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OneSteel Recycling Pty Ltd
Doc No. 60493017_2.1_Q4_2017

# 4th Quarter Emissions Testing Report 2017

OneSteel Recycling Hexham

NATA ACCREDITATION No. 2778 (14391)
Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

# 4th Quarter Emissions Testing Report 2017

OneSteel Recycling Hexham

Client: OneSteel Recycling Pty Ltd

ABN: 28 002 707 262

Prepared by

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

# Quality Information

Document 4th Quarter Emissions Testing Report 2017

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Prepared by Dylan Turnbull

Reviewed by Chad Whitburn AECOM Approved Signatory

Revision History

| Rev | Revision Date | Details | Authorised | |
|---|---|---|---|---|
| | | | Name/Position | Signature |
| 0 | 08-Dec-2017 | Report for Issue | Chad Whitburn<br>Associate Director - Compliance Services |  |

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**List of Tables**

# 1.0 Introduction

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

Testing was undertaken on 23 November 2017 to investigate emission concentrations for the following parameters:

- Fine Particulates ($PM_{10}$);
- 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 14892-0-M & 14892-0-P:
  - Total Particulate (TP);
  - Fine Particulates ($PM_{10}$); and
  - Moisture.
- SGS Australia Pty Ltd NATA accreditation number 2562, performed the following analysis detailed in report number ME304956 R0:
  - Hazardous Substances (Metals).

# 2.0 Sampling Plane Requirements

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

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

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

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

*a. The gas flow is basically in the same direction at all points along each sampling traverse;*

*b. The gas velocity at all sampling points is greater than 3 m/s;*

*c. The gas flow profile at the sampling plane shall be steady, evenly distributed and not have a cyclonic component which exceeds an angle of 15$^{o}$ to the duct axis, when measured near the periphery of a circular sampling plane;*

*d. The temperature difference between adjacent points of the survey along each sampling traverse is less than 10% of the absolute temperature, and the temperature at any point differs by less than 10% from the mean;*

*e. The ratio of the highest to lowest pitot pressure difference shall not exceed 9:1 and the ratio of highest to lowest gas velocities shall not exceed 3:1. For isokinetic testing with the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1; and*

*f. The gas temperature at the sampling plane should preferably be above the dewpoint.*

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

# 3.0 Methodology

## 3.1 NATA Accredited Methods

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

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

**Table 2 AECOM NATA Endorsed Methods**

| NSW EPA Approved Methods | USEPA Methods | Method Title |
|---|---|---|
| AS4323.1 (NSW EPA TM-1) | USEPA (2000) Method 1 | Selection of sampling positions |
| AS4323.2 (NSW EPA TM-15) | USEPA (2000) Method 5 under approved circumstances | Determination of total particulate matter – isokinetic manual sampling – gravimetric method |
| NSW EPA TM-2 | USEPA (2000) Method 2 | 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 23 November 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 2.4 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, 23 November 2017**

| Parameter | Emission Concentration (EPL Point 1) | Emission Concentration Limit |
|---|---|---|
| Total Particulate (TP) ($mg/m^3$) | 0.62 | 100 |
| Fine Particulate ($PM_{10}$) ($mg/m^3$) | 0.26 | NA |
| Lead ($mg/m^3$) | 0.00017 | 5.0 |
| Mercury ($mg/m^3$) | <0.00017 | 1.0 |
| Total Hazardous Substances (Metals) ($mg/m^3$) | 0.0030 | NA |

Results from testing conducted on EPL Point 1 on 23 November 2017 are below the regulatory limits listed in EPL 5345.

**Table 5 Fine Particulate ($PM_{10}$), Total Particulate and Hazardous Substance (Metals) Results, 23 November 2017**

| | | | |
|---|---|---|---|
| **Sampling Conditions:** | | | |
| Stack internal diameter at test location | 760 | mm | |
| Stack gas temperature (average) | 21.5 | °C | 294.7 K |
| Stack pressure (average) | 1017 | hPa | |
| Stack gas velocity (average, stack conditions) | 2.4 | m/s | |
| Stack gas flowrate (stack conditions) | 1.1 | $m^3/s$ | |
| Stack gas flowrate (0°C, dry gas, 1 atm pressure) | 0.99 | $m^3/s$ | |
| **Fine Particulate ($PM_{10}$) Testing** | | | |
| Test Period | 7:36 | - | 9:07 |
| Fine Particulate ($PM_{10}$) Mass | 0.3 | mg | |
| Gas Volume Sampled | 1.2 | $m^3$ | |
| Fine Particulate ($PM_{10}$) Emission*[1] | 0.26 | $mg/m^3$ | |
| Fine Particulate ($PM_{10}$) Mass Emission Rate*[2] | 0.26 | mg/s | |
| Regulatory Limit | NA | | |
| **Total Particulate Testing** | | | |
| Test Period | 7:36 | - | 9:07 |
| Total Particulate Mass | 0.7 | mg | |
| Gas Volume Sampled | 1.1 | $m^3$ | |
| Total Particulate Emission*[1] | 0.62 | $mg/m^3$ | |
| Total Particulate Mass Emission Rate*[2] | 0.61 | mg/s | |
| Regulatory Limit | 100 | $mg/m^3$ | |
| **Hazardous Substances (Metals) Testing** | | | |
| Test Period | 7:36 | - | 9:07 |
| Hazardous Substances (Metals) Mass | 0.0030 | mg | |
| Gas Volume Sampled | 1.2 | $m^3$ | |
| Hazardous Substances (Metals) Emission*[1] | 0.0026 | $mg/m^3$ | |
| Hazardous Substances (Metals) Mass Emission Rate*[2] | 0.0026 | mg/s | |
| Regulatory Limit | NA | | |
| **Moisture Content (%)** | **2.5** | | |
| **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.

**Table 6 Hazardous Substances (Metals) Elemental Analysis Results, 23 November 2017**

| Sample | Total Particulate Metals (mg) | Total Particulate Metals ($mg/m^3$) | Total Gaseous Metals (mg) | Total Gaseous Metals ($mg/m^3$) | Total Oxidisable Mercury (mg) | Total Oxidisable Mercury ($mg/m^3$) | Total (mg) | Total ($mg/m^3$) | Mass Emission Rate (mg/s) |
|---|---|---|---|---|---|---|---|---|---|
| Antimony | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Arsenic | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Beryllium | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Cadmium | 0.0015 | 0.0013 | 0.00029 | 0.00025 | | | 0.002 | 0.0017 | 0.0017 |
| Chromium | <0.001 | <0.00086 | 0.00019 | 0.00016 | | | 0.00019 | 0.00016 | 0.00016 |
| Cobalt | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Copper | <0.0012 | <0.001 | 0.00029 | 0.00025 | | | 0.00029 | 0.00025 | 0.00025 |
| Lead | 0.0002 | 0.00017 | <0.0002 | <0.00017 | | | 0.0002 | 0.00017 | 0.00017 |
| Magnesium | <0.058 | <0.05 | <0.0002 | <0.00017 | | | <0.002 | <0.0017 | <0.0017 |
| Manganese | <0.0018 | <0.0015 | <0.0094 | <0.008 | | | <0.0002 | <0.00017 | <0.00017 |
| Mercury | <0.0002 | <0.00017 | <0.0002 | <0.00017 | <0.0001 | <0.000086 | <0.0002 | <0.00017 | <0.00017 |
| Nickel | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Selenium | 0.0005 | 0.00043 | <0.0013 | <0.0011 | | | 0.0005 | 0.00043 | 0.00042 |
| Thallium | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Tin | <0.0004 | <0.00034 | 0.000087 | 0.000074 | | | 0.000087 | 0.000074 | 0.000073 |
| Vanadium | <0.0053 | <0.0045 | <0.0042 | <0.0036 | | | <0.0002 | <0.00017 | <0.00017 |
| Zinc | <1.401 | <1.2 | <0.001 | <0.00086 | | | <0.0002 | <0.00017 | <0.00017 |
| **Total Hazardous Metals*** | **0.0022** | **0.0019** | **0.00048** | **0.00041** | **<0.0001** | **<0.000086** | **0.0030** | **0.0026** | **0.0026** |
| **Total Metals** | **0.0022** | **0.0019** | **0.00086** | **0.00073** | | | **0.0033** | **0.0028** | **0.0028** |

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

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# Appendix A

Field Sheets (17 pages)

# Appendix A Field Sheets (17 pages)

# Emission Measurement Calculations Spreadsheet



**OneSteel Hexham**

AECOM's Project Number: 60493017

Emission Source: Shredder Stack

Date Sampled: 23-Nov-17

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

Observations made during testing period:

Sampling Performed By:

James Lang

Dylan Turnbull

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# Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

## STACK ANALYSIS - PRE-SAMPLING

Date: 23-Nov-17
Client: OneSteel Hexham
AECOM's Project No: 60493017
Stack/Duct Description: Shredder Stack
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Hazardous Substances (Metals)

Measurement/Observations

Stack Internal Dimensions:

Diameter 760 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 0.45 $m^2$

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 5
No. Diameters = 6.6
Type of Upstream Disturbance: Fan Entry
Downstream (m) = 2
No. Diameters = 2.6
Type of Down Stream Disturbance: StackExit

Total No. of sampling points = 12
PM2.5/10= 12
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 6
PM2.5/10= 6

Position of each sampling point, for each traverse:

Exclusion of any sample point numbers - comments:

| | A | | B | | PM10/2.5 A | | PM2.5/10 B | |
|---|---|---|---|---|---|---|---|---|
| No. | Distance from wall | S-type Pitot distances | Distance from wall | S-Type Pitot distances | | | | |
| 1 | 33 | 3 | 33 | 3 | | | | |
| 2 | 111 | 81 | 111 | 81 | | | | |
| 3 | 225 | 195 | 225 | 195 | | | | |
| 4 | 535 | 505 | 535 | 505 | | | | |
| 5 | 649 | 619 | 649 | 619 | | | | |
| 6 | 727 | 697 | 727 | 697 | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | | | | | | | | |
| 13 | | | | | | | | |
| 14 | | | | | | | | |
| 15 | | | | | | | | |
| 16 | | | | | | | | |
| 17 | | | | | | | | |
| 18 | | | | | | | | |
| 19 | | | | | | | | |
| 20 | | | | | | | | |

Check of total points against minimum, (yes/no) - comments:

General Comments:

Signed: .....

Checked: C Brudland

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# Emission Measurement Calculations Spreadsheet



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

Date: 23-Nov-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: 7:30 | | Sampling port No.: 1 | | |
|---|---|---|---|---|
| Measurement No. | Time sampled | CO (ppm). (dry) | $O_2$ (%), (dry) | $CO_2$ (%), (dry) |
| 1 | 7:30 | 0 | 20.9 | 0.0 |
| 2 | 7:31 | 0 | 20.9 | 0.0 |
| 3 | 7:32 | 0 | 20.9 | 0.0 |
| 4 | 7:33 | 0 | 20.9 | 0.0 |
| 5 | 7:34 | 0 | 20.9 | 0.0 |
| 6 | 7:35 | 0 | 20.9 | 0.0 |
| 7 | 7:36 | 0 | 20.9 | 0.0 |
| 8 | 7:37 | 0 | 20.9 | 0.0 |
| | Averages: | 0.0 ppm | 20.9 % | 0.0 % |

Moisture content (M3): 0.99
Moisture percentage (M2): 0.60 %

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) | $N_2$: | 78.6 %,(wet) |
| $CO_2$: | 0.0 %,(wet) | $O_2$: | 20.8 %,(wet) |
| $H_2O$: | 0.60 %(=M2) | | |

| | | |
|---|---|---|
| Therefore, stack gas density (GD) = | 1.28 $kg/m^3$ | ($0^oC$, wet, 1 atm pressure) |
| Therefore, stack gas density (GD) = | 1.29 $kg/m^3$ | ($0^oC$, dry, 1 atm pressure) |

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# Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

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

Date: 23-Nov-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: 9:00 | | Sampling port No.: 1 | | |
|---|---|---|---|---|
| Measurement No. | Time sampled | CO (ppm). (dry) | $O_2$ (%), (dry) | $CO_2$ (%), (dry) |
| 1 | 9:00 | 0 | 20.9 | 0.0 |
| 2 | 9:01 | 0 | 20.9 | 0.0 |
| 3 | 9:02 | 0 | 20.9 | 0.0 |
| 4 | 9:03 | 0 | 20.9 | 0.0 |
| 5 | 9:04 | 0 | 20.9 | 0.0 |
| 6 | 9:05 | 0 | 20.9 | 0.0 |
| 7 | 9:06 | 0 | 20.9 | 0.0 |
| 8 | 9:07 | 0 | 20.9 | 0.0 |
| | Averages: | 0.0 ppm | 20.9 % | 0.0 % |

Moisture content (M3): 0.98
Moisture percentage (M2): 2.39 %

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) | $N_2$: | 77.2 %,(wet) |
| $CO_2$: | 0.0 %,(wet) | $O_2$: | 20.4 %,(wet) |
| $H_2O$: | 2.39 %(=M2) | | |
| Therefore, stack gas density (GD) = | 1.28 $kg/m^3$ | ($0^oC$, wet, 1 atm pressure) | |
| Therefore, stack gas density (GD) = | 1.29 $kg/m^3$ | ($0^oC$, dry, 1 atm pressure) | |

# Emission Measurement Calculations Spreadsheet



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

Date: 23-Nov-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 : | 7:30 | Barometric Pressure : | | 1017 | hPa |
| Page No. : | 1 of 1 | Pitot Correction Factor : | | 0.84 | |
| Sampling Port No: | 1 to 2 | Stack Gas Density: | | 1.28 | $kg/m^3$ |
| Pitot Tube Type : | S | | | | (0 °C, Wet, 1 Atm) |

| Sampling Position No. | Distance from far wall (mm) | Max. Differential Pressure ΔP, kilo Pascals | Max Temp. °C | Max Temp. (Ts) K | Corrected Velocity (Vs) m/s |
|---|---|---|---|---|---|
| 1/1 | 3 | 0.005 | 20.0 | 293.2 | 2.4 |
| 1/2 | 81 | 0.005 | 20.0 | 293.2 | 2.4 |
| 1/3 | 195 | 0.005 | 20.0 | 293.2 | 2.4 |
| 1/4 | 505 | 0.005 | 20.0 | 293.2 | 2.4 |
| 1/5 | 619 | 0.005 | 20.0 | 293.2 | 2.4 |
| 1/6 | 697 | 0.005 | 20.0 | 293.2 | 2.4 |
| | | | | | |
| 2/1 | 3 | 0.005 | 20.0 | 293.2 | 2.4 |
| 2/2 | 81 | 0.005 | 20.0 | 293.2 | 2.4 |
| 2/3 | 195 | 0.005 | 20.0 | 293.2 | 2.4 |
| 2/4 | 505 | 0.005 | 20.0 | 293.2 | 2.4 |
| 2/5 | 619 | 0.005 | 20.0 | 293.2 | 2.4 |
| 2/6 | 697 | 0.005 | 20.0 | 293.2 | 2.4 |
| Average | | | 20.0 | 293.2 | 2.4 |

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 0.5 mm
Absolute pressure in stack (hPa) : 1017.05 hPa

# Emission Measurement Calculations Spreadsheet



**STACK ANALYSIS**

**SAMPLING OF FINE PARTICULATE (PM10)**

Date: 23-Nov-17
Client: OneSteel Hexham
AECOM's Project No: 60493017
Stack Description No.: Shredder Stack
Sample Nozzle No.: fine10
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 5.81 x $10^{-5}m^2$
Thimble No: T368
Blank thimble No: 0

**Leak Check (Pre-Sampling)**
Meter start: 258.9824 Meter finish: 258.9824
Time start: 6:53 Time finish: 6:54

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

**Leak Check (Post Sampling)**
Meter start: 260.2437 Meter finish: 260.2437
Time start: 9:08 Time finish: 9:09

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

**Sampling Record Table**

Barometric Pressure: 1017 hPa (start); 1017 hPa (finish)
Meter start: 258.9846 Time start: 7:36
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 | 0:07:30 | 33 | 13.6 | 26.0 | 21.0 | | Yes |
| 1/2 | 0:07:30 | 111 | 13.6 | 28.0 | 21.0 | | Yes |
| 1/3 | 0:07:45 | 225 | 13.6 | 30.0 | 22.0 | | Yes |
| 1/4 | 0:07:30 | 535 | 13.6 | 31.0 | 22.0 | | Yes |
| 1/5 | 0:07:45 | 649 | 13.6 | 32.0 | 23.0 | | Yes |
| 1/6 | 0:07:30 | 727 | 13.6 | 32.0 | 24.0 | | Yes |
| | | | | | | | |
| 2/1 | 0:07:30 | 33 | 13.6 | 33.0 | 24.0 | | Yes |
| 2/2 | 0:07:45 | 111 | 13.6 | 33.0 | 24.0 | | Yes |
| 2/3 | 0:07:30 | 225 | 13.6 | 33.0 | 25.0 | | Yes |
| 2/4 | 0:07:45 | 535 | 13.6 | 34.0 | 25.0 | | Yes |
| 2/5 | 0:07:30 | 649 | 13.6 | 34.0 | 25.0 | | Yes |
| 2/6 | 0:07:30 | 727 | 13.6 | 35.0 | 25.0 | | Yes |
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| | | | | | | | |
| Averages | | | | 31.8 | 23.4 | no result | |

Meter Finish: 260.2422 Time Finish: 9:07
Total Condensate collected: 9 ml Silica gel No(s) used: F26

# Emission Measurement Calculations Spreadsheet

## STACK ANALYSIS

## SAMPLING OF TOTAL PARTICULATE

Date: 23-Nov-17
Client: OneSteel Hexham
AECOM's Project No: 60493017
Stack Description No.: Shredder Stack
Sample Nozzle No.: S6
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 9.16 x $10^{-5}m^2$
Thimble No: T523
Blank thimble No:

**Leak Check (Pre-Sampling)**
Meter start: 390.1460 Meter finish: 390.1460
Time start: 6:55 Time finish: 6:56

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

**Leak Check (Post Sampling)**
Meter start: 391.3726 Meter finish: 391.3726
Time start: 9:10 Time finish: 9:11

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

**Sampling Record Table**

Barometric Pressure: 1017 hPa (start); 1017 hPa (finish)
Meter start: 390.1476 Time start: 7:36
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 | 0:07:36 | 33 | 13.2 | 24.0 | 20.0 | | Yes |
| 1/2 | 0:15:12 | 111 | 13.2 | 26.0 | 21.0 | | Yes |
| 1/3 | 0:22:48 | 225 | 13.2 | 27.0 | 21.0 | | Yes |
| 1/4 | 0:30:24 | 535 | 13.2 | 28.0 | 22.0 | | Yes |
| 1/5 | 0:38:00 | 649 | 13.2 | 29.0 | 22.0 | | Yes |
| 1/6 | 0:45:36 | 727 | 13.2 | 30.0 | 22.0 | | Yes |
| | | | | | | | |
| 2/1 | 0:53:12 | 33 | 13.2 | 30.0 | 23.0 | | Yes |
| 2/2 | 1:00:48 | 111 | 13.2 | 30.0 | 23.0 | | Yes |
| 2/3 | 1:08:24 | 225 | 13.2 | 30.0 | 24.0 | | Yes |
| 2/4 | 1:16:00 | 535 | 13.2 | 31.0 | 24.0 | | Yes |
| 2/5 | 1:23:36 | 649 | 13.2 | 31.0 | 24.0 | | Yes |
| 2/6 | 1:31:12 | 727 | 13.2 | 31.0 | 25.0 | | Yes |
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| Averages | | | | 28.9 | 22.6 | no result | |

Meter Finish: 391.3701 Time Finish: 9:07
Total Condensate collected: 4 ml Silica gel No(s) used: 135

# Emission Measurement Calculations Spreadsheet



**STACK ANALYSIS**

**SAMPLING OF HAZARDOUS SUBSTANCES (METALS)**

Date: 23-Nov-17
Client: OneSteel Hexham
AECOM's Project No: 60493017
Stack Description No.: Shredder Stack
Sample Nozzle No.: G53
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 9.5 x $10^{-5}m^2$
Thimble No: 0
Blank thimble No:

**Leak Check (Pre-Sampling)**
Meter start: 550.2776 Meter finish: 550.2776
Time start: 6:57 Time finish: 6:58

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

**Leak Check (Post Sampling)**
Meter start: 551.5530 Meter finish: 551.5530
Time start: 9:12 Time finish: 9:13

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

**Sampling Record Table**

Barometric Pressure: 1017 hPa (start); 1017 hPa (finish)
Meter start: 550.2790 Time start: 7:36
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 | 0:07:36 | 33 | 13.9 | 27.0 | 21.0 | | Yes |
| 1/2 | 0:15:12 | 111 | 13.9 | 29.0 | 22.0 | | Yes |
| 1/3 | 0:22:48 | 225 | 13.9 | 32.0 | 22.0 | | Yes |
| 1/4 | 0:30:24 | 535 | 13.9 | 34.0 | 23.0 | | Yes |
| 1/5 | 0:38:00 | 649 | 13.9 | 36.0 | 23.0 | | Yes |
| 1/6 | 0:45:36 | 727 | 13.9 | 35.0 | 24.0 | | Yes |
| | | | | | | | |
| 2/1 | 0:53:12 | 33 | 13.9 | 34.0 | 24.0 | | Yes |
| 2/2 | 1:00:48 | 111 | 13.9 | 33.0 | 25.0 | | Yes |
| 2/3 | 1:08:24 | 225 | 13.9 | 33.0 | 25.0 | | Yes |
| 2/4 | 1:16:00 | 535 | 13.9 | 32.0 | 26.0 | | Yes |
| 2/5 | 1:23:36 | 649 | 13.9 | 32.0 | 26.0 | | Yes |
| 2/6 | 1:31:12 | 727 | 13.9 | 32.0 | 26.0 | | Yes |
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| Averages | | | | 32.4 | 23.9 | no result | |

Meter Finish: 551.5510 Time Finish: 9:07
Total Condensate collected: 8 ml Silica gel No(s) used: DT10

# Emission Measurement Calculations Spreadsheet



## Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 23-Nov-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 : | 9:15 | Barometric Pressure : | | 1017 | hPa |
| Page No. : | 1 of 1 | Pitot Correction Factor : | | 0.84 | |
| Sampling Port No: | 1 to 2 | Stack Gas Density: | | 1.28 | $kg/m^3$ (0 °C, Wet, 1 Atm) |
| Pitot Tube Type : | S | | | | |

| 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 | 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 |
| | | | | | |
| 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): kPa
Static Pressure (U-tube, if required) : 0.5 mm
Absolute pressure in stack (hPa) : 1017.05 hPa

### Stack Analysis - Hazardous Substances Elemental Analysis Results

Date: 23-Nov-17 Client: OneSteel Hexham
AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

| | Particulate Metals Results | Gaseous Metals Results | Oixdisable 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)** | $KMnO_4$/ $H_2SO_4$ + Rinses (mg) **(5B)** | Residue Rinse 8N HCl (mg) (If Required) **(5C)** |
| Antimony | <0.0002 | <0.0002 | | | |
| Arsenic | <0.0002 | <0.0002 | | | |
| Beryllium | <0.0002 | <0.0002 | | | |
| Cadmium | 0.0015 | 0.00029 | | | |
| Chromium | <0.001 | 0.00019 | | | |
| Cobalt | <0.0002 | <0.0002 | | | |
| Copper | <0.0012 | 0.00029 | | | |
| Lead | 0.0002 | <0.0002 | | | |
| Magnesium | <0.058 | <0.0002 | | | |
| Manganese | <0.0018 | <0.0094 | | | |
| Mercury | <0.0002 | <0.0002 | <0.0001 | <0.0001 | <0.0001 |
| Nickel | <0.0002 | <0.0002 | | | |
| Selenium | 0.0005 | <0.0013 | | | |
| Thallium | <0.0002 | <0.0002 | | | |
| Tin | <0.0004 | 0.000087 | | | |
| Vanadium | <0.0053 | <0.0042 | | | |
| Zinc | <1.401 | <0.001 | | | |

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: 23-Nov-17 Client: OneSteel Hexham
AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

| Sample | Total Particulate Metals (mg) | Total Particulate Metals ($mg/m^3$) | Total Gaseous Metals (mg) | Total Gaseous Metals ($mg/m^3$) | Total Oxidisable Mercury (mg) | Total Oxidisable Mercury ($mg/m^3$) | Total (mg) | Total ($mg/m^3$) | Mass Emission Rate (mg/s) |
|---|---|---|---|---|---|---|---|---|---|
| Antimony | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Arsenic | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Beryllium | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Cadmium | 0.0015 | 0.0013 | 0.00029 | 0.00025 | | | 0.002 | 0.0017 | 0.0017 |
| Chromium | <0.001 | <0.00086 | 0.00019 | 0.00016 | | | 0.00019 | 0.00016 | 0.00016 |
| Cobalt | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Copper | <0.0012 | <0.001 | 0.00029 | 0.00025 | | | 0.00029 | 0.00025 | 0.00025 |
| Lead | 0.0002 | 0.00017 | <0.0002 | <0.00017 | | | 0.0002 | 0.00017 | 0.00017 |
| Magnesium | <0.058 | <0.05 | <0.0002 | <0.00017 | | | <0.002 | <0.0017 | <0.0017 |
| Manganese | <0.0018 | <0.0015 | <0.0094 | <0.008 | | | <0.0002 | <0.00017 | <0.00017 |
| Mercury | <0.0002 | <0.00017 | <0.0002 | <0.00017 | <0.0001 | <0.000086 | <0.0002 | <0.00017 | <0.00017 |
| Nickel | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Selenium | 0.0005 | 0.00043 | <0.0013 | <0.0011 | | | 0.0005 | 0.00043 | 0.00042 |
| Thallium | <0.0002 | <0.00017 | <0.0002 | <0.00017 | | | <0.0002 | <0.00017 | <0.00017 |
| Tin | <0.0004 | <0.00034 | 0.000087 | 0.000074 | | | 0.000087 | 0.000074 | 0.000073 |
| Vanadium | <0.0053 | <0.0045 | <0.0042 | <0.0036 | | | <0.0002 | <0.00017 | <0.00017 |
| Zinc | <1.401 | <1.2 | <0.001 | <0.00086 | | | <0.0002 | <0.00017 | <0.00017 |
| Total Hazardous Metals* | 0.0022 | 0.0019 | 0.00048 | 0.00041 | <0.0001 | <0.000086 | 0.0030 | 0.0026 | 0.0026 |
| Total Metals | 0.0022 | 0.0019 | 0.00086 | 0.00073 | | | 0.0033 | 0.0028 | 0.0028 |

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

# 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: 23-Nov-17 Client: OneSteel Hexham

AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume ($MV_3$): 1.2702 $m^3$

Average gas meter temp. ($T_{M,2}$): 27.6 °C

300.8 K

Average barometric pressure ($P_{BARO}$) 1017 hPa

Average pressure at meter ($P_{M,2}$) 1017.00 hPa

Sample gas volume ($MV_4$); (0°C, dry gas, 1 atm pressure): 1.1579 $m^3$

(B) PM10 concentration at standard conditions

Blank thimble No.: 0

Thimble No. used: T368

Blank weight: g

PM10 Weight 0.0003 g

Final PM10 Weight (Mp1): 0.00030 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ 0.00026 $g/m^3$ (0°C, dry gas, 1atm pressure)

;and $C_2$ = 0.26 $mg/m^3$ (0°C, dry gas, 1atm pressure)

$CO_2$ Basis 12 %

Average $CO_2$%: 0.0 %

Therefore, $C_c$: $= C_a \times 12/CO_2\% =$ 0.00026 $g/m^3$ (0°C, dry gas, 1atm pressure, 12% $CO_2$)

;and $C_{c1}$ = 0.26 $mg/m^3$ (0°C, dry gas, 1atm pressure, 12% $CO_2$)

$O_2$ Basis 7 %

Average $O_2$%: 20.9 %

Therefore, $C_b$: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.036 $g/m^3$ (0°C, dry gas, 1atm pressure, 7% $O_2$)

;and $C_{b1}$ = 36 $mg/m^3$ (0°C, dry gas, 1atm pressure, 7% $O_2$)

(C) Moisture content

Silica Gel Number: F26

$V_y$ = 10.7 g (from laboratory report) $V_w$ = g mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0120

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0143

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

$B_{ws}$ = 2.22 %

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# 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): 1.30 $kg/m^3$ (0°C, wet, 1 atm pressure)
1.29 $kg/m^3$ (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions = $(ii) \times \frac{(273.2)}{(273.2+Ts)} \times \frac{(Ps)}{(1013.25)}$

= 1.210 $kg/m^3$ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 2.40 m/s

(ii) Average of post-sampling velocities: 2.40 m/s

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

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

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

Qstack = Vs x A = 1.09 $m^3/s$ (stack conditions)

$$Qstd = Qstack \times \frac{Ps}{(Pstd)} \times \frac{(Tstd)}{(Ts)} \times \frac{(100 - B_w)}{100}$$

Qstd = 1.0 $m^3/s$ (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm = $C_{1a}$ x Qstd = 0.00026 g/s (0°C, dry gas, 1 atm pressure )
= 0.26 mg/s (0°C, dry gas, 1 atm pressure )

# Emission Measurement Calculations Spreadsheet



## STACK ANALYSIS - FINAL CALCULATIONS

**Total Particulate**

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

Date: 23-Nov-17 Client: OneSteel Hexham

AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

Metered volume ($MV_3$): 1.2225 $m^3$

Average gas meter temp. ($T_{M,2}$): 25.8 °C

299.0 K

Average barometric pressure ($P_{BARO}$) 1017 hPa

Average pressure at meter ($P_{M,2}$) 1017.00 hPa

Sample gas volume ($MV_4$); (0°C, dry gas, 1 atm pressure): 1.1211 $m^3$

(B) Total Particulate concentration at standard conditions

Blank thimble No.: Blank weight: g

Thimble No. used: T523 Total Particulate Weight 0.0007 g

Final Total Particulate Weight (Mp1): 0.00070 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.00062 $g/m^3$ (0°C, dry gas, 1atm pressure)

;and $C_2$ = 0.62 $mg/m^3$ (0°C, dry gas, 1atm pressure)

$CO_2$ Basis 12 %

Average $CO_2$%: 0.0 %

Therefore, $C_c$: $= C_a \times 12/CO_2\% =$ 0.00062 $g/m^3$ (0°C, dry gas, 1atm pressure, 12% $CO_2$)

;and $C_{c1}$ = 0.62 $mg/m^3$ (0°C, dry gas, 1atm pressure, 12% $CO_2$)

$O_2$ Basis 7 %

Average $O_2$%: 20.9 %

Therefore, $C_b$: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.087 $g/m^3$ (0°C, dry gas, 1atm pressure, 7% $O_2$)

;and $C_{b1}$ = 87 $mg/m^3$ (0°C, dry gas, 1atm pressure, 7% $O_2$)

(C) Moisture content

Silica Gel Number: 135

$V_v$ = 16.2 g (from laboratory report) $V_w$ = 4 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0053

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0216

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

$B_{ws}$ = 2.35 %

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# 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): 1.30 $kg/m^3$ ($0^oC$, wet, 1 atm pressure)
1.29 $kg/m^3$ ($0^oC$, dry, 1 atm pressure)

(iii) Gas density at stack conditions = (ii) x $\frac{(273.2)}{(273.2+Ts)}$ x $\frac{(Ps)}{(1013.25)}$

= 1.210 $kg/m^3$ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 2.40 m/s

(ii) Average of post-sampling velocities: 2.40 m/s

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

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

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

Qstack = Vs x A = 1.09 $m^3/s$ (stack conditions)

$$Qstd = Qstack \times \frac{Ps}{(Pstd)} \times \frac{(Tstd)}{(Ts)} \times \frac{(100 - B_w)}{100}$$

Qstd = 1.0 $m^3/s$ ($0^oC$, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm = $C_{1a}$ x Qstd = 0.00061 g/s ($0^oC$, dry gas, 1 atm pressure )
= 0.61 mg/s ($0^oC$, dry gas, 1 atm pressure )

## STACK ANALYSIS - FINAL CALCULATIONS

**Hazardous Substances (Metals)**

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

Date: 23-Nov-17 Client: OneSteel Hexham

AECOM's Project No: 60493017 Stack/Duct Description: Shredder Stack

(A) Sample gas volume at standard conditions

| | | | | |
|---|---|---|---|---|
| Metered volume ($MV_3$): | 1.2847 | $m^3$ | Average barometric pressure ($P_{BARO}$) | 1017 hPa |
| Average gas meter temp. ($T_{M,2}$): | 28.2 | °C | | |
| | 301.4 | K | Average pressure at meter ($P_{M,2}$) | 1017.00 hPa |
| Sample gas volume ($MV_4$); (0°C, dry gas, 1 atm pressure): | 1.1688 | $m^3$ | | |

(B) Metals concentration at standard conditions

Blank thimble No.: Blank weight: g

Thimble No. used: 0 Metals Weight 0.000003 g

Final Metals Weight (Mp1): 0.00000 g

Metals Concentration (C1): $=M_{p1}/MV_4=$ 2.6E-06 $g/m^3$ (0°C, dry gas, 1atm pressure)

;and $C_2$ = 0.0026 $mg/m^3$ (0°C, dry gas, 1atm pressure)

$CO_2$ Basis 12 %

Average $CO_2$%: 0.0 %

Therefore, $C_c$: $= C_a \times 12/CO_2\% =$ 0.0000026 $g/m^3$ (0°C, dry gas, 1atm pressure, 12% $CO_2$)

;and $C_{c1}$ = 0.0026 $mg/m^3$ (0°C, dry gas, 1atm pressure, 12% $CO_2$)

$O_2$ Basis 7 %

Average $O_2$%: 20.9 %

Therefore, $C_b$: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.00036 $g/m^3$ (0°C, dry gas, 1atm pressure, 7% $O_2$)

;and $C_{b1}$ = 0.36 $mg/m^3$ (0°C, dry gas, 1atm pressure, 7% $O_2$)

(C) Moisture content

Silica Gel Number: DT10

$V_v$ = 15.5 g (from laboratory report) $V_w$ = 8 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0107

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0207

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

$B_{ws}$ = 2.61 %

## 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): 1.30 $kg/m^3$ ($0^oC$, wet, 1 atm pressure)
1.29 $kg/m^3$ ($0^oC$, dry, 1 atm pressure)

(iii) Gas density at stack conditions = (ii) x $\frac{(273.2)}{(273.2+Ts)}$ x $\frac{(Ps)}{(1013.25)}$

= 1.210 $kg/m^3$ (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 2.40 m/s

(ii) Average of post-sampling velocities: 2.40 m/s

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

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

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

Qstack = Vs x A = 1.09 $m^3/s$ (stack conditions)

$$Qstd = Qstack \times \frac{Ps}{(Pstd)} \times \frac{(Tstd)}{(Ts)} \times \frac{(100 - B_w)}{100}$$

Qstd = 1.0 $m^3/s$ ($0^oC$, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm = $C_{1a}$ x Qstd = 0.0000026 g/s ($0^oC$, dry gas, 1 atm pressure )
= 0.0026 mg/s ($0^oC$, dry gas, 1 atm pressure )

ANZ

# Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

**EMISSION MONITORING RESULTS, SHREDDER STACK**
**ONESTEEL HEXHAM**
23-Nov-17
FINE PARTICULATE (PM10)
TOTAL PARTICULATE
HAZARDOUS SUBSTANCES (METALS)

| | | | |
|---|---|---|---|
| **Sampling Conditions:** | | | |
| Stack internal diameter at test location | 760 mm | | |
| Stack gas temperature (average) | 21.5 °C | | 294.7 K |
| Stack pressure (average) | 1017 hPa | | |
| Stack gas velocity (average, stack conditions) | 2.4 m/s | | |
| Stack gas flowrate (stack conditions) | 1.1 $m^3/s$ | | |
| Stack gas flowrate ($0^0$C, dry gas, 1 atm pressure) | 0.99 $m^3/s$ | | |
| **Fine Particulate (PM10) Testing** | | | |
| Test Period | 7:36 | - | 9:07 |
| Fine Particulate (PM10) Mass | 0.3 mg | | |
| Gas Volume Sampled | 1.2 $m^3$ | | |
| Fine Particulate (PM10) Emission*1 | 0.26 $mg/m^3$ | | |
| Fine Particulate (PM10) Mass Emission Rate*2 | 0.26 mg/s | | |
| Regulatory Limit | NA | | |
| **Total Particulate Testing** | | | |
| Test Period | 7:36 | - | 9:07 |
| Total Particulate Mass | 0.7 mg | | |
| Gas Volume Sampled | 1.1 $m^3$ | | |
| Total Particulate Emission*1 | 0.62 $mg/m^3$ | | |
| Total Particulate Mass Emission Rate*2 | 0.61 mg/s | | |
| Regulatory Limit | 100 $mg/m^3$ | | |
| **Hazardous Substances (Metals) Testing** | | | |
| Test Period | 7:36 | - | 9:07 |
| Hazardous Substances (Metals) Mass | 0.0030 mg | | |
| Gas Volume Sampled | 1.2 $m^3$ | | |
| Hazardous Substances (Metals) Emission*1 | 0.0026 $mg/m^3$ | | |
| Hazardous Substances (Metals) Mass Emission Rate*2 | 0.0026 mg/s | | |
| Regulatory Limit | NA | | |
| **Moisture Content (%)** | 2.5 | | |
| **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 $0^0$C, 1 atm, dry gas

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

# Appendix B

Laboratory Results
(8 pages)

# Appendix B Laboratory Results (8 pages)

Steel River Testing

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

# STACK EMISSION - PARTICULATES REPORT

**Origin:** AECOM - Newcastle
**Project:** **60493017**

**Report :** 14892-0-P



**Description :** Stack Emission Samples
Received: 30-Nov-17

**Date :** 05-Dec-17

**Report To :** James Lang
17 Warabrook Blvd, Warabrook NSW 2304

**Copy to:** FILE

| Thimble ID | | Volume (mL) | Total Particulate Matter (g) |
|---|---|---|---|
| T368 | Filter | - | 0.0003 |
| T523 | Filter | - | 0.0007 |

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

*Note : Sampled by Client*

**Reported By:** M Campbell
Michael Campbell

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

Steel River Testing

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

# STACK EMISSION - MOISTURE REPORT

**Origin:** AECOM - Newcastle
**Project:** **60493017**

**Report :** 14892-0-M



**Description :** Stack Emission Samples
Received: 30-Nov-17

**Date :** 05-Dec-17

**Report To :** James Lang
17 Warabrook Blvd, Warabrook NSW 2304

**Copy to:** FILE

| Jar ID | Moisture (g) |
|---|---|
| 135 | 16.2 |
| DT10 | 15.5 |
| F26 | 10.7 |



**Reported By:** M. Campbell
Michael Campbell

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

# ANALYTICAL REPORT

Accreditation No. 2562

| CLIENT DETAILS | | LABORATORY DETAILS | |
|---|---|---|---|
| Contact | Cye Buckland | Manager | Adam Atkinson |
| Client | AECOM Australia Pty Ltd | Laboratory | SGS Melbourne EH&S |
| Address | 17 Warabrook Boulevard<br>Warabrook<br>SYDNEY NSW 2304 | Address | 10/585 Blackburn Road<br>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 | **60493017-2.1** | SGS Reference | **ME304956 R0** |
| Order Number | **60493017-2.1** | Date Received | 24 Nov 2017 |
| Samples | 12 | Date Reported | 05 Dec 201- |

COMMENTS

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

SIGNATORIES

MING

Weiming Dai
Inorganic Supervisor

MING

Weiming Dai
Senior Chemist

| Parameter | Units | LOR | Sample Number<br>Sample Matrix<br>Sample Name<br>ME304956.001<br>Filter<br>Flakt 1 Metals 1 | ME304956.002<br>Filter<br>Metals 12 | ME304956.003<br>Impinger<br>Solution<br>Flakt 1 Metals 3 | ME304956.004<br>Impinger<br>Solution<br>Flakt 1 Metals 4 |
|---|---|---|---|---|---|---|
| **Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 4/12/2017** | | | | | | |
| 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 | 1.6 | <0.2 | - | - |
| Cr | µg total | 0.2 | 0.8 | 1.0 | - | - |
| Co | µg total | 0.2 | <0.2 | <0.2 | - | - |
| Cu | µg total | 0.2 | 1.1 | 1.0 | - | - |
| Pb | µg total | 0.2 | 0.4 | 0.2 | - | - |
| Mg | µg total | 2 | 41 | 58 | - | - |
| Mn | µg total | 0.2 | 0.8 | 1.0 | - | - |
| Hg | µg total | 0.2 | <0.2 | <0.2 | - | - |
| Ni | µg total | 0.2 | <0.2 | 0.2 | - | - |
| Se | µg total | 0.2 | 0.3 | <0.2 | - | - |
| Tl | µg total | 0.2 | <0.2 | <0.2 | - | - |
| Sn | µg total | 0.2 | 0.3 | 0.4 | - | - |
| V | µg total | 0.2 | 2.0 | 2.9 | - | - |
| Zn | µg total | 0.2 | 1000 | 1400 | - | - |
| **Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 4/12/2017** | | | | | | |
| Sb | µg total | 0.1 | - | - | <0.1 | <0.1 |
| As | µg total | 0.1 | - | - | <0.1 | <0.1 |
| Be | µg total | 0.1 | - | - | <0.1 | <0.1 |
| Cd | µg total | 0.1 | - | - | <0.1 | 0.4 |
| Cr | µg total | 0.1 | - | - | <0.1 | 0.3 |
| Co | µg total | 0.1 | - | - | <0.1 | <0.1 |
| Cu | µg total | 0.1 | - | - | <0.1 | 0.5 |
| Pb | µg total | 0.1 | - | - | <0.1 | <0.1 |
| Mg | µg total | 0.1 | - | - | <0.1 | <0.1 |
| Mn | µg total | 0.1 | - | - | <0.1 | 3.5 |
| Hg | µg total | 0.1 | - | - | <0.1 | <0.1 |
| Ni | µg total | 0.1 | - | - | <0.1 | 0.1 |
| Se | µg total | 0.1 | - | - | 0.6 | 0.7 |
| Tl | µg total | 0.1 | - | - | <0.1 | <0.1 |
| Sn | µg total | 0.1 | - | - | <0.1 | 9.9 |
| V | µg total | 0.1 | - | - | 0.7 | 2.6 |
| Zn | µg total | 0.1 | - | - | <0.1 | <0.1 |
| Sample Volume* | mL | - | - | - | 94 | 320 |

| Parameter | Units | LOR | Sample Number<br>Sample Matrix<br>Sample Name<br>ME304956.005<br>Impinger<br>Solution<br>Metals 8A | ME304956.006<br>Impinger<br>Solution<br>Metals 9 | ME304956.007<br>Impinger<br>Solution<br>Flakt 1 Metals 5A | ME304956.008<br>Impinger<br>Solution<br>Flakt 1 Metals 5C |
|---|---|---|---|---|---|---|
| **Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 4/12/2017** | | | | | | |
| Sb | µg total | 0.2 | - | - | - | - |
| As | µg total | 0.2 | - | - | - | - |
| Be | µg total | 0.2 | - | - | - | - |
| Cd | µg total | 0.2 | - | - | - | - |
| Cr | µg total | 0.2 | - | - | - | - |
| Co | µg total | 0.2 | - | - | - | - |
| Cu | µg total | 0.2 | - | - | - | - |
| Pb | µg total | 0.2 | - | - | - | - |
| Mg | µg total | 2 | - | - | - | - |
| Mn | µg total | 0.2 | - | - | - | - |
| Hg | µg total | 0.2 | - | - | - | - |
| Ni | µg total | 0.2 | - | - | - | - |
| Se | µg total | 0.2 | - | - | - | - |
| Tl | µg total | 0.2 | - | - | - | - |
| Sn | µg total | 0.2 | - | - | - | - |
| V | µg total | 0.2 | - | - | - | - |
| Zn | µg total | 0.2 | - | - | - | - |
| **Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 1/12/2017** | | | | | | |
| Sb | µg total | 0.1 | <0.1 | <0.1 | - | - |
| As | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Be | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Cd | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Cr | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Co | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Cu | µg total | 0.1 | 0.2 | <0.1 | - | - |
| Pb | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Mg | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Mn | µg total | 0.1 | 0.8 | 8.6 | - | - |
| Hg | µg total | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Ni | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Se | µg total | 0.1 | 0.4 | 0.9 | - | - |
| Tl | µg total | 0.1 | <0.1 | <0.1 | - | - |
| Sn | µg total | 0.1 | <0.1 | 9.2 | - | - |
| V | µg total | 0.1 | 2.4 | 1.8 | - | - |
| Zn | µg total | 0.1 | 1.0 | <0.1 | - | - |
| Sample Volume* | mL | - | 310 | 200 | 100 | 250 |

| Parameter | Units | LOR | Sample Number<br>Sample Matrix<br>Sample Name<br>ME304956.009<br>Impinger<br>Solution<br>Metals 8B | ME304956.010<br>Impinger<br>Solution<br>Metals 11 | ME304956.011<br>KMnO4<br>Flakt 1 Metals 5B | ME304956.012<br>KMnO4<br>Metals 10 |
|---|---|---|---|---|---|---|
| **Metals in Filters M29 ETC MA-1400.FL.M29.02 USEPA M29 Method: EPA29_FILT Tested: 4/12/2017** | | | | | | |
| Sb | µg total | 0.2 | - | - | - | - |
| As | µg total | 0.2 | - | - | - | - |
| Be | µg total | 0.2 | - | - | - | - |
| Cd | µg total | 0.2 | - | - | - | - |
| Cr | µg total | 0.2 | - | - | - | - |
| Co | µg total | 0.2 | - | - | - | - |
| Cu | µg total | 0.2 | - | - | - | - |
| Pb | µg total | 0.2 | - | - | - | - |
| Mg | µg total | 2 | - | - | - | - |
| Mn | µg total | 0.2 | - | - | - | - |
| Hg | µg total | 0.2 | - | - | - | - |
| Ni | µg total | 0.2 | - | - | - | - |
| Se | µg total | 0.2 | - | - | - | - |
| Tl | µg total | 0.2 | - | - | - | - |
| Sn | µg total | 0.2 | - | - | - | - |
| V | µg total | 0.2 | - | - | - | - |
| Zn | µg total | 0.2 | - | - | - | - |
| **Metals in Impingers M29 ETC MA-1400.IMP.M29.06 (ug total) Method: EPA29_METIMP Tested: 1/12/2017** | | | | | | |
| Sb | µg total | 0.1 | - | - | - | - |
| As | µg total | 0.1 | - | - | - | - |
| Be | µg total | 0.1 | - | - | - | - |
| Cd | µg total | 0.1 | - | - | - | - |
| Cr | µg total | 0.1 | - | - | - | - |
| Co | µg total | 0.1 | - | - | - | - |
| Cu | µg total | 0.1 | - | - | - | - |
| Pb | µg total | 0.1 | - | - | - | - |
| Mg | µg total | 0.1 | - | - | - | - |
| Mn | µg total | 0.1 | - | - | - | - |
| Hg | µg total | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Ni | µg total | 0.1 | - | - | - | - |
| Se | µg total | 0.1 | - | - | - | - |
| Tl | µg total | 0.1 | - | - | - | - |
| Sn | µg total | 0.1 | - | - | - | - |
| V | µg total | 0.1 | - | - | - | - |
| Zn | µg total | 0.1 | - | - | - | - |
| Sample Volume* | mL | - | 98 | 250 | 400 | 100 |

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

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

| Parameter | QC Reference | Units | LOR | MB | LCS %Recovery |
|---|---|---|---|---|---|
| Sb | LB017281 | µg total | 0.2 | <0.2 | NA |
| As | LB017281 | µg total | 0.2 | <0.2 | NA |
| Be | LB017281 | µg total | 0.2 | <0.2 | NA |
| Cd | LB017281 | µg total | 0.2 | <0.2 | NA |
| Cr | LB017281 | µg total | 0.2 | <0.2 | NA |
| Co | LB017281 | µg total | 0.2 | <0.2 | NA |
| Cu | LB017281 | µg total | 0.2 | <0.2 | NA |
| Pb | LB017281 | µg total | 0.2 | <0.2 | NA |
| Mg | LB017281 | µg total | 2 | <2 | NA |
| Mn | LB017281 | µg total | 0.2 | <0.2 | NA |
| Hg | LB017281 | µg total | 0.2 | <0.2 | NA |
| Ni | LB017281 | µg total | 0.2 | <0.2 | NA |
| Se | LB017281 | µg total | 0.2 | <0.2 | NA |
| Tl | LB017281 | µg total | 0.2 | <0.2 | NA |
| Sn | LB017281 | µg total | 0.2 | <0.2 | NA |
| V | LB017281 | µg total | 0.2 | <0.2 | NA |
| Zn | LB017281 | µg total | 0.2 | <0.2 | NA |

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

| Parameter | QC Reference | Units | LOR | MB | LCS %Recovery |
|---|---|---|---|---|---|
| Sb | LB017303 | µg total | 0.1 | <0.1 | 102% |
| As | LB017303 | µg total | 0.1 | <0.1 | 102% |
| Be | LB017303 | µg total | 0.1 | <0.1 | 93% |
| Cd | LB017303 | µg total | 0.1 | <0.1 | 101% |
| Cr | LB017303 | µg total | 0.1 | <0.1 | 98% |
| Co | LB017303 | µg total | 0.1 | <0.1 | 96% |
| Cu | LB017303 | µg total | 0.1 | <0.1 | 100% |
| Pb | LB017303 | µg total | 0.1 | <0.1 | 107% |
| Mg | LB017303 | µg total | 0.1 | <0.1 | 95% |
| Mn | LB017303 | µg total | 0.1 | <0.1 | 100% |
| Hg | LB017303 | µg total | 0.1 | <0.1 | 100% |
| Ni | LB017303 | µg total | 0.1 | <0.1 | 98% |
| Se | LB017303 | µg total | 0.1 | <0.1 | 104% |
| Tl | LB017303 | µg total | 0.1 | <0.1 | 107% |
| Sn | LB017303 | µg total | 0.1 | <0.1 | 102% |
| V | LB017303 | µg total | 0.1 | <0.1 | 98% |
| Zn | LB017303 | µg total | 0.1 | <0.1 | 102% |
| Sample Volume* | LB017303 | mL | - | 1.0 | NA |

# METHOD SUMMARY

| 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.<br>. Filters are digested using the appropriate sample preparation methods.<br>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.<br>Prior to analysis. samples are be solubilised or digested using the appropriate sample preparation methods. |

## FOOTNOTES

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

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 calcuated by summing the individual analyte LORs and dividing by two. For example. where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg. the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed. the " Total" LOR will be the sum of those two LORs.

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

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

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

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

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

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

End of Report

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