

OneSteel Recycling Pty Ltd 20-Jun-2017 Doc No. 60493017_2.1_Q2_2017

2nd Quarter Emissions Testing Report 2017

OneSteel Recycling Hexham



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2nd Quarter Emissions Testing Report 2017

OneSteel Recycling Hexham

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Job No.: 60493017

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1.0 Introduction

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

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

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

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

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

2.0 Sampling Plane Requirements

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

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

Type of flow disturbance	Minimum distance upstream from disturbance, diameters (D)	Minimum distance downstream from disturbance, diameters (D)
Bend, connection, junction, direction change	>2D	>6D
Louvre, butterfly damper (partially closed or closed)	>3D	>6D
Axial fan	>3D	>8D (see Note)
Centrifugal fan	>3D	>6D

NOTE: The plane should be selected as far as practicable from a fan. Flow straighteners may be required to ensure the position chosen meets the check criteria listed in Items (a) to (f) below.

- a. The gas flow is basically in the same direction at all points along each sampling traverse;
- b. The gas velocity at all sampling points is greater than 3 m/s;
- c. The gas flow profile at the sampling plane shall be steady, evenly distributed and not have a cyclonic component which exceeds an angle of 15° to the duct axis, when measured near the periphery of a circular sampling plane;
- d. The temperature difference between adjacent points of the survey along each sampling traverse is less than 10% of the absolute temperature, and the temperature at any point differs by less than 10% from the mean;
- e. The ratio of the highest to lowest pitot pressure difference shall not exceed 9:1 and the ratio of highest to lowest gas velocities shall not exceed 3:1. For isokinetic testing with the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1; and
- f. The gas temperature at the sampling plane should preferably be above the dewpoint.

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

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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.

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

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

3.2 Equipment Calibration

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

4.0 Sampling Location

4.1 Sampling Location Summary

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

Table 3 Sampling Location Summary

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

¹ AS 4323.1 Section 4.1

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

D = Diameters

5.0 Results

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

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

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

Table 4 Shredder Baghouse Emission Results Summary, 5 April 2017

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

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

Table 5 Fine Particulate (PM ₁₀), Total Particulate and Hazardous Substanc	e (Metals) R	esults, 5 April 2	017
Sampling Conditions:			
Stack internal diameter at test location	760	mm	
Stack gas temperature (average)	22.0	°C	295.2 K
Stack pressure (average)	1025	hPa	
Stack gas velocity (average, stack conditions)	2.4	m/s	
Stack gas flowrate (stack conditions)	1.1	m³/s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	1	m³/s	
Fine Particulate (PM ₁₀) Testing			
Test Period	10:05	-	12:52
Fine Particulate (PM ₁₀) Mass	5.8	mg	
Gas Volume Sampled	0.962	m³	
Fine Particulate (PM ₁₀) Emission* ¹	6.0	mg/m ³	
Fine Particulate (PM ₁₀) Mass Emission Rate* ²	6.0	mg/s	
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	10:05	-	12:52
Total Particulate Mass	1.3	mg	
Gas Volume Sampled	1.05	m³	
Total Particulate Emission*1	1.2	mg/m³	
Total Particulate Mass Emission Rate* ²	1.2	mg/s	
Regulatory Limit	100	mg/m³	
Hazardous Substances (Metals) Testing			
Test Period	10:05	-	12:52
Hazardous Substances (Metals) Mass	0.036	mg	
Gas Volume Sampled	1.17	m ³	
Hazardous Substances (Metals) Emission*1	0.031	mg/m ³	
Hazardous Substances (Metals) Mass Emission Rate* ²	0.031	mg/s	
Regulatory Limit	N/A		
Moisture Content (%)	1.7		
Gas Density (dry at 1 atmosphere)	1.29	kg/m ³	
Dry Molecular Weight	28.8	g/g-mole	

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

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

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

Sample	Total Particulate Metals (mg)	Total Particulate Metals (mg/m ³)	Total Gaseous Metals (mg)	Total Gaseous Metals (mg/m ³)	Total Oxidisable Mercury (mg)	Total Oxidisable Mercury (mg/m ³)	Total (mg)	Total (mg/m³)	Mass Emission Rate (mg/s)
Antimony	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Arsenic	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Beryllium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Cadmium	0.024	0.021	0.0013	0.0011			0.03	0.026	0.026
Chromium	0.0009	0.00077	0.00035	0.0003			0.001	0.00086	0.00086
Cobalt	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Copper	0.0012	0.001	0.00048	0.00041			0.002	0.0017	0.0017
Lead	<0.3	<0.26	<0.399	<0.34			<0.0002	<0.00017	<0.00017
Magnesium	0.025	0.021	0.004	0.0034			0.03	0.026	0.026
Manganese	0.0027	0.0023	0.0012	0.001			0.004	0.0034	0.0034
Mercury	<0.0002	<0.00017	<0.0001	<0.000086	<0.0001	<0.000086	<0.0002	<0.00017	<0.00017
Nickel	0.001	0.00086	0.00008	0.000069			0.001	0.00086	0.00086
Selenium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Thallium	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Tin	<0.0002	<0.00017	<0.0001	<0.000086			<0.0002	<0.00017	<0.00017
Vanadium	<0.0008	<0.00069	<0.0001	<0.00086			<0.0002	<0.00017	<0.00017
Zinc	0.22	0.19	0.0055	0.0047			0.2	0.17	0.17
Total Hazardous Metals*	0.029	0.025	0.0029	0.0025	<0.0001	<0.000086	0.036	0.031	0.031
Total Metals	0.27	0.24	0.013	0.011			0.27	0.23	0.23

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

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Appendix A

Field Sheets (19 pages)

Appendix A Field Sheets (19 pages)

Q4AN(EV)-332-FM31

OneSteel Hexham

AECOM's Project Number: 60493017

Emission Source: Shredder Stack

Date Sampled: 5-Apr-17

ANALYTE(S)

Fine Particulate (PM10)

Total Particulate

Hazardous Substances (Metals)

NSW EPA OM - 5 NSW EPA TM - 15 NSW EPA TM - 12, 13 & 14

METHOD

Observations made during testing period:

Long pause in test due to plant shut down

Sampling Performed By:

ames Lang

Dylan Turnbull



Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

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

		Measurement/Obse	rvations		
Stack Inte	ernal Dimensions:				
	760 Length idth (mm) t Diameter N/A	0 mm Width mm	Cross Sectional Area Minimum No. of sampling points=	• 0.45 m 12	2
Lquivalon		1100		12	-
	from sampling plane to isturbances:		Total No. of sampling No. of sampling trave	PM2.5/10=	12 12
Upstream	(m) = 5		sampled =	i ocorporto	2
No. Diame				PM2.5/10=	2
	pstream Disturbance:	Fan Entry	No. of sampling point		
Downstrea		A strait manager	traverse/port =		6
No. Diame			A CALCULATION OF	PM2.5/10=	6
	own Stream Disturbance:	Stack Exit			5
Position o	f each sampling point, for	each traverse:	Exclusion of any sam numbers - comments		
	А	В	PM10/2.5 A	PM2.5/1	
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot d	istances
1	33	3	33	3	-
2 3 4 5 6	111	81	111	81	
3	225	195	225	195	
4	535	505	535	505	
5	649	619	649	619	
	727	697	727	697	
7	4				_
8					
9			Chook of total paints	aggingt	
10 11			Check of total points		
12			minimum, (yes/no) - c	comments.	
13					
14			-		
15					
16					
17	· · · · · · · · · · · · · · · · · · ·				
18					
19			General Comments:		
20	Sec. 1		Contra Comments.		
20	11	1	Da	-22	
Signed:	1		Checked		
eigneu	10-1		on concorrection of the second s	************	

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

AECOM

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

2.90 %

 Date:
 5-Apr-17

 Client:
 OneSteel Hexham

 AECOM's Project No:
 60493017

 Stack/Duct Description:
 Shredder Stack

 Test 1:
 Fine Particulate (PM10)

 Test 2:
 Total Particulate

 Test 3:
 Hazardous Substances (Metals)

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

Moisture percentage (M2):

Measurements

CO:	0.0000 %,(dry)	N ₂ :	79.1 %,(dry)	
CO2:	0.0 %,(dry)	O ₂ :	20.9 %,(dry)	
Gas Comp	positions converted to wet basis:			
CO:	0.0000 %,(wet)	N ₂ :	76.8 %,(wet)	
CO ₂ :	0.0 %,(wet)	O ₂ :	20.3 %,(wet)	
H ₂ O:	2.90 %(=M2)			
Therefore	, stack gas density (GD) =	1.27 kg/m ³	(0°C, wet, 1 atm pressure)	-
Therefore	, stack gas density (GD) =	1.29 kg/m ³	(0°C, dry, 1 atm pressure)	

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Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

1.57 %

 Date:
 5-Apr-17

 Client:
 OneSteel Hexham

 AECOM's Project No:
 60493017

 Stack/Duct Description:
 Shredder Stack

 Test 1:
 Fine Particulate (PM10)

 Test 2:
 Total Particulate

 Test 3:
 Hazardous Substances (Metals)

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

Moisture content (M3): Moisture percentage (M2):

Measurements

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

Q4AN(EV)-332-FM31

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

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

Time :	9:30	Barometric Pr			hPa
Page No. :	1 of 1	Pitot Correction		0.84	
Sampling Port No:	1 to 2	Stack Gas De	ensity:	1.27	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	0.005	21.0	294.2	2.4
1/2	81	0.005	21.0	294.2	2.4
1/3	195	0.005	21.0	294.2	2.4
1/4	505	0.005	21.0	294.2	2.4
1/5	619	0.005	21.0	294.2	2.4
1/6	697	0.005	21.0	294.2	2.4
2/1	3	0.005	21.0	294.2	2.4
2/2	81	0.005	21.0	294.2	2.4
2/3	195	0.005	21.0	294.2	2.4
2/4	505	0.005	21.0	294.2	2.4
2/5	619	0.005	21.0	294.2	2.4
2/6	697	0.005	21.0	294.2	2.4
Average			21.0	294.2	2.4

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 0.5 mm 1025.05 hPa

Q4AN(EV)-332-FM31

A=COM

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 5-Apr	1/				
Client: OneSteel H	exham				
AECOM's Project No:	60	493017			
Stack Description No.:	Shredder Stack				
Sample Nozzle No .:	fine3	Sample Nozz	zle Area (An):	1.35	x 10 ⁻⁵ m ²
Sampling Port No .:	1 to 2	Thimble No:		T474	
Page No:	1 of 1	Blank thimble	e No:	0	
Leak Check (Pre-Samp	ling)	Leak Check	(Post Sampling)	
Meter start: 277.05	76 Meter finish: 2	77.0576 Meter start:	278.1099	Meter finish:	278.1099
Time start: 9	52 Time finish:	9:53 Time start:	12:53	Time finish:	12:54
Therefore, leakage rate	= no leak L/min	Therefore, le	akage rate =	no leak	L/min
(>0.1 l/min. is unaccepta	ble)	(>0.1 l/min. is	s unacceptable)		
Repeat:		Repeat:			
Comments:		Comments:			

Sampling Record Table

Barometric Pressure:	1025 hPa (s	tart);	1025 hPa (finish)
Meter start:	277.0612	Time start:	10:05
Meter correction factor (GMf) :		1.0000	

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	0:06:45	33	12.6	27.0	22.0		Yes
1/2	0:06:45	111	12.6	30.0	22.0		Yes
1/3	0:06:45	225	12.6	33.0	22.0		Yes
1/4	0:06:45	535	12.6	35.0	22.0		Yes
1/5	0:07:00	649	12.6	36.0	22.0	1	Yes
1/6	0:06:45	727	12.6	37.0	22.0		Yes
2/1	0:06:45	33	12.6	37.0	22.0		Yes
2/2	0:06:45	111	12.6	30.0	22.0	1	Yes
2/3	0:06:45	225	12.6	34.0	23.0		Yes
2/4	0:07:00	535	12.6	31.0	23.0	i	Yes
2/5	0:06:45	649	12.6	34.0	23.0		Yes
2/6	0:06:45	727	12.6	35.0	24.0		Yes
				00.0	00.4	and the set	
Averages		278,1090		33.3 Time Finish:	22.4	no result 12:52	



STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 5-Apr-1	17					
Client: OneSteel He	exham					
AECOM's Project No:		60493017				
Stack Description No.:	Shredder Stack					
Sample Nozzle No .:	S6		Sample Nozzle Are	ea (An):	9.16	x 10 ⁻⁵ m ²
Sampling Port No .:	1 to 2		Thimble No:		T476	
Page No:	1 of 1		Blank thimble No:			
Leak Check (Pre-Sampl	ing)		Leak Check (Post	Sampling	1)	
Meter start: 308.425	2 Meter finish:	308.4252	Meter start:		Meter finish:	309.5598
Time start: 9:5	54 Time finish:	9:55	Time start:	12:54	Time finish:	12:55
Therefore, leakage rate =	no leak L/	/min	Therefore, leakage	rate =	no leak	L/min
(>0.1 l/min. is unacceptab	ole)		(>0.1 l/min. is unac	ceptable)		
Repeat:			Repeat:			
Comments:			Comments:			

Sampling Record Table

Barometric Pressure:	1025 hPa (s	start);	1025 hPa (finish)
Meter start:	308.4290	Time start:	10:05
Meter correction factor (GMf) :		1.0100	

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	0:06:48	33	13.0	23.0	19.0	- / - / - / - /	Yes
1/2	0:13:36	111	13.0	27.0	19.0	1	Yes
1/3	0:20:24	225	13.0	30.0	20.0	in	Yes
1/4	0:27:12	535	13.0	32.0	21.0		Yes
1/5	0:34:00	649	13.0	34.0	21.0		Yes
1/6	0:40:48	727	13.0	35.0	22.0	A	Yes
2/1	0:47:36	33	13.0	36.0	22.0		Yes
2/2	0:54:24	111	13.0	28.0	22.0	2	Yes
2/3	1:01:12	225	13.0	32.0	22.0	·	Yes
2/4	1:08:00	535	13.0	30.0	23.0		Yes
2/5	1:14:48	649	13.0	33.0	23.0		Yes
2/6	1:21:36	727	13.0	34.0	23.0	-	Yes
			_				
Averages	-			31.2	21.4	no result	-
Aeter Finish:		309.5587		Time Finish:	-1.4	12:52	

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



1=COA

Q4AN(EV)-332-FM31

STACK ANALYSIS

SAMPLING OF HAZARDOUS SUBSTANCES (METALS)
Date: 5-Apr-17

Date:	5-Apr-1/						
Client: Ones	Steel Hext	nam					
AECOM's Project	No:		60493017				
Stack Description	No.:	Shredder Stad	ck				
Sample Nozzle No	0.:	G12		Sample Nozzle An	ea (An):	11.31	x 10 ⁻⁵ m ²
Sampling Port No		1 to 2		Thimble No:		NA	
Page No:		1 of 1		Blank thimble No:			
Leak Check (Pre	-Sampling	g)		Leak Check (Pos	t Sampling)	
Meter start:	148.9304	Meter finish:	148.9304	Meter start:	150.2185	Meter finish:	
Time start:	9:56	Time finish:	9:57	Time start:	12:55	Time finish:	12:56
Therefore, leakag	je rate =	no leak	L/min	Therefore, leakag	e rate =	no leak	L/min
(>0.1 l/min. is una	acceptable)		(>0.1 l/min. is una	cceptable)		
Repeat:				Repeat:			
Comments:				Comments:			

Sampling Record Table

Barometric Pressure:	1025 hPa (s	tart);	1025 hPa (finish)	
Meter start:	148.9327	Time start:	10:05	
Meter correction factor (GMf) :		0.9900		

:00 53 :48 64	11 25 35 49 27 33	15.7 15.7 15.7 15.7 15.7 15.7 15.7 15.7	25.0 30.0 33.0 35.0 36.0 37.0 29.0 33.0 32.0 35.0 36.0 	21.0 21.0 22.0 22.0 22.0 22.0 22.0 23.0 23.0 23		Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
:24 22 :12 53 :00 64 :48 72 :36 3 :24 11 :12 22 :00 53 :48 64	225 335 449 227 133 111 225 335 49	15.7 15.7 15.7 15.7 15.7 15.7 15.7 15.7	33.0 35.0 36.0 37.0 29.0 33.0 32.0 35.0	21.0 22.0 22.0 22.0 22.0 22.0 23.0 23.0 23		Yes Yes Yes Yes Yes Yes Yes Yes Yes
:12 53 :00 64 :48 72 :36 3 :24 11 :12 22 :00 53 :48 64	35 49 27 13 11 25 35 49	15.7 15.7 15.7 15.7 15.7 15.7 15.7 15.7	35.0 36.0 37.0 29.0 33.0 32.0 35.0	22.0 22.0 22.0 22.0 23.0 23.0 23.0 24.0 24.0		Yes Yes Yes Yes Yes Yes Yes Yes
:12 53 :00 64 :48 72 :36 3 :24 11 :12 22 :00 53 :48 64	49 27 13 11 25 35 49	15.7 15.7 15.7 15.7 15.7 15.7 15.7 15.7	36.0 37.0 29.0 33.0 32.0 35.0	22.0 22.0 22.0 23.0 23.0 23.0 24.0 24.0		Yes Yes Yes Yes Yes Yes Yes
:00 64 :48 72 :36 3 :24 11 :12 22 :00 53 :48 64	27 33 11 25 35 49	15.7 15.7 15.7 15.7 15.7 15.7 15.7	37.0 37.0 29.0 33.0 32.0 35.0	22.0 22.0 23.0 23.0 24.0 24.0		Yes Yes Yes Yes Yes Yes
:48 72 :36 3 :24 11 :12 22 :00 53 :48 64	27 33 11 25 35 49	15.7 15.7 15.7 15.7 15.7 15.7 15.7	37.0 29.0 33.0 32.0 35.0	22.0 22.0 23.0 23.0 24.0 24.0		Yes Yes Yes Yes Yes
:36 3 :24 11 :12 22 :00 53 :48 64	3 11 25 35 49	15.7 15.7 15.7 15.7 15.7 15.7	29.0 33.0 32.0 35.0	22.0 23.0 23.0 24.0 24.0		Yes Yes Yes Yes
:24 11 :12 22 :00 53 :48 64	11 25 35 49	15.7 15.7 15.7 15.7	29.0 33.0 32.0 35.0	23.0 23.0 24.0 24.0		Yes Yes Yes Yes
:24 11 :12 22 :00 53 :48 64	11 25 35 49	15.7 15.7 15.7 15.7	33.0 32.0 35.0	23.0 24.0 24.0		Yes Yes Yes
12 22 00 53 48 64	25 35 49	15.7 15.7 15.7	33.0 32.0 35.0	24.0 24.0		Yes Yes
:00 53 :48 64	35 49	15.7 15.7	32.0 35.0	24.0 24.0		Yes
:48 64	49	15.7	35.0	24.0		Yes
		10.7				
		1				
	-		-	-		
	-		33.2	22.5	no result	
		150.2171	150.2171	150 2171 Time Einish:		

Q4AN(EV)-332-FM31

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

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

Time :	13:00	Barometric Pr			hPa
Page No. :	1 of 1	Pitot Correction		0.84	
Sampling Port No:	1 to 2	Stack Gas De	ensity:	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 ∆P, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	(Vs) m/s
1/1	3	0.005	23.0	296.2	2.4
1/2	81	0.005	23.0	296.2	2.4
1/3	195	0.005	23.0	296.2	2.4
1/4	505	0.005	23.0	296.2	2.4
1/5	619	0.005	23.0	296.2	2.4
1/6	697	0.005	23.0	296.2	2.4
	1.1.1			000.0	0.4
2/1	3	0.005	23.0	296.2	2.4
2/2	81	0.005	23.0	296.2	2.4
2/3	195	0.005	23.0	296.2	2.4
2/4	505	0.005	23.0	296.2	2.4
2/5	619	0.005	23.0	296.2	2.4
2/6	697	0.005	23.0	296.2	2.4
Average			23.0	296.2	2.4

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 0.5 mm 1025.05 hPa

Stack Analysis - Hazardous Substances Elemental Analysis Results

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

	Particulate Metals Results	Gaseous Metals Results	Oixdi	sable Mercury	Results
Metal	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)	KMnO₄/ H₂SO₄ + Rinses (mg) (5B)	Residue Rinse 8N HCI (mg) (lf Required) (5C)
Antimony	<0.0002	<0.0001		ULI DI SI	
Arsenic	< 0.0002	<0.0001	1111111111111111111111		
Beryllium	<0.0002	<0.0001	600000000000000000000000000000000000000		
Cadmium	0.024	0.0013			
Chromium	0.0009	0.00035			
Cobalt	<0.0002	< 0.0001	2002/00/00/00	Haddaaladadk	
Copper	0.0012	0.00048			400000000000000000000000000000000000000
Lead	<0.3	<0.399	Second Second		THE SAME
Magnesium	0.025	0.004			
Manganese	0.0027	0.0012	a an an Arrente	-51 N. 191	
Mercury	<0.0002	<0.0001	< 0.0001	NA	NA
Nickel	0.001	0.00008			
Selenium	<0.0002	<0.0001			
Thallium	<0.0002	<0.0001		101202020	
Tin	<0.0002	<0.0001			
Vanadium	<0.0008	<0.0001			
Zinc	0.22	0.0055	44444444444444	910430027884	100000000000000000000000000000000000000

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

AECOM's Pro	ject No:		60493017	Stack/Duct De	scription:	Shredder Stack			
Sample	Total Particulate Metals (mg)	Total Particulate Metals (mg/m ³)	Total Gaseous Metals (mg)	Total Gaseous Metals (mg/m ³)	Total Oxidisable Mercury (mg)	Total Oxidisable Mercury (mg/m ³)	Total (mg)	Total (mg/m ³)	Mass Emission Rate (mg/s)
Antimony	< 0.0002	< 0.00017	< 0.0001	<0.000086			< 0.0002	< 0.00017	< 0.00017
Arsenic	< 0.0002	< 0.00017	< 0.0001	<0.000086			< 0.0002	< 0.00017	< 0.00017
Beryllium	< 0.0002	< 0.00017	< 0.0001	<0.000086			< 0.0002	< 0.00017	< 0.00017
Cadmium	0.024	0.021	0.0013	0.0011			0.03	0.026	0.026
Chromium	0.0009	0.00077	0.00035	0.0003	22222222222		0.001	0.00086	0.00086
Cobalt	< 0.0002	< 0.00017	< 0.0001	<0.000086	55550000000		< 0.0002	< 0.00017	< 0.00017
Copper	0.0012	0.001	0.00048	0.00041	12222201200.000		0.002	0.0017	0.0017
Lead	< 0.3	<0.26	< 0.399	< 0.34	0.0000000000000000000000000000000000000		< 0.0002	< 0.00017	< 0.00017
Magnesium	0.025	0.021	0.004	0.0034			0.03	0.026	0.026
Manganese	0.0027	0.0023	0.0012	0.001	000000000000000000000000000000000000000		0.004	0.0034	0.0034
Mercury	< 0.0002	< 0.00017	< 0.0001	<0.000086	< 0.0001	<0.000086	< 0.0002	< 0.00017	< 0.00017
Nickel	0.001	0.00086	0.00008	0.000069	100220000000		0.001	0.00086	0.00086
Selenium	< 0.0002	< 0.00017	< 0.0001	<0.000086	Internet and a second s	energy weather	< 0.0002	< 0.00017	< 0.00017
Thallium	< 0.0002	< 0.00017	< 0.0001	<0.000086			< 0.0002	< 0.00017	< 0.00017
Tin	< 0.0002	< 0.00017	< 0.0001	<0.000086	100000000000000000000000000000000000000	esectedese	< 0.0002	< 0.00017	< 0.00017
Vanadium	<0.0008	< 0.00069	< 0.0001	<0.000086	100000000000000000000000000000000000000		< 0.0002	< 0.00017	< 0.00017
Zinc	0.22	0.19	0.0055	0.0047	840300655555		0.2	0.17	0.17
Total Hazardous Metals*	0.029	0.025	0.0029	0.0025	<0.0001	<0.000086	0.036	0.031	0.031
Total Metals	0.27	0.24	0.013	0.011		1	0.27	0.23	0.23

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

STACK ANALYSIS - PM10 CALCULATIONS

Date: AECOM's Project No:	5-Apr-17 60493017	Client: Stack/Duct [OneSteel H Description:		ack
1. Gas Analysis					
1.27	76				
%CO2	0.0				
%O2	20.9				
%N2+%CO	79.1				
Fraction Moisture Content, Bws	0.01	Ma=	0.99		
2. Molecular Weight of Stack Ga	s (Dry Basis)				
Mol. Wt. of Stack Gas (dry)	28.84				
Mol. Wt. of Stack Gas (wet)	28.52				
3. Absolute Stack Pressure					
	Pascals	in. Hg			
Barometric Pressure (Pbar)	102500	30.26			
Stack Static Pressure (Pg)	102505	30,26			
Absolute Stack Pressure		30.26			
4. Viscosity of Stack Gas					
	°C	oft			
Average Stack Temp.	23.0	73.4			
Average Meter Temperature:	27.8	Contra la			
Stack Gas Viscosity		181.5			
5. Cyclone Flow Rate		40.0			
	ft ³ /min	m³/min	L/min	L/s	
Cyclone Flow Rate	0.45	0.0158	15.78	0.26	

6. Nozzle Velocity, Rmin and Rmax

Nozzle Number	Nozzle Diameter	Nozzle	Velocity	Rmin	Rmax	Vmin	Vmin	Vmax	Vmax
	(inches)	ft/sec	m/s	[-]	•	ft/sec	m/s	ft/sec	m/s
0	0.124	88.78	29.22	0.765	1.225	67.89	22.27	108.72	35.67
1	0.133	77.10	25.38	0.756	1.230	58.30	19.13	94.86	31.12
2	0.146	64.34	21.18	0.742	1,240	47.72	15.66	79.76	26.17
3	0.163	51.15	16.84	0.716	1,255	36,60	12.01	64.20	21.06
4	0.177	43.50	14.32	0.690	1.270	30.00	9.84	55.23	18.12
5	0.186	39.37	12.96	0.669	1.280	26.35	8.64	50.41	16.54
6	0.216	29.33	9.66	0.575	1.322	16.87	5.53	38.78	12.72
7	0.224	27.11	8.92	0.535	1.336	14.50	4.76	36.22	11.88
8	0.263	19.74	6.50	#NUM!	1.410	9.87	3.24	27.83	9.13
9	0,299	15.25	5.02	#NUM!	1.494	7.63	2.50	22.79	7.48
10	0.341	11.75	3.87	#NUM!	1.609	5.87	1.93	17.62	5.78
11	0.392	8.88	2.92	#NUM!	1.773	4.44	1.46	13.32	4.37
	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate	1.00				
Selected Nozzle	(inches)	(m)	(m ²)	(L/min)					
3	0.163	0.004	0.000014	13.7					

AECOM

STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

ampling Time	Total Run Time	81.6	Number of points	12
Velocity Head (pitot)	Vel Head	Sqr Root	Dwell time	Total tin
Pa	in H20		mins	min
4.91	0.02	0.14	6.8	6.8
4.91	0.02	0.14	6.8	13.5
4.91	0.02	0.14	6.8	20.3
4.91	0.02	0.14	6.8	27.0
4.91	0.02	0.14	6.8	34.0
4.91	0.02	0.14	6.8	40.8
4.91	0.02	0.14	6.8	47.5
4.91	0.02	0.14	6.8	54.3
4.91	0.02	0.14	6.8	61.0
4.91	0.02	0.14	6.8	68.0
4.91	0.02	0.14	6.8	74.8
4.91	0.02	0.14	6.8	81.5
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	Average	0.14	81.60	
	Square	0.02		
dunamia Cut Class				
odynamic Cut Size (ucyc)	2			
182	.6 one conditions (Q _s)			

Total time min	Full hours	Full minutes	Seconds
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6.8		6	45
13.5	0	13	30
20.3	0	20	15
27.0	0	27	0
13.5 20.3 27.0 34.0	0	27 34	0
40.0		40	
40.8	0	40	45
47.5 54.3 61.0	0	47	30 15
54.2	0	4/	30
04.5	0	54 1	15
61.0	1	1	0
68.0	1	8	0
74.8	1	14	45
81.5	1	21	30
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TestPM10 ussion Measurement Calculations Spreadsheet (Q4AN(EV)-332-EM31) vision 2 May 28, 2015 En

Q4AN(EV)-332-FM31

AECOM

Fine Particulate (PM1) (Calculations perform		ance with relevant	t test method	d as defined on cov	er page)
Date: 5-Ap AECOM's Project No:		60493017	Client: Stack/Duc	OneSteel Hexham t Description: Sh	redder Stack
(A) Sample gas volun	ne at standai	rd conditions			
Metered volume (MV ₃		1.0478		Average barometri pressure (P _{BARO})	
Average gas meter te	mp. (1 _{M,2}):	301.0		Average pressure meter (P _{M.2})	1025 hPa at 1025.00 hPa
				moter (1 M.2)	1025.00 HFa
Sample gas volume (I			- 3		
gas, 1 atm pressure):		0.9621	m		
(B) PM10 concentration	on at standa	rd conditions			
Blank thimble No.:		0		Blank weight:	g
Thimble No. used:	T474			PM10 Weight	0.0058 g
Final PM10 Weight (M		0.00580			3
PM10 Concentration	(C1):		=M _{p1} /MV ₄ =		0.0060 g/m ³ (0°C, dry gas, 1atm pressure)
			;and C ₂ =		6.0 mg/m ³ (0°C, dry gas,
CO ₂ Basis	12 %				1atm pressure)
Average CO ₂ %:		0.0 %			
Therefore, C _c :		= C _a x 12/	CO ₂ % =		n ³ (0°C, dry gas, 1atm essure, 12% CO ₂)
			;and C _{c1} =)/m ³ (0⁰C, dry gas, 1atm essure, 12% CO₂)
O ₂ Basis	7 %				
Average O ₂ %:		20.9 %			
Therefore, C _b :	=C _a x (21 - O _{2ref} %)/(21 - (O _{2mea} %)	0.84 g/r	n^3 (0°C, dry gas, 1atm pressure, 7% O ₂)
			;and C _{b1} =	840 mg	p/m^3 (0°C, dry gas, 1atm pressure 7% O ₂)
(C) Moisture content Silica Gel Number:	P26				176 027
V _v =	7.2 g (from	laboratory report)		V _w =	2 mL (=grams)
Volume of Water Vap			0.0027		(recorded on
Volume of Water Vap			0.0096		Laboratory Form
	our conden	And the second			108)
Therefore, B _{ws} =		(V _{wc(std)} +V _{wsg(std})+V (V _{wc(std)} +V _{wsg(std)} +V			
B _{ws} =		1.26 %			



ANZ			
Emission	Measurement	Calculations	Spreadsheet

Q4AN(EV)-332-FM31

Fine Particulate (PM10)	
(D) Gas Composition and Density (Re-calculation	ion)
(i) Initial gas density for sampling:	1.27 kg/m ³ (from

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

(ii) Re-calculated gas density based on moisture content in (c):

1.27 kg/m³ (from Laboratory Form 107)

1.26 kg/m³ (0°C, wet, 1 atm pressure) 1.29 kg/m³ (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

(ii) x (273.2) x (Ps) (273.2+Ts) (1013.25)

1.180 kg/m³ (stack conditions, wet)

2.40 m/s (stack conditions, wet)

N/A m/s (stack conditions, wet)

2.40 m/s

2.40 m/s

N/A m/s

(E) Gas Velocities

(i) Average of pre-sampling velocities:

(ii) Average of post-sampling velocities:

(iii) Average of while-sampling velocities:

 (iv) Overall average of pre-sampling and postsampling velocities (Vs):
 (Note: (Vs) is from all individual data, not from (i) and (ii) alone.)

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

Qstack =		Vs x A =		1.09 m ³ /s (stack conditions)	
Qstd =	Qstack x	<u>Ps</u> x (Pstd)	<u>(Tstd)</u> x (Ts)	<u>(100 - B_w)</u> 100	

Qstd =

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

```
(G) Mass Emission Rate
```

Rm =	C _{1a} x Qstd =	0.0060	g/s (0°C, dry gas, 1 atm pressure)		
	=	6.0	mg/s (0°C, dry gas, 1 atm pressure)		
	C _{1a} x Qstd =	0.0060	g/s (0°C, dry gas, 1 atm pressure	12%	CO ₂)	
	=	6.0	mg/s (0°C, dry gas, 1 atm pressure	12%	$CO_2)$	
	C _{1a} x Qstd =	0.85	g/s (0°C, dry gas, 1 atm pressure	7%	O ₂)	
	-	850	mg/s (0°C, dry gas, 1 atm pressure	7%	O ₂)	



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STACK ANALYSIS - FINAL CALCULATIONS

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

ferrida and					
Date:	5-Apr-17		Client:	OneSteel Hexham	these
AECOM's P	oject No:	60493017	Stack/Duct	Description: Shredder S	DIACK
(A) Sample (gas volume at standard o	onditions			
Metered volu	ume (MV ₃):	1.1410	m ³	Average barometric	
	meter temp. (T _{M.2}):	26.3		pressure (P _{BARO})	1025 hPa
		299.5	к	Average pressure at meter $(P_{M,2})$	1025.00 hPa
Sample gas	volume (MV ₄); (0°C, dry		1.0		
gas, 1 atm p	ressure):	1.0529	m ³		
(B) Total Pa	rticulate concentration at	standard condi	tions		
Blank thimbl		a na ser an seo de se		Blank weight:	g
Thimble No.				Total Particulate Weight	0.0013 g
	Particulate Weight (Mp1):	0.00130	9 =M _{p1} /MV ₄ =	0.0013	g/m ³ (0°C, dry gas,
Total Particu	late Concentration (C1):		-w _{p1} /w v ₄ -	0.0012	1atm pressure)
			and C ₂ =	1.2	mg/m ³ (0°C, dry gas,
CO ₂ Basis	12 %				1atm pressure)
Average CC	2%:	0.0 %			
				3 1000	1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-
Therefore, C	ici	= C _a x 12/	CO ₂ % =	0.0012 g/m ³ (0°C, pressure,	12% CO ₂)
			;and C _{c1} =	1.2 mg/m ³ (0°(pressure,	C, dry gas, 1atm 12% CO ₂)
O ₂ Basis	7 %				
Average O2	%:	20.9 %			
Therefore, (C _b : =C _a x (21	- O _{2ref} %)/(21 - 0	O _{2mea} %)	0.17 g/m ³ (0°C, 7%	dry gas, 1atm pressure, O_2)
			;and C _{b1} =	170 mg/m ³ (0° 7%	C, dry gas, 1atm pressure O ₂)
(C) Moisture Silica Gel N					
V _v =		oratory report)		V _w =	4 mL (=grams)
	Vater Vapour Condensed		0.0053		(recorded on Laboratory Form
	Vater Vapour Condensed	and the second sec	0.0097		108)
Therefore, I		(Vwc(std)+Vwsg(str			
1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		c(std)+V _{wsg(std)} +V			
	B., =	1.41 %			

B_{ws} = 1.41 %



Q4AN(EV)-332-FM31

STACK ANALYSIS - FINA	L CALCULATIONS CONTINUED
Total Particulate	

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

(i) Initial gas density for sampling:	1.27 kg/m ³ (from Laboratory Form 107)
(ii) Re-calculated gas density based on moisture content in (c):	1.26 kg/m ³ (0°C, wet, 1 atm pressure) 1.29 kg/m ³ (0°C, dry, 1 atm pressure)
(iii) Gas density at stack conditions =	(ii) x <u>(273.2)</u> x <u>(Ps)</u> (273.2+Ts) (1013.25)
-	1.180 kg/m ³ (stack conditions, wet)

(E) Gas Velocities

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

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

Qstack =		Vs x A =	1.09 m ³ /s (stack conditions)
Qstd =	Qstack x	<u>Ps</u> x	<u>(Tstd)</u> x (100 - B _w)
		(Pstd)	(Ts) 100

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

(G) Mass Emission Rate

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



Q4AN(EV)-332-FM31

STACK ANALYSIS - FINAL CALCULATIONS

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

Date: AECOM's Pro	5-Apr-17 ject No:		e Meridi i	OneSteel Hexham Description: Shredde	r Stack
(A) Sample ga	is volume at standard	l conditions			
Metered volum	ne (MV ₃): neter temp. (T _{M.2}):	1.2716		Average barometric pressure (P _{BARO})	1025 hPa
	The second second	301.0		Average pressure at me (P _{M,2})	ter 1025.00 hPa
Sample gas ve gas, 1 atm pre	olume (MV4); (0°C, di essure):	y 1.1675 (m ³		
(B) Metals cor Blank thimble Thimble No. u Final Metals V Metals Conce	sed: NA Veight (Mp1):	0.00004		Blank weight: Metals Weight 0.0000	g 0.000036 g 31 g/m ³ (0°C, dry gas, 1atm pressure)
CO ₂ Basis Average CO ₂	12 % %:	0.0 %	and C ₂ =	0.0	³¹ mg/m ³ (0°C, dry gas, 1atm pressure)
Therefore, C _c	6	= C _a x 12/C	O ₂ % =	0.000031 g/m ³ (0° pressure	C, dry gas, 1atm e, 12% CO ₂)
			;and C _{c1} =		0°C, dry gas, 1atm e, 12% CO ₂)
O ₂ Basis Average O ₂ %	7 %	20.9 %			
Therefore, C _b	=C _a x (2	21 - O _{2ref} %)/(21 - O	_{2mea} %)	0.0043 g/m ³ (0° 7%	C, dry gas, 1atm pressure, O ₂)
			and C _{b1} =	4.3 mg/m ³ (7%	0°C, dry gas, 1atm pressure, O ₂)
(C) Moisture of Silica Gel Nur					
	ater Vapour Condens ater Vapour Condens _{is} =			V _w =	5 mL (=grams) (recorded on Laboratory Form 108)
		2 05 %			

B_{ws} = 2.05 %



Q4AN(EV)-332-FM31

ANZ Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hazardous Substances (Metals)

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

(i) Initial gas density for sampling:

1.27 kg/m³ (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c):

1.27 kg/m³ (0°C, wet, 1 atm pressure) 1.29 kg/m³ (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

(ii) x (273.2) x (Ps) (273.2+Ts) (1013.25)

1.189 kg/m³ (stack conditions, wet)

(E) Gas Velocities

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

=

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

Qstack =		Vs x A =	1.09 m ³ /s (stack conditions))
Qstd =	Qstack x	<u>Ps</u> x	<u>(Tstd)</u> × <u>(100 - B_w)</u>	
		(Pstd)	(Ts) 100	

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

(G) Mass Emission Rate

Rm =	C _{1a} x Qstd = =	0.000031 0.031	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure)	
	C _{1a} x Qstd = =	0.000031 0.031	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure	12% 12%	CO_2) CO_2)
	C _{1a} x Qstd = =	0.0043 4.3	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure	7% 7%	O ₂) O ₂)

AECOM

ANZ Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, SHREDDER STACK ONESTEEL HEXHAM 5-Apr-17 FINE PARTICULATE (PM10) TOTAL PARTICULATE HAZARDOUS SUBSTANCES (METALS)							
Sampling Conditions:							
Stack internal diameter at test location	760 mm						
Stack gas temperature (average)	22.0 °C		295.2 K				
Stack pressure (average)	1025 hPa						
Stack gas velocity (average, stack conditions)	2.4 m/s						
Stack gas flowrate (stack conditions)	1.1 m³/s						
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	1 m ³ /s						
Fine Particulate (PM10) Testing	2020		45.55				
Test Period	10:05	2	12:52				
Fine Particulate (PM10) Mass	5.8 mg						
Gas Volume Sampled	0.962 m ³						
Fine Particulate (PM10) Emission*1	6.0 mg/m ³						
Fine Particulate (PM10) Mass Emission Rate*2	6.0 mg/s						
Regulatory Limit	N/A						
Total Particulate Testing	10.05						
Test Period	10:05	2	12:52				
Total Particulate Mass	1.3 mg						
Gas Volume Sampled	1.05 m ³						
Total Particulate Emission*1	1.2 mg/m ³						
Total Particulate Mass Emission Rate*2	1.2 mg/s						
Regulatory Limit	100 mg/m ³						
Hazardous Substances (Metals) Testing	10.05		10.50				
Test Period Hazardous Substances (Metals) Mass	10:05	1	12:52				
[경기에서 2017] 이번 정치가 가지 않는 것이 아이에 들어서 집에 들어 가슴다.	0.036 mg 1.17 m ³						
Gas Volume Sampled							
Hazardous Substances (Metals) Emission*1	0.031 mg/m ³						
Hazardous Substances (Metals) Mass Emission Rate*2 Regulatory Limit	0.031 mg/s N/A						
Moisture Content (%)	1.7						
Gas Density (dry at 1 atmosphere)	1.29 kg/m ³						
Dry Molecular Weight	28.8 g/g-mole						

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

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

Appendix B

Laboratory Results (8 pages)

Appendix B Laboratory Results (8 pages)



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

STACK EMISSION - PARTICULATES REPORT

Project: 60493017 Description : Stack Emission Samples Date : 12-Apr-17

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



NATA Accredited Laboratory 18079 Accredited for compliance with ISO/IEC 17025 - Testing Reported By: J Campbell

Jason Campbell

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

Note : Sampled by Client



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

STACK EMISSION - MOISTURE REPORT

<u>Origin:</u> Project:	AECOM - Newcastle 60493017	Report :	13347-0-M	Page 1 of 1
Description :	Stack Emission Samples Received: 06-Apr-17	<u>Date :</u>	12-Apr-17	
<u>Report To :</u>	Cye Buckland 17 Warabrook Blvd, Warabrook NSW 2304	<u>Copy to:</u>	FILE	
Jar ID	Μ	loisture (g)		
G100		7.3		
JL352		13.3		
P26		7.2		



NATA Accredited Laboratory 18079 Accredited for compliance with ISO/IEC 17025 - Testing Reported By: J Campbol

Jason Campbell

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







CLIENT DETAILS		LABORATORY DETAI	ILS
Contact	Cye Buckland	Manager	Adam Atkinson
Client	AECOM Australia Pty Ltd	Laboratory	SGS Melbourne EH&S
Address	Level 21, 420 George Street (PO BOX Q410, QVB Post Office SYDNEY NSW 1230) SYDNEY NSW 2000	Address	10/585 Blackburn Road Notting Hill Victoria 3168
Telephone	02 8295 3600	Telephone	+61395743200
Facsimile	02 8934 0001	Facsimile	+61395743399
Email	cye.buckland@aecom.com	Email	Au.SampleReceipt.Melbourne@sgs.com
Project	(Not specified)	SGS Reference	ME302438 R0
Order Number	60493017/1.1	Date Received	07 Apr 2017
Samples	12	Date Reported	13 Apr 2017

COMMENTS _

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

SIGNATORIES ____

MING

Weiming Dai Inorganic Supervisor

> SGS Australia Pty Ltd ABN 44 000 964 278

10, 585 Blackburn Rd Notting Hill VIC 3168

t +61 3 9574 3200 Australia f +61 3 9574 3399



ME302438 R0

	S	nple Number ample Matrix Sample Date ample Name	ME302438.001 Filter 05 Apr 2017 Metals 1	ME302438,002 Filter 05 Apr 2017 Metals 12	ME302438.003 Impinger 05 Apr 2017 Metals 3	ME302438.004 Impinger 05 Apr 2017 Metals 4
Parameter	Units	LOR			1. 2. 2. 2	-
Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29	Method: EPA2	9_FILT Te	sted: 12/4/2017			
Sb	µg total	0.2	<0.2	<0.2	-	
As	µg total	0.2	<0.2	<0.2	-	-
Be	µg total	0.2	<0.2	<0.2	-	-
Cd	µg total	0.2	23	<0.2	-	+
Cr	µg total	0.2	0.5	0.3	-	-
Co	µg total	0.2	<0.2	<0.2	•	-
Cu	µg total	0.2	0.7	0.5	-	-
Pb	µg total	0.2	0.2	<0.2	-	-
Mg	µg total	2	31	16	· · ·	
Mn	µg total	0.2	0.5	3.5	•	-
Hg	µg total	0.2	<0.2	<0.2	-	•
Ni	µg total	0.2	0.3	<0.2		
Se	µg total	0.2	<0.2	<0.2	•	-
n	µg total	0.2	<0.2	<0.2		
Sn	µg total	0.2	<0.2	<0.2	-	-
v	µg total	0.2	0.7	0.8	-	
Zn	µg total	0.2	260	100		

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

Sb	µg total	0.1			0.1	<0.1
As	µg total	0.1	-	-	<0.1	<0.1
Be	µg total	0.1	-	-	<0.1	<0.1
Cd	µg total	0.1		-	1.4	1.4
Cr	µg total	0.1		-	0.7	0.4
Co	µg total	0.1		-	<0.1	<0.1
Cu	µg total	0.1	-	-	1.0	1.0
Ръ	µg total	0.1	•	-	97	310
Mg	µg total	0.1	-	-	11	4.9
Mn	µg total	0.1	-	-	7.2	5.1
Hg	µg total	0.1		•	<0.1	<0.1
Ni	µg total	0.1	-	-	0.8	0.7
Se	µg total	0.1	-	-	<0.1	<0.1
Π	µg total	0.1	-	-	<0.1	<0.1
Sn	µg total	0.1	-	-	<0.1	<0.1
v	µg total	0.1		-	<0.1	<0.1
Zn	µg total	0.1		-	43	6.2
Sample Volume*	mL	-		-	97	310



ME302438 R0

12.0		Sample Nun Sample Ma Sample N Sample N	atrix Impinger Date 05 Apr 2017	ME302438,006 Impinger 05 Apr 2017 Metals 9	ME302438.007 Impinger 05 Apr 2017 Metals 5A	ME302438,008 Impinger 05 Apr 2017 Metals 5C
Parameter	Un	iits LOF	3			
Metals in Filters M29 ETC MA-1400	FL.M29.02 USEPA M29 Method:	EPA29_FILT	Tested: 12/4/2017			
Sb	µg to	otal 0.2	-			
As	µg to	otal 0.2	-	-	-	
Be	µg to	otal 0.2	-	-	-	-
Cd	µg to	otal 0.2			+	•
Cr	µg to	otal 0.2		•	-	-
Co	µg to	otal 0.2	-	•	-	
Cu	µg to	otal 0.2		-	-	
Pb	µg to	otal 0.2	-	-		-
Mg	µg ta	otal 2			+	
Mn	µg to	otal 0.2	-			-
Hg	µg ta	otal 0.2				-
Ni	µg to	tal 0.2	-		-	
Se	µg to	otal 0.2	-			-
п	µg to	tal 0.2	-	-		
Sn	µg to	tal 0.2	-	-		-
v	µg to	tal 0.2	-	-		-
Zn	µg to	tal 0.2	-	-		-

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

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

.



ME302438 R0

	5	nple Number Imple Matrix Sample Date ample Name	ME302438.009 Impinger 05 Apr 2017 Metals 8B	ME302438.010 Impinger 05 Apr 2017 Metals 11	ME302438.011 KMnO4 05 Apr 2017 Metals 5B	ME302438.012 KMnO4 05 Apr 2017 Metals 10
Parameter	Units	LOR				110-1
Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA	M29 Method: EPA2	9_FILT Ter	sted: 12/4/2017			
Sb	µg total	0.2	-	-	-	-
As	µg total	0.2	-	-	-	-
Be	µg total	0.2	•	-	-	-
Cd	µg total	0.2	-	-		-
Cr	µg total	0.2	-			
Co	µg total	0.2	÷.			
Cu	µg total	0.2		•		-
Pb	µg total	0.2	•	-		-
Mg	µg total	2	•	• •		
Mn	µg total	0.2		•	1	-
Hg	µg total	0.2	-	-	-	
Ni	µg total	0.2	-	•		+
Se	µg total	0.2	-	-		
Π	µg total	0.2	-	•	•	-
Sn	µg total	0.2	-	-	-	-
v	µg total	0.2	-	-		-
Zn	µg total	0.2	-			

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

Sample Volume*	mL	-	99	250	400	100
Zn	µg total	0.1		•	-	-
/	µg total	0.1	-	-	•	
ŝn	µg total	0.1	•	-	•	-
π	µg total	0.1	•	-		-
Se	µg total	0.1	-	-	•	•
Ni	µg total	0.1		-		-
Hg	µg total	0.1	<0.1	<0.1	<0.1	<0.1
Mn	µg total	0.1		-	-	
Mg	µg total	0.1	-	-	-	
Pb	µg total	0.1	-	-	-	
Cu	µg total	0.1	-		-	-
Co	µg total	0.1	-	-		
Cr	µg total	0.1		-	-	
Cd	µg total	0.1	-	•	•	
Be	µg total	0.1	-	•		
As	µg total	0.1	-	-	-	-
5b	µg total	0.1		•		•



QC SUMMARY

MB blank results are compared to the Limit of Reporting

LCS and MSD relative percent differences are measured against their original counterpart samples according to the formula : the absolute difference of the two results divided by the average of the two results as a percentage. Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

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

Parameter	ec	Units	LOR	MB	LCS
	Reference		1	and the second	%Recovery
Sb	LB012668	µg total	0.2	<0.2	NA
As	LB012668	µg total	0.2	<0.2	NA
Be	LB012668	µg total	0.2	<0.2	NA
Cd	LB012668	µg total	0.2	<0.2	NA
Cr	LB012668	µg total	0.2	<0.2	NA
Co	LB012668	µg total	0.2	<0.2	NA
Cu	LB012668	µg total	0.2	<0.2	NA
Pb	LB012668	µg total	0.2	<0.2	NA
Mg	LB012668	µg total	2	<2	NA
Mn	LB012668	µg total	0.2	<0.2	NA
Hg	LB012668	µg total	0.2	<0.2	NA
Ni	LB012668	µg total	0.2	<0.2	NA
Se	LB012668	µg total	0.2	<0.2	NA
n	LB012668	µg total	0.2	<0.2	NA
Sn	LB012668	µg total	0.2	<0.2	NA
v	LB012668	µg total	0.2	<0.2	NA
Zn	LB012668	µg total	0.2	<0.2	NA

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

Parameter	0,0	Units	LOR	MB
and the second	Reference	and the second	1000	
Sb	LB012671	µg total	0.1	<0.1
As	LB012671	µg total	0.1	<0.1
Be	LB012671	µg total	0.1	<0.1
Cd	LB012671	µg total	0.1	<0.1
Cr	LB012671	µg total	0.1	<0.1
Co	LB012671	µg total	0.1	<0.1
Cu	LB012671	µg total	0.1	<0.1
Pb	LB012671	µg total	0.1	<0.1
Mg	LB012671	µg total	0.1	<0.1
Mn	LB012671	µg total	0.1	<0.1
Hg	LB012671	µg total	0.1	<0.1
Ni	LB012671	µg total	0.1	<0.1
Se	LB012671	µg total	0.1	<0.1
n	LB012671	µg total	0.1	<0.1
Sn	LB012671	µg total	0.1	<0.1
v	LB012671	µg total	0.1	<0.1
Zn	LB012671	µg total	0.1	<0.1



METHOD SUMMARY

EPA29

METHODOLOGY SUMMARY

Metals in Impinger Solutions by ICP MS.

FOOTNOTES

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

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

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

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

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

Note that in terms of units of radioactivity:

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

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

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/IMP-4U-ENV-DU-022%20QA%20QC%20Plan.pdf

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