0015	0.0013	0.0018	0.0015			0.0033	0.0028	0.0080
Lead	0.0017	0.0014	0.0016	0.0013			0.0033	0.0028	0.0080
Magnesium	0.040	0.034	0.0044	0.0037			0.045	0.038	0.11
Manganese	0.0048	0.0041	0.058	0.049			0.063	0.053	0.15
Mercury	<0.00010	<0.000085	<0.00010	<0.000085	0.000051	0.000043	0.000051	0.000043	0.00012
Nickel	0.0018	0.0015	0.0097	0.0082			0.012	0.010	0.029
Selenium	0.000040	0.000034	0.00035	0.00030			0.00039	0.00033	0.00095
Thallium	<0.00010	<0.000085	<0.00010	<0.000085			<0.00010	<0.000085	<0.00024
Tin	0.00079	0.00067	<0.0089	<0.0075			0.00079	0.00067	0.0019
Vanadium	<0.00020	<0.00017	<0.00050	<0.00042			<0.00025	<0.00021	<0.00061
Zinc	1.3	1.1	0.017	0.015			1.3	1.10	3.2
Total Hazardous Metals*	0.010	0.0084	0.091	0.077	0.000051	0.000043	0.10	0.087	0.25
Total Metals	1.3	1.1	0.12	0.097			1.5	1.2	3.5

* 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)

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

Infrabuild Recycling Hexham

AECOM's Project Number: 60493017

Emission Source: Shredder Stack

Date Sampled: 9-Apr-21

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:



for Sam Hamilton



for Nick Stanning

Q4AN(EV)-332-FM31

Date: 9-Apr-21
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		
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					
Signed:			Checked:		

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 9-Apr-21
 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: 9:35		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O ₂ (%), (dry)	CO ₂ (%), (dry)
1	9:35	0	20.9	0.0
2	9:36	0	20.9	0.0
3	9:37	0	20.9	0.0
4	9:38	0	20.9	0.0
5	9:39	0	20.9	0.0
6	9:40	0	20.9	0.0
7	9:41	0	20.9	0.0
8	9:42	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)	

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 9-Apr-21
 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: 10:45		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O ₂ (%), (dry)	CO ₂ (%), (dry)
1	10:45	0	20.9	0.0
2	10:46	0	20.9	0.0
3	10:47	0	20.9	0.0
4	10:48	0	20.9	0.0
5	10:49	0	20.9	0.0
6	10:50	0	20.9	0.0
7	10:51	0	20.9	0.0
8	10:52	0	20.9	0.0
Averages:		0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
 Moisture percentage (M2): 2.11 %

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 : 77.4 %,(wet)
CO ₂ : 0.0 %,(wet)	O ₂ : 20.5 %,(wet)
H ₂ O: 2.11 % (=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)	

Q4AN(EV)-332-FM31

Date: 9-Apr-21
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)

Static Pressure (Dwyer) (Pa):	kPa
Static Pressure (U-tube, if required) :	-4.6 mm
Absolute pressure in stack (hPa) :	1005.55 hPa

Q4AN(EV)-332-FM31

SAMPLING OF FINE PARTICULATE (PM₁₀)

Date: 9-Apr-21

Client: Infrabuild Recycling Hexham

AECOM's Project No: 60493017

Stack Description No.: Shredder Stack

Stack Description Row:	Emitter Stack			
Sample Nozzle No.:	fine7	Sample Nozzle Area (An):	2.82	$\times 10^{-5} \text{ m}^2$

Sampling Port No.:	1 to 2	Thimble No:	T30
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Page No: 1 of 1 Blank thimble No: 0

Leak Check (Pre-Sampling)

Meter start: 5891.5364 Meter finish: 5891.5364 Meter start: 5892.5714 Meter finish: 5892.5714

Time start: 9:25 Time finish: 9:26 Time start: 10:55 Time finish: 10:56

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: 1006 hPa (start):

1006 hPa (finish)

Meter start: 5891.5472

Time start: 9:35

Meter correction factor (GMf) : 0.9805

Meter Finish:	5892.5696	Time Finish:	10:53
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Total Condensate collected: 5 ml

Silica gel No(s) used: M040

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 9-Apr-21

Date: 9-Apr-21
Client: Infrabuild Recycling Hexham

AECOM's Project No: 60493017

Stack Description No.: Shredder Stack

Stack Description Row:	Shredder Stack			
Sample Nozzle No.:	s3	Sample Nozzle Area (An):	2.93	$\times 10^{-5} \text{ m}^2$

Sample Nozzle No.:	50	Sample Nozzle Area (mm ²):	2.50
Sampling Port No.:	1 to 2	Thimble No:	S95

Sampling Port No.: 1 to 2 Thimble No.:
Page No: 1 of 1 Blank thimble No:

Leak Check (Pre-Sampling)

Leak Check (Pre-Sampling)		Leak Check (Post-Sampling)	
Meter start:	49.7362	Meter finish:	49.7362
Meter start:	50.7302	Meter finish:	50.7302

Water start:	45:7.502	Water finish:	45:7.502	Water start:	50:7.502	Water finish:	50:7.502
Time start:	9:26	Time finish:	9:27	Time start:	10:56	Time finish:	10:57

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:

Repeat:

Comments:

Comments:

Sampling Record Table

Barometric Pressure: 1006 hPa (start); 1006 hPa (finish)

Barometric Pressure:	1000 mbar (start),	1000
Meter start:	49.7414	Time start: 9:35

Meter correction factor (GMf) : 0.9937

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)
1/1	0:06:30	33	10.2	22.0	18.0		Yes
1/2	0:13:00	111	10.9	25.0	19.0		Yes
1/3	0:19:30	225	13.3	25.0	20.0		Yes
1/4	0:26:00	535	11.9	27.0	21.0		Yes
1/5	0:32:30	649	12.3	28.0	22.0		Yes
1/6	0:39:00	727	14.2	28.0	23.0		Yes
2/1	0:45:30	33	14.5	29.0	24.0		Yes
2/2	0:52:00	111	15.2	29.0	24.0		Yes
2/3	0:58:30	225	13.2	30.0	25.0		Yes
2/4	1:05:00	535	11.5	31.0	26.0		Yes
2/5	1:11:30	649	10.7	31.0	27.0		Yes
2/6	1:18:00	727	13.7	32.0	27.0		Yes
Averages				28.1	23.0	no result	

Averages			28.1	28.6	No Result
Meter Finish:	50.7274		Time Finish:	10:53	

meter finish:	30.7274	meter finish:	
Total Condensate collected:	10 ml	Silica gel No(s) used:	G003

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF HAZARDOUS SUBSTANCES (METALS)

Date: 9-Apr-21

Client: Infrabuild Recycling Hexham

AECOM's Project No: 60493017

Stack Description No.: Shredder Stack

Stack Description No.:	xi	Sample Nozzle Area (A _n):	3.76	x 10 ⁻⁵ m ²
------------------------	----	---------------------------------------	------	-----------------------------------

Sample NOZZLE No.:	1	Sample NOZZLE No.:	0
Sampling Port No.:	1 to 2	Thimble No.:	0

Page No: 1 of 1 Blank thimble No:

Leak Check (Pre-Sampling)

Meter start: 39434.0082 Meter finish: 39434.0082 Meter start: 39435.3104 Meter finish: 39435.3104

Time start: 9:27 Time finish: 9:28 Time start: 10:57 Time finish: 10:58

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

(>0.1 l/min. is unacceptable)

Repeat:

Repeat:

Repeat:

Comments:

Repeat:

Comments:

Sampling Record Table

Barometric Pressure: 1006 hPa (start); 1006 hPa (finish)

Barometric Pressure:		1000 m a (start),	1000
Meter start:	39434.0150	Time start:	9:35

Meter correction factor (GMf) : 1.0153

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)
1/1	0:06:30	33	13.4	32.0	30.0		Yes
1/2	0:13:00	111	14.3	31.0	30.0		Yes
1/3	0:19:30	225	17.4	31.0	30.0		Yes
1/4	0:26:00	535	15.6	31.0	29.0		Yes
1/5	0:32:30	649	16.1	30.0	28.0		Yes
1/6	0:39:00	727	18.6	29.0	28.0		Yes
2/1	0:45:30	33	19.0	29.0	27.0		Yes
2/2	0:52:00	111	20.0	28.0	27.0		Yes
2/3	0:58:30	225	17.3	28.0	26.0		Yes
2/4	1:05:00	535	15.0	27.0	25.0		Yes
2/5	1:11:30	649	14.1	27.0	25.0		Yes
2/6	1:18:00	727	17.9	27.0	24.0		Yes
Averages				29.2	27.4	no result	

Averages			29.2	27.4	No Result
Meter Finish:	39435.3076	Time Finish:	10:53		

meter finish:	39455.5070	meter finish:	
Total Condensate collected:	8 ml	Silica gel No(s) used:	GO48

Q4AN(EV)-332-FM31

Date: 9-Apr-21
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)

Static Pressure (Dwyer) (Pa): kPa
 Static Pressure (U-tube, if required) : -5.2 mm
 Absolute pressure in stack (hPa) : 1005.49 hPa

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

Stack Analysis - Hazardous Substances Elemental Analysis Results

Date: 9-Apr-21 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	0.00005			
Arsenic	0.00017	<0.0001			
Beryllium	0.00001	<0.0001			
Cadmium	0.0002	0.00185			
Chromium	0.0012	0.0194			
Cobalt	0.00002	0.00025			
Copper	0.00152	0.00175			
Lead	0.0017	0.00155			
Magnesium	0.0404	0.0044			
Manganese	0.0048	0.0579			
Mercury	<0.0001	<0.0001	<0.0001	0.0000513	<0.0001
Nickel	0.00182	0.0097			
Selenium	0.00004	0.00035			
Thallium	<0.0001	<0.0001			
Tin	0.00079	<0.0089			
Vanadium	<0.0002	<0.0005			
Zinc	1.29	0.0174			

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: 9-Apr-21 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	<0.0000847	0.000050	0.000042			0.000050	0.000042	0.00012
Arsenic	0.00017	0.00014	<0.0001	<0.0000847			0.00017	0.00014	0.00041
Beryllium	0.000010	0.0000085	<0.0001	<0.0000847			0.000010	0.0000085	0.000024
Cadmium	0.00020	0.00017	0.0019	0.0016			0.0021	0.0018	0.0051
Chromium	0.0012	0.0010	0.019	0.016			0.021	0.01780	0.051
Cobalt	0.000020	0.000017	0.00025	0.00021			0.00027	0.00023	0.00066
Copper	0.0015	0.0013	0.0018	0.0015			0.0033	0.0028	0.0080
Lead	0.0017	0.0014	0.0016	0.0013			0.0033	0.0028	0.0080
Magnesium	0.040	0.034	0.0044	0.0037			0.045	0.038	0.11
Manganese	0.0048	0.0041	0.058	0.049			0.063	0.053	0.15
Mercury	<0.0001	<0.0000847	<0.0001	<0.0000847	0.000051	0.000043	0.000051	0.000043	0.00012
Nickel	0.0018	0.0015	0.0097	0.0082			0.012	0.010	0.029
Selenium	0.000040	0.000034	0.00035	0.00030			0.00039	0.00033	0.00095
Thallium	<0.0001	<0.0000847	<0.0001	<0.0000847			<0.0001	<0.0000847	<0.000243
Tin	0.00079	0.00067	<0.0089	<0.00754			0.00079	0.00067	0.0019
Vanadium	<0.0002	<0.000169	<0.0005	<0.000423			<0.00025	<0.000212	<0.000607
Zinc	1.3	1.1	0.017	0.015			1.3	1.10	3.2
Total Hazardous Metals*	0.010	0.0084	0.091	0.077	0.000051	0.000043	0.10	0.087	0.25
Total Metals	1.3	1.1	0.12	0.097			1.5	1.2	3.5

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

STACK ANALYSIS - PM10 CALCULATIONS

Date: 9-Apr-21 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 0.02 M₃= 0.98

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) 100600 29.70
 Stack Static Pressure (Pg) 100549 29.68

Absolute Stack Pressure 29.68

4. Viscosity of Stack Gas

°C °F
 Average Stack Temp. 28.0 82.4
 Average Meter Temperature: 26.9
 Stack Gas Viscosity 183.3

5. Cyclone Flow Rate

ft³/min m³/min L/min L/s
 Cyclone Flow Rate 0.46 0.0161 16.08 0.27

6. Nozzle Velocity, Rmin and Rmax

Nozzle Number	Nozzle Diameter	Nozzle Velocity		Rmin	Rmax	Vmin	Vmin	Vmax	Vmax
	(inches)	ft/sec	m/s	[-]	[-]	ft/sec	m/s	ft/sec	m/s
0	0.128	84.80	27.91	0.761	1.227	64.57	21.19	104.04	34.13
1	0.136	74.98	24.68	0.753	1.232	56.48	18.53	92.39	30.31
2	0.159	54.81	18.04	0.723	1.251	39.63	13.00	68.56	22.49
3	0.184	41.22	13.57	0.676	1.277	27.88	9.15	52.62	17.26
4	0.177	44.19	14.55	0.690	1.269	30.51	10.01	56.10	18.41
5	0.211	31.16	10.26	0.595	1.314	18.55	6.09	40.95	13.44
6	0.217	29.67	9.77	0.574	1.322	17.05	5.59	39.23	12.87
7	0.236	24.99	8.23	0.468	1.355	12.49	4.10	33.86	11.11
8	0.275	18.39	6.05	#NUM!	1.434	9.19	3.02	26.37	8.65
9	0.304	15.06	4.96	#NUM!	1.504	7.53	2.47	22.59	7.41
10	0.345	11.71	3.86	#NUM!	1.617	5.86	1.92	17.57	5.77
11	0.394	8.94	2.94	#NUM!	1.777	4.47	1.47	13.41	4.40
	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate					
Selected Nozzle	(inches)	(m)	(m ²)	(L/min)					
7	0.236	0.006	0.000028	13.1					

Date: 9-Apr-21 Client: Infrabuild Recycling Hexham
AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

7.Sampling Time	Total Run Time	78	Number of points
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[illegible]

TestPM10
Emission Measurement Calculations Spreadsheet (Q4AN(EV)-332-FM31)
Revision 2 May 28, 2015

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 9-Apr-21 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): 1.0025 m³ Average barometric pressure (P_{BARO}) 1006 hPa
 Average gas meter temp. ($T_{M,2}$): 26.9 °C
 300.1 K Average pressure at meter ($P_{M,2}$) 1006.00 hPa
 Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.9061 m³

(B) PM10 concentration at standard conditions

Blank thimble No.: 0 Blank weight: g
 Thimble No. used: T30 PM10 Weight: 0.0007 g
 Final PM10 Weight (M_{p1}): 0.00070 g
 PM10 Concentration (C_1): $=M_{p1}/MV_4=$ 0.00077 g/m³ (0°C, dry gas, 1atm pressure)
 ;and $C_2 =$ 0.77 mg/m³ (0°C, dry gas, 1atm pressure)
 CO₂ Basis 12 %
 Average CO₂%: 0.0 %

Therefore, C_c : $=C_a \times 12/CO_2\% =$ 0.00077 g/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)
 ;and $C_{c1} =$ 0.77 mg/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)

O₂ Basis 7 %
 Average O₂%: 20.9 %

Therefore, C_b : $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.11 g/m³ (0°C, dry gas, 1atm pressure, 7% O₂)
 ;and $C_{b1} =$ 110 mg/m³ (0°C, dry gas, 1atm pressure, 7% O₂)

(C) Moisture content

Silica Gel Number: M040
 $V_v =$ 9.22 g (from laboratory report) $V_w =$ 5 mL (=grams)
 Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0067 (recorded on Laboratory Form 108)
 Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0123
 Therefore, $B_{ws} = \frac{(V_{wc(std)} + V_{wsg(std)})}{(V_{wc(std)} + V_{wsg(std)} + V_{m(std)})}$
 $B_{ws} =$ 2.05 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

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

(i) Initial gas density for sampling:	1.28 kg/m ³ (from Laboratory Form 107)
(ii) Re-calculated gas density based on moisture content in (c):	1.28 kg/m ³ (0°C, wet, 1 atm pressure) 1.29 kg/m ³ (0°C, dry, 1 atm pressure)
(iii) Gas density at stack conditions =	(ii) x $\frac{(273.2)}{(273.2+T_s)}$ x $\frac{(P_s)}{(1013.25)}$
=	1.158 kg/m ³ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities:	7.30 m/s
(ii) Average of post-sampling velocities:	6.85 m/s
(iii) Average of while-sampling velocities:	N/A m/s
(iv) Overall average of pre-sampling and post-sampling velocities (Vs):	7.08 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)

$$Q_{\text{stack}} = V_s \times A = 3.21 \text{ m}^3/\text{s} \text{ (stack conditions)}$$

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

$$Q_{\text{std}} = 2.8 \text{ m}^3/\text{s} \text{ (0°C, dry gas, 1 atm pressure)}$$

(G) Mass Emission Rate

Rm =	C _{1a} x Qstd =	0.0022	g/s (0°C, dry gas, 1 atm pressure))
	=	2.2	mg/s (0°C, dry gas, 1 atm pressure))
	C _{1a} x Qstd =	0.0022	g/s (0°C, dry gas, 1 atm pressure)	12% CO ₂)
	=	2.2	mg/s (0°C, dry gas, 1 atm pressure)	12% CO ₂)
	C _{1a} x Qstd =	0.31	g/s (0°C, dry gas, 1 atm pressure)	7% O ₂)
	=	310	mg/s (0°C, dry gas, 1 atm pressure)	7% O ₂)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 9-Apr-21

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):	0.9798 m ³	Average barometric pressure (P _{BARO}):	1006 hPa
Average gas meter temp. (T _{M,2}):	25.5 °C	Average pressure at meter (P _{M,2}):	1006.00 hPa
	298.7 K		
Sample gas volume (MV ₄); (0°C, dry gas, 1 atm pressure):	0.8897 m ³		

(B) Total Particulate concentration at standard conditions

Blank thimble No.:		Blank weight:	g
Thimble No. used:	S95	Total Particulate Weight	0.0052 g
Final Total Particulate Weight (Mp1):	0.00520 g		
Total Particulate Concentration (C1):	=M _{p1} /MV ₄ =	0.0058 g/m ³ (0°C, dry gas, 1atm pressure)	
		5.8 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 % =	0.0058 g/m ³ (0°C, dry gas, 1atm pressure, 12% CO ₂)
	;and C _{c1} =	5.8 mg/m ³ (0°C, dry gas, 1atm pressure, 12% CO ₂)

O₂ Basis 7 %Average O₂%: 20.9 %

Therefore, C _b :	=C _a x (21 - O _{2ref} %)/(21 - O _{2mea} %)	0.81 g/m ³ (0°C, dry gas, 1atm pressure, 7% O ₂)
	;and C _{b1} =	810 mg/m ³ (0°C, dry gas, 1atm pressure, 7% O ₂)

(C) Moisture content

Silica Gel Number: G003

V _v =	9.8 g (from laboratory report)	V _w =	10 mL (=grams)
Volume of Water Vapour Condensed (V _{wc(std)}) =	0.0133		(recorded on
Volume of Water Vapour Condensed (V _{wsg(std)}) =	0.0131		Laboratory Form 108)

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

B_{ws} = 2.88 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

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

(i) Initial gas density for sampling:	1.28 kg/m ³ (from Laboratory Form 107)
(ii) Re-calculated gas density based on moisture content in (c):	1.29 kg/m ³ (0°C, wet, 1 atm pressure) 1.29 kg/m ³ (0°C, dry, 1 atm pressure)
(iii) Gas density at stack conditions =	(ii) x $\frac{(273.2)}{(273.2+T_s)}$ x $\frac{(P_s)}{(1013.25)}$
=	1.167 kg/m ³ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities:	7.30 m/s
(ii) Average of post-sampling velocities:	6.85 m/s
(iii) Average of while-sampling velocities:	N/A m/s
(iv) Overall average of pre-sampling and post-sampling velocities (Vs):	7.08 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)

$$Q_{\text{stack}} = V_s \times A = 3.21 \text{ m}^3/\text{s} \text{ (stack conditions)}$$

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

$$Q_{\text{std}} = 2.8 \text{ m}^3/\text{s} \text{ (0°C, dry gas, 1 atm pressure)}$$

(G) Mass Emission Rate

Rm =	C _{1a} x Qstd =	0.016	g/s (0°C, dry gas, 1 atm pressure))
	=	16	mg/s (0°C, dry gas, 1 atm pressure))
	C _{1a} x Qstd =	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 Qstd =	2.3	g/s (0°C, dry gas, 1 atm pressure)	7% O ₂)
	=	2300	mg/s (0°C, dry gas, 1 atm pressure)	7% O ₂)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Hazardous Substances (Metals)

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

Date: 9-Apr-21 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): 1.3124 m³ Average barometric pressure (P_{BARO}) 1006 hPa
 Average gas meter temp. ($T_{M,2}$): 28.3 °C
 301.5 K Average pressure at meter ($P_{M,2}$) 1006.00 hPa
 Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.1807 m³

(B) Metals concentration at standard conditions

Blank thimble No.: Blank weight: g
 Thimble No. used: 0 Metals Weight: 0.00010 g
 Final Metals Weight (M_{p1}): 0.00010 g
 Metals Concentration (C_1): $=M_{p1}/MV_4=$ 0.000087 g/m³ (0°C, dry gas, 1atm pressure)
 ;and $C_2 =$ 0.087 mg/m³ (0°C, dry gas, 1atm pressure)
 CO₂ Basis 12 %
 Average CO₂%: 0.0 %

Therefore, C_c : $=C_a \times 12/CO_2\% =$ 0.000087 g/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)
 ;and $C_{c1} =$ 0.087 mg/m³ (0°C, dry gas, 1atm pressure, 12% CO₂)

O₂ Basis 7 %Average O₂%: 20.9 %

Therefore, C_b : $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.012 g/m³ (0°C, dry gas, 1atm pressure, 7% O₂)
 ;and $C_{b1} =$ 12 mg/m³ (0°C, dry gas, 1atm pressure, 7% O₂)

(C) Moisture content

Silica Gel Number: GO48

$V_v =$ 4.46 g (from laboratory report) $V_w =$ 8 mL (=grams)
 Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0107 (recorded on
 Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0060 Laboratory Form 108)

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

$B_{ws} =$ 1.39 %

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:	1.28 kg/m ³ (from Laboratory Form 107)
(ii) Re-calculated gas density based on moisture content in (c):	1.28 kg/m ³ (0°C, wet, 1 atm pressure) 1.29 kg/m ³ (0°C, dry, 1 atm pressure)
(iii) Gas density at stack conditions =	(ii) x $\frac{(273.2)}{(273.2+T_s)}$ x $\frac{(P_s)}{(1013.25)}$
=	1.158 kg/m ³ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities:	7.30 m/s
(ii) Average of post-sampling velocities:	6.85 m/s
(iii) Average of while-sampling velocities:	N/A m/s
(iv) Overall average of pre-sampling and post-sampling velocities (Vs):	7.08 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)

$$Q_{\text{stack}} = V_s \times A = 3.21 \text{ m}^3/\text{s} \text{ (stack conditions)}$$

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

$$Q_{\text{std}} = 2.9 \text{ m}^3/\text{s} \text{ (0°C, dry gas, 1 atm pressure)}$$

(G) Mass Emission Rate

Rm =	C _{1a} x Qstd =	0.00025	g/s (0°C, dry gas, 1 atm pressure)	
	=	0.25	mg/s (0°C, dry gas, 1 atm pressure)	
	C _{1a} x Qstd =	0.00025	g/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	=	0.25	mg/s (0°C, dry gas, 1 atm pressure	12% CO ₂)
	C _{1a} x Qstd =	0.035	g/s (0°C, dry gas, 1 atm pressure	7% O ₂)
	=	35	mg/s (0°C, dry gas, 1 atm pressure	7% O ₂)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, SHREDDER STACK INFRABUILD RECYCLING HEXHAM 9-Apr-21 FINE PARTICULATE (PM10) TOTAL PARTICULATE HAZARDOUS SUBSTANCES (METALS)		
Sampling Conditions:		
Stack internal diameter at test location	760 mm	
Stack gas temperature (average)	26.6 °C	299.8 K
Stack pressure (average)	1006 hPa	
Stack gas velocity (average, stack conditions)	7.1 m/s	
Stack gas flowrate (stack conditions)	3.2 m ³ /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	2.8 m ³ /s	
Fine Particulate (PM10) Testing		
Test Period	9:35	- 10:53
Fine Particulate (PM10) Mass	0.7 mg	
Gas Volume Sampled	0.906 m ³	
Fine Particulate (PM10) Emission*1	0.77 mg/m ³	
Fine Particulate (PM10) Mass Emission Rate*2	2.2 mg/s	
Regulatory Limit	N/A	
Total Particulate Testing		
Test Period	9:35	- 10:53
Total Particulate Mass	5.2 mg	
Gas Volume Sampled	0.89 m ³	
Total Particulate Emission*1	5.8 mg/m ³	
Total Particulate Mass Emission Rate*2	16 mg/s	
Regulatory Limit	100 mg/m ³	
Hazardous Substances (Metals) Testing		
Test Period	9:35	- 10:53
Hazardous Substances (Metals) Mass	0.103 mg	
Gas Volume Sampled	1.18 m ³	
Hazardous Substances (Metals) Emission*1	0.087 mg/m ³	
Hazardous Substances (Metals) Mass Emission Rate*2	0.25 mg/s	
Regulatory Limit	N/A	
Moisture Content (%)		
	2.1	
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)

CERTIFICATE OF ANALYSIS

Work Order : **EN2102943**
Client : **AECOM Australia Pty Ltd**
Contact : **MR CYE BUCKLAND**
Address : **17 WARABROOK BOULEVARDE**
WARABROOK NSW, AUSTRALIA 2304
Telephone : **+61 02 4911 4900**
Project : **60493017**
Order number : **60493017**
C-O-C number : **----**
Sampler : **----**
Site : **----**
Quote number : **NE/024/21**
No. of samples received : **10**
No. of samples analysed : **5**

Page : 1 of 2
Laboratory : Environmental Division Newcastle
Contact : Tahlee Brook
Address : 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone : +61 2 4014 2500
Date Samples Received : 13-Apr-2021 15:32
Date Analysis Commenced : 21-Apr-2021
Issue Date : 22-Apr-2021 17:24



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **EMISSIONS**
 (Matrix: **AIR**)

				Sample ID	T30	S95	G003	M040	G048
Sampling date / time					[13-Apr-2021]	[13-Apr-2021]	[13-Apr-2021]	[13-Apr-2021]	[13-Apr-2021]
Compound	CAS Number	LOR	Unit		EN2102943-003	EN2102943-004	EN2102943-005	EN2102943-006	EN2102943-007
					Result	Result	Result	Result	Result
EA143B: Total Particulate Matter - Stack Tests									
Moisture @ 105°C	----	0.01	g		----	----	9.80	9.22	4.46
Particulate Matter	----	0.0001	g		0.0007	0.0052	----	----	----

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 **60493017/6.1**
 Order Number **60493017/6.1**
 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 **ME319991 R0**
 Date Received **15 Apr 2021**
 Date Reported **22 Apr 2021**

COMMENTS

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

SIGNATORIES



Christopher BENNETT
 Laboratory Technician



Ryan ZHANG
 Inorganics Team Leader

	Sample Number	ME319991.001	ME319991.002	ME319991.003	ME319991.004
	Sample Matrix	Filter	Impinger	Impinger	Impinger
	Sample Date	09 Apr 2021	09 Apr 2021	09 Apr 2021	09 Apr 2021
	Sample Name	Shredder_Metals	Shredder_Metals	Shredder_Metals	Shredder_Metals
		1	3	4	5A
Parameter	Units	LOR			

Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 16/4/2021

Sb	µg total	0.05	<0.05	-	-	-
As	µg total	0.05	0.96	-	-	-
Be	µg total	0.05	0.07	-	-	-
Cd	µg total	0.05	0.25	-	-	-
Cr	µg total	0.05	3.4	-	-	-
Co	µg total	0.05	0.07	-	-	-
Cu	µg total	0.05	2.1	-	-	-
Pb	µg total	0.05	3.1	-	-	-
Mg	µg total	0.05	290	-	-	-
Mn	µg total	0.05	8.4	-	-	-
Hg	µg total	0.05	<0.05	-	-	-
Ni	µg total	0.05	2.1	-	-	-
Se	µg total	0.05	0.16	-	-	-
Tl	µg total	0.05	<0.05	-	-	-
Sn	µg total	0.05	0.77	-	-	-
V	µg total	0.25	<0.25	-	-	-
Zn	µg total	0.05	8300	-	-	-

Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 20/4/2021

Sb	µg total	0.1	-	<0.1	0.1	-
As	µg total	0.1	-	<0.1	<0.1	-
Be	µg total	0.1	-	<0.1	<0.1	-
Cd	µg total	0.1	-	<0.1	1.9	-
Cr	µg total	0.1	-	0.1	20	-
Co	µg total	0.1	-	<0.1	0.3	-
Cu	µg total	0.1	-	<0.1	1.8	-
Pb	µg total	0.1	-	0.1	1.6	-
Mg	µg total	0.1	-	0.8	5.9	-
Mn	µg total	0.1	-	1.0	60	-
Hg	µg total	0.1	-	<0.1	<0.1	<0.1
Ni	µg total	0.1	-	0.1	10	-
Se	µg total	0.1	-	<0.1	0.4	-
Tl	µg total	0.1	-	<0.1	<0.1	-
Sn	µg total	0.1	-	0.2	4.5	-
V	µg total	0.1	-	0.2	0.1	-
Zn	µg total	0.1	-	1.1	27	-
Sample Volume*	mL	-	-	110	300	120

			Sample Number	ME319991.005	ME319991.006	ME319991.007	ME319991.008
			Sample Matrix	KMNO4	Impinger	Impinger	Impinger
			Sample Date	09 Apr 2021	09 Apr 2021	12 Apr 2021	12 Apr 2021
			Sample Name	Shredder_Metals 5B	Shredder_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: 21/4/2021

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: 16/4/2021

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	-	-	0.4	-
Mn	µg total	0.1	-	-	1.6	-
Hg	µg total	0.1	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	-	-	<0.1	-
V	µg total	0.1	-	-	0.2	-
Zn	µg total	0.1	-	-	9.4	-
Sample Volume*	mL	-	390	250	310	98

	Sample Number	ME319991.009	ME319991.010	ME319991.011	ME319991.012
	Sample Matrix	Impinger	KMNO4	Impinger	Filter
	Sample Date	12 Apr 2021	12 Apr 2021	12 Apr 2021	12 Apr 2021
	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: 21/4/2021

Sb	µg total	0.05	-	-	-	<0.05
As	µg total	0.05	-	-	-	0.79
Be	µg total	0.05	-	-	-	0.06
Cd	µg total	0.05	-	-	-	<0.05
Cr	µg total	0.05	-	-	-	2.3
Co	µg total	0.05	-	-	-	<0.05
Cu	µg total	0.05	-	-	-	0.58
Pb	µg total	0.05	-	-	-	1.5
Mg	µg total	0.05	-	-	-	250
Mn	µg total	0.05	-	-	-	3.0
Hg	µg total	0.05	-	-	-	<0.05
Ni	µg total	0.05	-	-	-	0.38
Se	µg total	0.05	-	-	-	0.12
Tl	µg total	0.05	-	-	-	<0.05
Sn	µg total	0.05	-	-	-	0.18
V	µg total	0.25	-	-	-	<0.25
Zn	µg total	0.05	-	-	-	7000

Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 16/4/2021

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	<0.1	-	-	-
Pb	µg total	0.1	<0.1	-	-	-
Mg	µg total	0.1	1.1	-	-	-
Mn	µg total	0.1	0.5	-	-	-
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	8.9	-	-	-
V	µg total	0.1	0.3	-	-	-
Zn	µg total	0.1	0.2	-	-	-
Sample Volume*	mL	-	210	96	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_FILT

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Sb	LB040617	µg total	0.05	<0.05	104%
As	LB040617	µg total	0.05	<0.05	103%
Be	LB040617	µg total	0.05	<0.05	107%
Cd	LB040617	µg total	0.05	<0.05	101%
Cr	LB040617	µg total	0.05	<0.05	104%
Co	LB040617	µg total	0.05	<0.05	104%
Cu	LB040617	µg total	0.05	<0.05	106%
Pb	LB040617	µg total	0.05	<0.05	98%
Mg	LB040617	µg total	0.05	<0.05	105%
Mn	LB040617	µg total	0.05	<0.05	107%
Hg	LB040617	µg total	0.05	<0.05	101%
Ni	LB040617	µg total	0.05	<0.05	104%
Se	LB040617	µg total	0.05	<0.05	99%
Tl	LB040617	µg total	0.05	<0.05	105%
Sn	LB040617	µg total	0.05	<0.05	104%
V	LB040617	µg total	0.25	<0.25	104%
Zn	LB040617	µg total	0.05	<0.05	104%

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

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Sb	LB040615	µg total	0.1	<0.1	102%
As	LB040615	µg total	0.1	<0.1	112%
Be	LB040615	µg total	0.1	<0.1	105%
Cd	LB040615	µg total	0.1	<0.1	101%
Cr	LB040615	µg total	0.1	<0.1	103%
Co	LB040615	µg total	0.1	<0.1	104%
Cu	LB040615	µg total	0.1	<0.1	105%
Pb	LB040615	µg total	0.1	<0.1	100%
Mg	LB040615	µg total	0.1	<0.1	105%
Mn	LB040615	µg total	0.1	<0.1	102%
Hg	LB040615	µg total	0.1	<0.1	
Ni	LB040615	µg total	0.1	<0.1	104%
Se	LB040615	µg total	0.1	<0.1	100%
Tl	LB040615	µg total	0.1	<0.1	105%
Sn	LB040615	µg total	0.1	<0.1	101%
V	LB040615	µg total	0.1	<0.1	103%
Zn	LB040615	µg total	0.1	<0.1	102%
Sample Volume*	LB040615	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
***	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:

- 1 Bq is equivalent to 27 pCi
- 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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