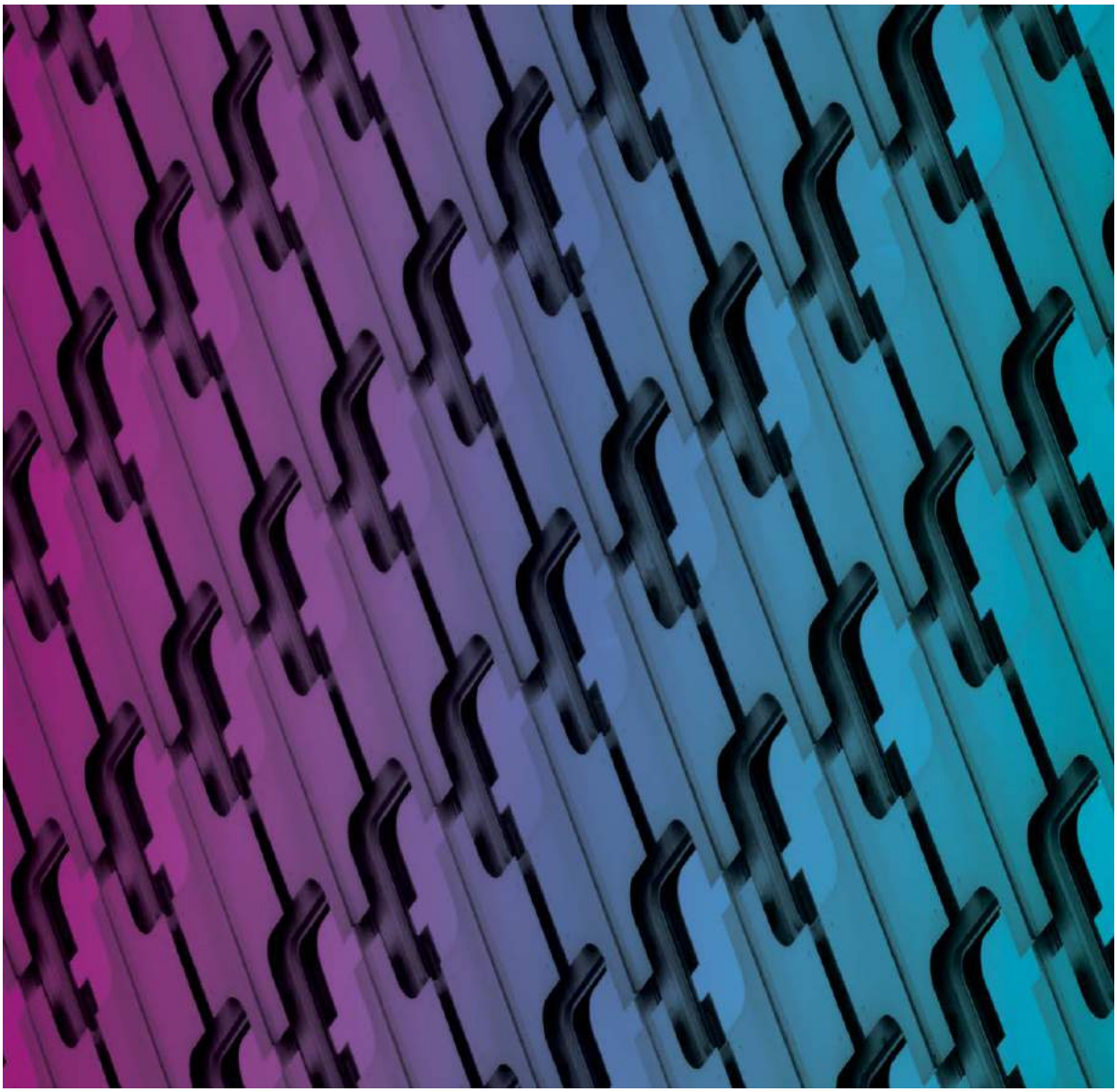
Annual Emissions Testing Report 2016



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

Annual Emissions Testing Report 2016

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1.0 Introduction

AECOM was appointed by Weston Aluminium Pty Ltd to conduct a series of measurements to determine air emissions from seven stacks located at their Weston plant in Kurri Kurri, NSW. Emission testing was a compliance requirement of Environmental Protection Licence (EPL) number 6423.

Testing was conducted over the period of June and August 2015 to determine emission concentrations for the following parameters:

Stack 1 (EPL Point 1)

- Total Particulate;
- Fine Particulate (PM_{10});
- Sulfuric Acid Mist (H_2SO_4 as SO_3);
- Sulfur Dioxide (SO_2 as SO_3);
- Chlorine;
- Hydrogen Chloride;
- Gaseous Fluoride;
- Particulate Fluoride;
- Hazardous Substances (Metals);
- Volatile Organic Compounds (VOC);
- Oxides of Nitrogen;
- Carbon Monoxide;
- Cyanide; and
- Polycyclic Aromatic Hydrocarbons (PAH).

Stacks 2, 3, and 4 (EPL Points 2, 3, and 4)

- Total Particulate;
- Fine Particulate (PM_{10}); and
- Hydrogen Fluoride.

Stack 5 (EPL Point 13)

- Total Particulate;
- Fine Particulate (PM_{10});
- Sulfuric Acid Mist (H_2SO_4 as SO_3);
- Sulfur Dioxide (SO_2 as SO_3);
- Chlorine;
- Hydrogen Chloride;
- Hydrogen Fluoride;
- Hazardous Substances (Metals);
- Dioxins and Furans;
- Polycyclic Aromatic Hydrocarbons (PAH);
- Volatile Organic Compounds (VOC);
- Oxides of Nitrogen;

- Oxygen; and
- Carbon Monoxide.

Stack 6 (EPL Point 14)

- Total Particulate;
- Fine Particulate (PM_{10});
- Hydrogen Fluoride;
- Sulfuric Acid Mist (H_2SO_4 as SO_3);
- Sulfur Dioxide (SO_2 as SO_3);
- Volatile Organic Compounds;
- Polycyclic Aromatic Hydrocarbons;
- Oxides of Nitrogen;
- Carbon Monoxide; and
- Oxygen (O_2).

Stack 7 (EPL Point 15)

- Total Particulate;
- Fine Particulate (PM_{10});
- Hydrogen Fluoride;
- Sulfuric Acid Mist (H_2SO_4 as SO_3);
- Sulfur Dioxide (SO_2 as SO_3);
- Polycyclic Aromatic Hydrocarbons (PAH) ;
- Volatile Organic Compounds (VOC); and
- Oxides of Nitrogen.

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

- Steel River Testing Pty. Ltd., NATA accreditation number 18079, performed the following analysis detailed in report number 11615-0-M, 11615-0-P, 11616-0-M, 11616-0-P, 11793-0-M, 11793-0-P, 000006601 and 000006602:
    - Moisture;
    - Particle Sizing (not NATA Accredited);
    - Fine Particulate (PM_{10}); and
    - Total Particulate.
- Australian Laboratory Services, NATA accreditation number 18079, performed the following analysis detailed in report number EN1602428, EN1602429, EN1602768 and EN1602848;
    - Fluoride;
    - Cyanide;
    - Sulfuric Acid Mist;
    - Sulfur Dioxide;
    - Hydrogen Chloride;
    - Chlorine; and
    - Volatile Organic Compounds.

- National Measurements Institute, NATA accreditation number 198, performed the following analysis detailed in report number ORG16_045A, ORG16_045B, ORG16_052 and DAU16_161;
    - Dioxins and Furans; and
    - Polycyclic Aromatic Hydrocarbons.
- Leeder Consulting, NATA accreditation number 14429, performed the following analysis detailed in report numbers M161449;
    - Hazardous Substances (Metals)

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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.

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

The sampling planes for Stacks 2, 3, 4, 5, 6 and 7 (EPA Identification No. 2, 3, 4, 13, 14 and 15 respectively) were in accordance with AS 4323.1 Section 4.1. Stack 1 (EPA Identification No. 1) did not satisfy the requirements of AS 4323.1 Section 4.1 with regard to the upstream and downstream distances from disturbances. To compensate for this, additional sampling points were added in accordance with AS 4323.1 Section 4.2.

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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 No. 2778 (14391), and are approved for the sampling and analysis of gases and aerosols. 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	Parameter measured
NSW EPA TM-1 (AS 4323.1-1995)	USEPA (2000) Method 1 under approved circumstances	Selection of sampling positions
NSW EPA TM-2	USEPA (2000) Method 2 or 2C or USEPA (1999) Method 2F or 2G or 2H (as appropriate)	Velocity or volumetric flow rate or temperature or pressure of stack gases
NSW EPA TM-3	USEPA (2000) Method 8 (for sampling and analysis) or APHA (1998) Method 4110B (for analysis only if interference from fluorides, free ammonia and/or dimethyl aniline has been demonstrated to the satisfaction of the Chief Scientist) (as appropriate)	Sulfuric acid mist (H_2SO_4) or sulphur trioxide (SO_3)
NSW EPA TM-4	USEPA (2000) Method 6 or 6A or 6B or USEPA (1996) Method 6C or ISO (1989) Method 7934 or ISO (1992) Method 7935 or ISO (1993) Method 10396 or ISO (1998) Method 11632 (as appropriate)	Sulfur dioxide (SO_2)
NSW EPA TM-7	USEPA (2000) 26A	Chlorine (Cl_2)
NSW EPA TM-8	USEPA (2000) 26A	Hydrogen chloride (HCl)
NSW EPA TM-9	USEPA (2000) Method 13A or 13B (as appropriate)	Fluorine (F_2) or any compound containing fluorine, except where emitted by a primary aluminium smelter while manufacturing aluminium from alumina
NSW EPA TM-12	USEPA (2000) Method 29 or USEPA (2000) Method 102 (for mercury only in hydrogen rich streams) (as appropriate)	Type 1 substances (elements antimony (Sb), arsenic (As), cadmium (Cd), lead (Pb) or mercury (Hg) or any compound containing one or more of those elements)
NSW EPA TM-13	USEPA (2000) Method 29 (Analysis for tin and vanadium to be done by Inductively Coupled Argon Plasma Emission Spectroscopy (ICAP) as defined in USEPA Method 29) or USEPA (1986) Method 7910 (for vanadium only) or USEPA (1986) Method 7911 (for vanadium only) (as appropriate)	Type 2 substances (elements beryllium (Be), chromium (Cr), cobalt (Co), manganese (Mn), nickel (Ni), selenium (Se), tin (Sn) or vanadium (V) or any compound containing one or more of those elements)
NSW EPA TM-14	Cadmium (Cd) or mercury (Hg) or any compound containing one or more of those elements	USEPA (2000) Method 29 or USEPA (2000) Method 102 (for mercury only in hydrogen rich streams) (as appropriate)
NSW EPA TM-15 (AS 4323.2-1995)	USEPA (2000) Method 5 under approved circumstances	Solid particles (Total)

NSW EPA Approved Methods	USEPA Methods	Parameter measured
NSW EPA TM-22	USEPA (2000) Method 4	Moisture content in stack gases
NSW EPA TM-23	USEPA (2000) Method 3	Dry gas density or molecular weight of stack gases
NSW EPA TM-34	USEPA (2000) Method 18 or USEPA (2000) Method 25 or 25A or 25B or 25C or 25D or 25E (as appropriate)	Volatile organic compounds
NSW EPA OM-5	USEPA (1997) Method 201 or 201A (as appropriate)	'Fine' particulates (PM_{10})
NSW EPA OM-6	California EPA Air Resources Board (1997) Method 429	Polycyclic aromatic hydrocarbons (PAHs)
NSW EPA TM-18	USEPA (1995) Method 23	Dioxins and furans
NSW EPA TM-32	USEPA Method 10	Determination of Carbon Monoxide emissions from stationary sources
NSW EPA TM-25	USEPA Method 3A	Determination of Oxygen concentrations from stationary sources
NSW EPA TM-11	USEPA(2000) Method 7C	Determination of Nitrogen dioxide or nitric oxide emissions from stationary sources

3.2 Deviations from NATA Accredited Methods

The following method is not accredited with the National Association of Testing Authorities (NATA), Accreditation No. 2778 (14391). Specific details of the methods are available on request.

All sampling and analysis is conducted according to the method in **Table 3**.

Table 3 NATA Method Deviations

USEPA Methods	Parameter Measured
USEPA (2011) Other Test Method 29	Sampling and analysis for Hydrogen Cyanide emissions from stationary sources

4.0 Sampling Location

4.1 Sampling Location Summary

Table 4 provides a summary of the location sampled by AECOM during June, July and August 2016 at the Weston Aluminium plant in Kurri Kurri, NSW.

Table 4 Sampling Location Summary

Discharge Description	Stack 1 (EPA Identification No. 1)	Stack 2 (EPA Identification No. 2)	Stack 3 (EPA Identification No. 3)	Stack 4 (EPA Identification No. 4)	Stack 5 (EPA Identification No. 13)	Stack 6 (EPA Identification No. 14)	Stack 7 (EPA Identification No. 15)
Duct Shape	Circular	Circular	Circular	Circular	Circular	Circular	Circular
Construction Material	Metal	Metal	Metal	Metal	Metal	Metal	Metal
Duct Diameter (mm)	1650	1265	1000	1395	1490	580	1500
Minimum No. Sampling Points	16	12	12	12	12	8	12
Sampling Ports	2	2	2	2	2	2	2
Min. Points/Traverse	8	6	6	6	6	4	6
Disturbance	Yes	No	No	No	No	No	No
Distance from Upstream Disturbance	2D	6D	6D	6D	7D	9D	7D
Type of Disturbance	Fan entry	Fan entry	Fan entry	Fan entry	Fan entry	Bend	Fans
Distance from Downstream Disturbance	4D	6D	7D	4D	7D	5D	2D
Type of Disturbance	Stack Exit	Stack exit	Stack exit	Stack exit	Stack exit	Stack exit	Stack exit
Ideal Sampling Location	No	Yes	Yes	Yes	Yes	Yes	Yes
Correction Factors Applied	Yes	No	No	No	No	No	No
Total No. Points Sampled	20	12	12	12	12	8	12
Points/Traverse	10	6	6	6	6	4	6
Sampling Performed to Standard*	Yes[2]	Yes[1]	Yes[1]	Yes[1]	Yes[1]	Yes[1]	Yes[1]

*AS 4323.1 Stationary source emissions Method 1 – Selection of sampling positions

[1] AS 4323.1 Section 4.1

[2] AS 4323.1 Section 4.2

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5.0 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.

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6.0 Results

A summary of test results for the 2016 annual testing is presented in **Tables 5 & 6**. Calculated Fine Particulate (PM_{10}) cut sizes for all stacks tested are displayed in **Table 7**. Gas Data Concentrations and Mass Emission Rate summaries are reported in **Tables 8 & 9** respectively. Detailed results along with gas stream properties during the testing periods can be found in **Tables 10** to **24**. Hazardous Substances (Metals) results can be found in **Tables 25** and **26**, Polycyclic Aromatic Hydrocarbons, and Dioxins and Furans results in **Tables 27** to **31**. Speciated Volatile Organic Carbon Results are found in Tables **32** to **35**.

All emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atm pressure for comparison with regulatory limits outlined in the Weston Aluminium Environmental Protection Licence 6423.

Field notes recorded during the project are attached as **Appendix A**. with Laboratory Analysis Reports attached as **Appendix B**, and Raw & Calculated Gas Data as **Appendix C**.

Table 5 Stack Emissions Results Summary Annual 2016

Parameter	Stack 1 EPL Point 1	Stack 5 EPL Point 13	Stack 6 EPL Point 14	Stack 7 EPL Point 15
Carbon Monoxide (CO) (mg/m^3)	5	18 (125)	1	
Carbon Monoxide (CO) (ppm)	4 (100)			
Chlorine (mg/m^3)	<2.3	<1.8		
Cyanide	0.15 (0.5)			
Dioxins and Furans (Lower Bound) (ng/m^3)		0.0000046 (0.1)		
Dioxins and Furans (Middle Bound) (ng/m^3)		0.00073 (0.1)		
Fine Particulate (PM_{10}) (mg/m^3)	0.6	0.26	1.9 [2] [21.1%][1]	4.3
Gaseous Fluoride (mg/m^3)	0.047 (2)			
Hydrogen Chloride (mg/m^3)	<11 (400)	<9.2 (10)		
Oxides of Nitrogen (as Equivalent NO_2) (mg/m^3)	9 (2500)	5 (100)	26	<1
Oxygen (%)		20.9	16.6	
Particulate Fluoride (mg/m^3)	0.13			
Sulfur Dioxide (SO_2 as SO_3) (mg/m^3)	<12	<13	<13	<17
Sulfuric Acid Mist (H_2SO_4 as SO_3) (mg/m^3)	<2.5 (100)	<2.6 (100)	<2.5	<3.4
Total Fluoride (mg/m^3)		0.038	0.13	0.19
Total Particulate (mg/m^3)	1.7 (25)	0.28 (10)	8.9[2] (10)	13 (15)
Total Polycyclic Aromatic Hydrocarbons (mg/m^3)	0.026	0.06	0.016	0.0035
Type 1 and 2 Substances in Aggregate (Metals) (mg/m^3)	0.0043 (10)	0.095 (5)		
Volatile Organic Compounds (VOC) (mg/m^3)	<0.36	0.3 (77)	2.3	<0.35

1 Result calculated from particle sizing analysis of the total particulate catch

2 Results corrected to 3% oxygen for comparison to EPL limit

Note – EPL Limits are in parenthesis

Table 6 Air Emission Results Summary, Stacks 2, 3, & 4 – 2016

Parameter	Stack 2 (EPL Point 2)	Stack 3 (EPL Point 3)	Stack 4 (EPL Point 4)
Total Particulate (mg/m^3)	0.4 (35)	0.55 (50)	1.9 (24)
Fine Particulate (PM_{10}) (mg/m^3)	<0.26	<0.27	0.68
Total Fluoride (mg/m^3)	0.074	0.08	0.098

Note – EPL Limits are in parenthesis

USEPA method 201A, section 6.3.5 (Determination of PM_{10} Emissions) and USEPA Conditional Test Method 040, Section 17, Table 2 (Determination of $PM_{2.5}$ Emissions) specifies that results are acceptable provided the calculated aerodynamic cut size (D_{50}) for the test lies between 9.0μm and 11.0μm. Post sampling cut size calculations performed for the sampling conducted are displayed in **Table 7**.

Cut size, or D_{50}, refers to the aerodynamic diameter of the particles contained in the gas stream which can be captured with a 50% efficiency and is a calculated value. For a Fine Particulate (PM_{10}) test particle sizes of 10μm and less are expected.

The cut size (D_{50}) is calculated prior to testing and is based on the pre-test measurements such as stack gas velocity, stack gas temperature, moisture content of the gas stream and stack gas density. This pre-test calculation of cut size (D_{50}) is used in conjunction with the pre-test measurements, some of which are stated above, to establish the sampling conditions or parameters.

Table 7 Calculated PM_{10} Cut Sizes

Sampling Location	PM_{10} Cut Size (D_{50})
Stack 1	9.7
Stack 2	9.9
Stack 3	10.1
Stack 4	10.1
Stack 5	9.6
Stack 7	9.8

All of the calculated cut sizes meet the criteria for cut size conditions stated above.

Table 8 Calculated Gas Concentrations Data Summary

Parameter	Stack 1	Stack 5	Stack 6	Stack 7
Date of Sampling	5-Jul-16	24-Jun-16	1-Jul-16	3-Aug-16
Time Period	8:25-9:25	12:40-13:40	9:45-10:45	9:30-10:30
Nitrogen Oxide (NO) (mg/m^3)	5	2	16	<1
Nitrogen Dioxide (NO_2) (mg/m^3)	0.4	2.4	0.5	<0.1
Nitrogen Oxides (NO_x) (mg/m^3)	6	4	17	<1
Oxides of Nitrogen as Equivalent NO_2 (mg/m^3)	9 (2500)	5 (100)	26	<1
Carbon Monoxide (ppm)	4 (100)			
Carbon Monoxide (mg/m^3)	5	18 (125)	1	
Oxygen (%)		20.9	16.6	

Note – EPL Limits are provided in parenthesis.

Table 9 Gas Mass Emission Rates Summary

Parameter	Stack 1	Stack 5	Stack 6	Stack 7
Date of Sampling	5-Jul-16	24-Jun-16	1-Jul-16	3-Aug-16
Time Period	8:25-9:25	12:40-13:40	9:45-10:45	9:30-10:30
Stack Gas Flow Rate (0°C, dry gas, 1 atm pressure)	21	27	1.9	21
Nitrogen Oxide (NO) (mg/s)	105	54	30.4	<21
Nitrogen Dioxide (NO_2) (mg/s)	8.4	64.8	1.0	<2.1
Nitrogen Oxides (NO_x) (mg/s)	126	108	32.3	<21
Oxides of Nitrogen as Equivalent NO_2 (mg/s)	189	135	49.4	<21
Carbon Monoxide (mg/s)	105	34.2	1.9	

Table 10 Stack 1 Fine Particulate (PM_{10}), Total Particulate and Cyanide Results, 5 July 2016

Sampling Conditions:				
Stack internal diameter at test location	1650	mm		
Stack gas temperature (average)	68.2	^{o}C	341.4	K
Stack pressure (average)	1007	hPa		
Stack gas velocity (average, stack conditions)	13	m/s		
Stack gas flowrate (stack conditions)	27	m^3/s		
Stack gas flowrate (00C, dry gas, 1 atm pressure)	21	m^3/s		
Fine Particulate (PM10) Testing				
Test Period	8:44	-	10:24	
Fine Particulate (PM10) Mass	0.8	mg		
Gas Volume Sampled	1.32	m^3		
Fine Particulate (PM10) Emission*1	0.6	mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	13	mg/s		
Regulatory Limit	NA	mg/m^3		
Total Particulate Testing				
Test Period	8:44	-	10:24	
Total Particulate Mass	3.2	mg		
Gas Volume Sampled	1.83	m^3		
Total Particulate Emission*1	1.7	mg/m^3		
Total Particulate Mass Emission Rate*2	37	mg/s		
Regulatory Limit	25	mg/m^3		
Cyanide Testing				
Test Period	8:44	-	10:24	
Cyanide Mass	0.16	mg		
Gas Volume Sampled	1.06	m^3		
Cyanide Emission*1	0.15	mg/m^3		
Cyanide Mass Emission Rate*2	3.2	mg/s		
Regulatory Limit	0.5	mg/m^3		
Moisture Content (%)	**1.0**			
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.

Table 11 Stack 1 Particulate and Gaseous Fluoride Results, 5 July 2016

Sampling Conditions:				
Stack internal diameter at test location	1650	mm		
Stack gas temperature (average)	80.0	^{o}C	353.2	K
Stack pressure (average)	1007	hPa		
Stack gas velocity (average, stack conditions)	12	m/s		
Stack gas flowrate (stack conditions)	26	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	19	m^3/s		
Particulate Fluoride Testing				
Test Period	10:41	-	12:21	
Particulate Fluoride Mass	0.113	mg		
Gas Volume Sampled	0.855	m^3		
Particulate Fluoride Emission*1	0.13	mg/m^3		
Particulate Fluoride Mass Emission Rate*2	2.5	mg/s		
Regulatory Limit	NA	mg/m^3		
Gaseous Fluoride Testing				
Test Period	10:41	-	12:21	
Gaseous Fluoride Mass	0.04	mg		
Gas Volume Sampled	0.855	m^3		
Gaseous Fluoride Emission*1	0.047	mg/m^3		
Gaseous Fluoride Mass Emission Rate*2	0.91	mg/s		
Regulatory Limit	2	mg/m^3		
Moisture Content (%)	**2.7**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.9**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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 12 Stack 1 Hazardous Substances, Sulfuric Acid Mist and Sulfur Dioxide Results, 5 July 2016

Sampling Conditions:				
Stack internal diameter at test location	1650	mm		
Stack gas temperature (average)	80.0	^{o}C	353.2	K
Stack pressure (average)	1007	hPa		
Stack gas velocity (average, stack conditions)	12	m/s		
Stack gas flowrate (stack conditions)	26	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	20	m^3/s		
Hazardous Substances (Metals) Testing				
Test Period	10:41	-	12:21	
Hazardous Substances (Metals) Mass	0.005	mg		
Gas Volume Sampled	1.18	m^3		
Hazardous Substances (Metals) Emission*1	0.0043	mg/m^3		
Hazardous Substances (Metals) Mass Emission Rate*2	0.084	mg/s		
Regulatory Limit	10	mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing				
Test Period	10:41	-	12:21	
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2	mg		
Gas Volume Sampled	0.809	m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<2.5	mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<49	mg/s		
Regulatory Limit	100	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing				
Test Period	10:41	-	12:21	
Sulfur Dioxide (SO2 as SO3) Mass	<10	mg		
Gas Volume Sampled	0.809	m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	<12	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	<240	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.6**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.9**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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 13 Stack 1 Polycyclic Aromatic Hydrocarbons, Hydrogen Chloride and Chlorine Results, 5 July 2016

Sampling Conditions:				
Stack internal diameter at test location	1650	mm		
Stack gas temperature (average)	81.0	^{o}C	354.2	K
Stack pressure (average)	1007	hPa		
Stack gas velocity (average, stack conditions)	12	m/s		
Stack gas flowrate (stack conditions)	26	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	19	m^3/s		
Polycyclic Aromatic Hydrocarbons Testing				
Test Period	12:32	-	14:12	
Polycyclic Aromatic Hydrocarbons Mass	0.025	mg		
Gas Volume Sampled	0.96	m^3		
Polycyclic Aromatic Hydrocarbons Emission*1	0.026	mg/m^3		
Polycyclic Aromatic Hydrocarbons Mass Emission Rate*2	0.5	mg/s		
Regulatory Limit	NA	mg/m^3		
Hydrogen Chloride Testing				
Test Period	12:32	-	14:12	
Hydrogen Chloride Mass	<10	mg		
Gas Volume Sampled	0.875	m^3		
Hydrogen Chloride Emission*1	<11	mg/m^3		
Hydrogen Chloride Mass Emission Rate*2	<210	mg/s		
Regulatory Limit	400	mg/m^3		
Chlorine Testing				
Test Period	12:32	-	14:12	
Chlorine Mass	<2	mg		
Gas Volume Sampled	0.875	m^3		
Chlorine Emission*1	<2.3	mg/m^3		
Chlorine Mass Emission Rate*2	<45	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**2.1**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.8**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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 14 Stack 2 Fine Particulate, Total Particulate and Total Fluoride Results, 29 June 2016

Sampling Conditions:				
Stack internal diameter at test location	1265	mm		
Stack gas temperature (average)	23.5	^{o}C	296.7	K
Stack pressure (average)	1025	hPa		
Stack gas velocity (average, stack conditions)	11	m/s		
Stack gas flowrate (stack conditions)	14	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	13	m^3/s		
Fine Particulate (PM10) Testing				
Test Period	12:40	-	13:40	
Fine Particulate (PM10) Mass	<0.2	mg		
Gas Volume Sampled	0.762	m^3		
Fine Particulate (PM10) Emission*1	<0.26	mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	<3.3	mg/s		
Regulatory Limit	NA	mg/m^3		
Total Particulate Testing				
Test Period	12:40	-	13:40	
Total Particulate Mass	0.2	mg		
Gas Volume Sampled	0.498	m^3		
Total Particulate Emission*1	0.4	mg/m^3		
Total Particulate Mass Emission Rate*2	5.1	mg/s		
Regulatory Limit	35	mg/m^3		
Total Fluoride Testing				
Test Period	12:40	-	13:40	
Total Fluoride Mass	0.04	mg		
Gas Volume Sampled	0.541	m^3		
Total Fluoride Emission*1	0.074	mg/m^3		
Total Fluoride Mass Emission Rate*2	0.94	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.1**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.8**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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 15 Stack 3 Fine Particulate, Total Particulate and Total Fluoride Results, 29 June 2016

Sampling Conditions:				
Stack internal diameter at test location	1000	mm		
Stack gas temperature (average)	22.0	^{o}C	295.2	K
Stack pressure (average)	1025	hPa		
Stack gas velocity (average, stack conditions)	11	m/s		
Stack gas flowrate (stack conditions)	8.4	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	7.8	m^3/s		
Fine Particulate (PM10) Testing				
Test Period	10:54	-	11:54	
Fine Particulate (PM10) Mass	<0.2	mg		
Gas Volume Sampled	0.734	m^3		
Fine Particulate (PM10) Emission*1	<0.27	mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	<2.1	mg/s		
Regulatory Limit	NA	mg/m^3		
Total Particulate Testing				
Test Period	10:54	-	11:54	
Total Particulate Mass	0.3	mg		
Gas Volume Sampled	0.548	m^3		
Total Particulate Emission*1	0.55	mg/m^3		
Total Particulate Mass Emission Rate*2	4.3	mg/s		
Regulatory Limit	50	mg/m^3		
Total Fluoride Testing				
Test Period	10:54	-	11:54	
Total Fluoride Mass	0.04	mg		
Gas Volume Sampled	0.497	m^3		
Total Fluoride Emission*1	0.08	mg/m^3		
Total Fluoride Mass Emission Rate*2	0.62	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.2**			
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 0^0C, 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 16 Stack 4 Fine Particulate, Total Particulate and Total Fluoride Results, 29 June 2016

Sampling Conditions:				
Stack internal diameter at test location	1395	mm		
Stack gas temperature (average)	24.0	^{o}C	297.2	K
Stack pressure (average)	1024	hPa		
Stack gas velocity (average, stack conditions)	17	m/s		
Stack gas flowrate (stack conditions)	26	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	24	m^3/s		
Fine Particulate (PM10) Testing				
Test Period	8:56	-	9:56	
Fine Particulate (PM10) Mass	0.5	mg		
Gas Volume Sampled	0.737	m^3		
Fine Particulate (PM10) Emission*1	0.68	mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	16	mg/s		
Regulatory Limit	NA	mg/m^3		
Total Particulate Testing				
Test Period	8:56	-	9:56	
Total Particulate Mass	1.5	mg		
Gas Volume Sampled	0.807	m^3		
Total Particulate Emission*1	1.9	mg/m^3		
Total Particulate Mass Emission Rate*2	45	mg/s		
Regulatory Limit	24	mg/m^3		
Total Fluoride Testing				
Test Period	8:56	-	9:56	
Total Fluoride Mass	0.08	mg		
Gas Volume Sampled	0.816	m^3		
Total Fluoride Emission*1	0.098	mg/m^3		
Total Fluoride Mass Emission Rate*2	2.3	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.0**			
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 0^0C, 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 17 Stack 5 Fine Particulate and Total Particulate Results, 24 June 2016

Sampling Conditions:				
Stack internal diameter at test location	1490	mm		
Stack gas temperature (average)	69.0	^{o}C	342.2	K
Stack pressure (average)	1003	hPa		
Stack gas velocity (average, stack conditions)	17	m/s		
Stack gas flowrate (stack conditions)	30	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	23	m^3/s		
Fine Particulate (PM10) Testing				
Test Period	9:58	-	10:58	
Fine Particulate (PM10) Mass	0.2	mg		
Gas Volume Sampled	0.779	m^3		
Fine Particulate (PM10) Emission*1	0.26	mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	6	mg/s		
Regulatory Limit	NA	mg/m^3		
Total Particulate Testing				
Test Period	9:58	-	10:58	
Total Particulate Mass	0.2	mg		
Gas Volume Sampled	0.719	m^3		
Total Particulate Emission*1	0.28	mg/m^3		
Total Particulate Mass Emission Rate*2	6.4	mg/s		
Regulatory Limit	10	mg/m^3		
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 0^0C, 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 18 Stack 5 Total Fluoride, Sulfuric Acid Mist and Sulfur Dioxide Results, 24 June 2016

Sampling Conditions:				
Stack internal diameter at test location	1490	mm		
Stack gas temperature (average)	51.5	^{o}C	324.7	K
Stack pressure (average)	1004	hPa		
Stack gas velocity (average, stack conditions)	17	m/s		
Stack gas flowrate (stack conditions)	31	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	25	m^3/s		
Total Fluoride Testing				
Test Period	11:48	-	12:48	
Total Fluoride Mass	0.03	mg		
Gas Volume Sampled	0.785	m^3		
Total Fluoride Emission*1	0.038	mg/m^3		
Total Fluoride Mass Emission Rate*2	0.95	mg/s		
Regulatory Limit	NA	mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing				
Test Period	11:48	-	12:48	
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2	mg		
Gas Volume Sampled	0.765	m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<2.6	mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<65	mg/s		
Regulatory Limit	100	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing				
Test Period	11:48	-	12:48	
Sulfur Dioxide (SO2 as SO3) Mass	<10	mg		
Gas Volume Sampled	0.765	m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	<13	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	<330	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.4**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.8**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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 19 Stack 5 Hazardous Substances, Hydrogen Chloride and Chlorine Results, 24 June 2016

Sampling Conditions:				
Stack internal diameter at test location	1490	mm		
Stack gas temperature (average)	31.5	^{o}C	304.7	K
Stack pressure (average)	1004	hPa		
Stack gas velocity (average, stack conditions)	18	m/s		
Stack gas flowrate (stack conditions)	31	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	27	m^3/s		
Hazardous Substances (Metals) Testing				
Test Period	13:06	-	14:06	
Hazardous Substances (Metals) Mass	0.11	mg		
Gas Volume Sampled	1.19	m^3		
Hazardous Substances (Metals) Emission*1	0.095	mg/m^3		
Hazardous Substances (Metals) Mass Emission Rate*2	2.6	mg/s		
Regulatory Limit	5	mg/m^3		
Hydrogen Chloride Testing				
Test Period	13:06	-	14:06	
Hydrogen Chloride Mass	<10	mg		
Gas Volume Sampled	1.08	m^3		
Hydrogen Chloride Emission*1	<9.2	mg/m^3		
Hydrogen Chloride Mass Emission Rate*2	<250	mg/s		
Regulatory Limit	10	mg/m^3		
Chlorine Testing				
Test Period	13:06	-	14:06	
Chlorine Mass	<2	mg		
Gas Volume Sampled	1.08	m^3		
Chlorine Emission*1	<1.8	mg/m^3		
Chlorine Mass Emission Rate*2	<49	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.2**			
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 0^0C, 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 20 Stack 5 Dioxins Results, 24 June 2016

Sampling Conditions:				
Stack internal diameter at test location	1490	mm		
Stack gas temperature (average)	49.0	^{o}C	322.2	K
Stack pressure (average)	1003	hPa		
Stack gas velocity (average, stack conditions)	17	m/s		
Stack gas flowrate (stack conditions)	30	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	25	m^3/s		
Dioxins and Furans Lower Bound Testing				
Test Period	9:08	-	15:10	
Dioxins and Furans Lower Bound Mass	0.000017	ng		
Gas Volume Sampled	3.69	m^3		
Dioxins and Furans Lower Bound Emission*1	0.0000046	ng/m^3		
Dioxins and Furans Lower Bound Mass Emission Rate*2	0.00011	ng/s		
Regulatory Limit	0.1	ng/m^3		
Dioxins and Furans Middle Bound Testing				
Test Period	9:08	-	15:10	
Dioxins and Furans Middle Bound Mass	0.0027	ng		
Gas Volume Sampled	3.69	m^3		
Dioxins and Furans Middle Bound Emission*1	0.00073	ng/m^3		
Dioxins and Furans Middle Bound Mass Emission Rate*2	0.018	ng/s		
Regulatory Limit	0.1	ng/m^3		
Polycyclic Aromatic Hydrocarbons Testing				
Test Period	9:08	-	15:10	
Polycyclic Aromatic Hydrocarbons Mass	0.22	mg		
Gas Volume Sampled	3.69	m^3		
Polycyclic Aromatic Hydrocarbons Emission*1	0.06	mg/m^3		
Polycyclic Aromatic Hydrocarbons Mass Emission Rate*2	1.5	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**2.4**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.8**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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 21 Stack 6 Total Particulate and Total Fluoride Results, 1 July 2016

Sampling Conditions:				
Stack internal diameter at test location	580	mm		
Stack gas temperature (average)	181.5	^{o}C	454.7	K
Stack pressure (average)	1005	hPa		
Stack gas velocity (average, stack conditions)	11	m/s		
Stack gas flowrate (stack conditions)	3	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	1.8	m^3/s		
Total Particulate Testing				
Test Period	9:06	-	10:07	
Total Particulate Mass	3.0	mg		
Gas Volume Sampled	1.37	m^3		
Total Particulate Emission*1 at 3% O2	8.9	mg/m^3		
Total Particulate Mass Emission Rate*2	3.9	mg/s		
Regulatory Limit at 3% O2	10	mg/m^3		
Total Fluoride Testing				
Test Period	9:06	-	10:07	
Total Fluoride Mass	0.07	mg		
Gas Volume Sampled	0.522	m^3		
Total Fluoride Emission*1	0.13	mg/m^3		
Total Fluoride Mass Emission Rate*2	0.23	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.5**			
Gas Density (dry at 1 atmosphere)	**1.30**	**kg/m^3**		
Dry Molecular Weight	**29.1**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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 22 Stack 6 Polycyclic Aromatic Hydrocarbons, Sulfuric Acid mist and Sulfur Dioxide Results, 1 July 2016

Sampling Conditions:				
Stack internal diameter at test location	580	mm		
Stack gas temperature (average)	180.5	^{o}C	453.7	K
Stack pressure (average)	1004	hPa		
Stack gas velocity (average, stack conditions)	12	m/s		
Stack gas flowrate (stack conditions)	3.3	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	1.9	m^3/s		
Polycyclic Aromatic Hydrocarbons Testing				
Test Period	10:24	-	11:28	
Polycyclic Aromatic Hydrocarbons Mass	0.015	mg		
Gas Volume Sampled	0.963	m^3		
Polycyclic Aromatic Hydrocarbons Emission*1	0.016	mg/m^3		
Polycyclic Aromatic Hydrocarbons Mass Emission Rate*2	0.031	mg/s		
Regulatory Limit	NA	mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing				
Test Period	10:24	-	11:28	
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2	mg		
Gas Volume Sampled	0.785	m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<2.5	mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<4.8	mg/s		
Regulatory Limit	NA	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing				
Test Period	10:24	-	11:28	
Sulfur Dioxide (SO2 as SO3) Mass	<10	mg		
Gas Volume Sampled	0.785	m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	<13	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	<25	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.5**			
Gas Density (dry at 1 atmosphere)	**1.30**	**kg/m^3**		
Dry Molecular Weight	**29**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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 23 Stack 7 Fine Particulate, Total Particulate and Polycyclic Aromatic Hydrocarbons Results, 3 August 2016

Sampling Conditions:				
Stack internal diameter at test location	1500	mm		
Stack gas temperature (average)	22.6	^{o}C	295.8	K
Stack pressure (average)	1016	hPa		
Stack gas velocity (average, stack conditions)	13	m/s		
Stack gas flowrate (stack conditions)	23	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	21	m^3/s		
Fine Particulate (PM10) Testing				
Test Period	8:58	-	10:02	
Fine Particulate (PM10) Mass	3.3	mg		
Gas Volume Sampled	0.774	m^3		
Fine Particulate (PM10) Emission*1	4.3	mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	89	mg/s		
Regulatory Limit	NA	mg/m^3		
Total Particulate Testing				
Test Period	8:58	-	10:02	
Total Particulate Mass	8.6	mg		
Gas Volume Sampled	0.678	m^3		
Total Particulate Emission*1	13	mg/m^3		
Total Particulate Mass Emission Rate*2	270	mg/s		
Regulatory Limit	15	mg/m^3		
Polycyclic Aromatic Hydrocarbons Testing				
Test Period	8:58	-	10:02	
Polycyclic Aromatic Hydrocarbons Mass	0.0033	mg		
Gas Volume Sampled	0.952	m^3		
Polycyclic Aromatic Hydrocarbons Emission*1	0.0035	mg/m^3		
Polycyclic Aromatic Hydrocarbons Mass Emission Rate*2	0.072	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**1.3**			
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 0^0C, 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 24 Stack 7 Total Fluoride, Sulfuric Acid Mist and Sulfur Dioxide Results, 3 August 2016

Sampling Conditions:				
Stack internal diameter at test location	1500	mm		
Stack gas temperature (average)	24.2	^{o}C	297.4	K
Stack pressure (average)	1016	hPa		
Stack gas velocity (average, stack conditions)	12	m/s		
Stack gas flowrate (stack conditions)	22	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	19	m^3/s		
Total Fluoride Testing				
Test Period	10:24	-	11:25	
Total Fluoride Mass	0.12	mg		
Gas Volume Sampled	0.637	m^3		
Total Fluoride Emission*1	0.19	mg/m^3		
Total Fluoride Mass Emission Rate*2	3.7	mg/s		
Regulatory Limit	NA	mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing				
Test Period	10:24	-	11:25	
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2	mg		
Gas Volume Sampled	0.589	m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<3.4	mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<66	mg/s		
Regulatory Limit	NA	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing				
Test Period	10:24	-	11:25	
Sulfur Dioxide (SO2 as SO3) Mass	<10	mg		
Gas Volume Sampled	0.589	m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	<17	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	<330	mg/s		
Regulatory Limit	NA	mg/m^3		
Moisture Content (%)	**2.0**			
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 0^0C, 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 25 Stack 1 Elemental Metals Results, 5 July 2016

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	<0.000085			<0.0002	<0.00017	<0.0033
Arsenic	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Beryllium	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Cadmium	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Chromium	0.0002	0.00017	0.0039	0.0033			0.004	0.0034	0.066
Cobalt	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Copper	<0.0008	<0.00068	0.0005	0.00043			0.0005	0.00043	0.0084
Lead	0.0002	0.00017	0.00055	0.00047			0.0008	0.00068	0.013
Magnesium	<0.05	<0.043	<0.043	<0.037			<0.002	<0.0017	<0.033
Manganese	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Mercury	<0.0002	<0.00017	<0.0001	<0.000085	<0.0001	<0.000085	<0.0005	<0.00043	<0.0084
Nickel	0.0002	0.00017	<0.0001	<0.000085			0.0002	0.00017	0.0033
Selenium	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Thallium	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Tin	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Vanadium	<0.0002	<0.00017	<0.0001	<0.000085			<0.0002	<0.00017	<0.0033
Zinc	<0.0002	<0.00017	0.0011	0.00094			0.0011	0.00094	0.018
Total Hazardous Metals*	**0.0006**	**0.00051**	**0.0045**	**0.0038**	**<0.0001**	**<0.000085**	**0.005**	**0.0043**	**0.083**
Total Metals	**0.0006**	**0.00051**	**0.0061**	**0.0051**			**0.0066**	**0.0056**	**0.11**

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

Table 26 Stack 5 Elemental Metals Results, 24 June 2016

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	<0.000084			<0.0002	<0.00017	<0.0046
Arsenic	<0.0002	<0.00017	0.00035	0.00029			0.00035	0.00029	0.0079
Beryllium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Cadmium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Chromium	0.0002	0.00017	0.079	0.066			0.08	0.067	1.8
Cobalt	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Copper	<0.0008	<0.00067	0.029	0.024			0.029	0.024	0.65
Lead	0.0002	0.00017	0.026	0.022			0.03	0.025	0.68
Magnesium	<0.05	<0.042	<0.043	<0.036			<0.002	<0.0017	<0.046
Manganese	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Mercury	<0.0002	<0.00017	<0.0001	<0.000084	<0.0001	<0.000084	<0.0005	<0.00042	<0.011
Nickel	<0.0002	<0.00017	0.0033	0.0028			0.0033	0.0028	0.076
Selenium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Thallium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Tin	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Vanadium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Zinc	0.014	0.012	0.0077	0.0064			0.02	0.017	0.46
Total Hazardous Metals*	**0.0004**	**0.00034**	**0.11**	**0.091**	**<0.0001**	**<0.000084**	**0.11**	**0.095**	**2.6**
Total Metals	**0.014**	**0.012**	**0.15**	**0.12**			**0.16**	**0.14**	**3.7**

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

Table 27 Stack 1 Speciated Polycyclic Aromatic Hydrocarbons Results, 5 July 2016

	Sample Result			Emission		Mass Emission Rate	
	(ng)	(µg)	(mg)	(µg/m^3)	(mg/m^3)	(µg/s)	(mg/s)
Naphthalene	11000	11	0.011	11	0.011	220	0.22
2 - Methylnaphthalene	12000	12	0.012	13	0.013	240	0.24
Acenaphthylene	180	0.18	0.00018	0.19	0.00019	3.6	0.0036
Acenaphthene	700	0.7	0.0007	0.73	0.00073	14	0.014
Fluorene	280	0.28	0.00028	0.29	0.00029	5.6	0.0056
Phenanthrene	290	0.29	0.00029	0.3	0.0003	5.8	0.0058
Anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Fluoranthene	190	0.19	0.00019	0.2	0.0002	3.8	0.0038
Pyrene	210	0.21	0.00021	0.22	0.00022	4.2	0.0042
Benz(a)anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Chrysene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Benzo(b)fluoranthene	27	0.027	0.000027	0.028	0.000028	0.54	0.00054
Benzo(k)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Benzo(e)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Benzo(a)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Perylene	420	0.42	0.00042	0.44	0.00044	8.4	0.0084
Indeno(123:cd)pyrene	<150	<0.15	<0.00015	<0.16	<0.00016	<3	<0.003
Dibenzo(ah)anthracene	<140	<0.14	<0.00014	<0.15	<0.00015	<2.8	<0.0028
Benzo(ghi)perylene	<210	<0.21	<0.00021	<0.22	<0.00022	<4.2	<0.0042
Sum of reported PAH's	**25000**	**25**	**0.025**	**26**	**0.026**	**510**	**0.51**

Table 28 Stack 5 Speciated Polycyclic Aromatic Hydrocarbons Results, 24 June 2016

	Sample Result			Emission		Mass Emission Rate	
	(ng)	(µg)	(mg)	(µg/m^3)	(mg/m^3)	(µg/s)	(mg/s)
Naphthalene	140000	140	0.14	38	0.038	940	0.94
2 - Methylnaphthalene	18000	18	0.018	4.9	0.0049	120	0.12
Acenaphthylene	32000	32	0.032	8.7	0.0087	210	0.21
Acenaphthene	730	0.73	0.00073	0.2	0.0002	4.9	0.0049
Fluorene	13000	13	0.013	3.5	0.0035	87	0.087
Phenanthrene	14000	14	0.014	3.8	0.0038	94	0.094
Anthracene	1400	1.4	0.0014	0.38	0.00038	9.4	0.0094
Fluoranthene	770	0.77	0.00077	0.21	0.00021	5.2	0.0052
Pyrene	520	0.52	0.00052	0.14	0.00014	3.5	0.0035
Benz(a)anthracene	42	0.042	0.000042	0.011	0.000011	0.28	0.00028
Chrysene	22	0.022	0.000022	0.006	0.000006	0.15	0.00015
Benzo(b)fluoranthene	49	0.049	0.000049	0.013	0.000013	0.33	0.00033
Benzo(k)fluoranthene	<20	<0.02	<0.00002	<0.0054	<0.0000054	<0.13	<0.00013
Benzo(e)pyrene	34	0.034	0.000034	0.0092	0.0000092	0.23	0.00023
Benzo(a)pyrene	<20	<0.02	<0.00002	<0.0054	<0.0000054	<0.13	<0.00013
Perylene	<20	<0.02	<0.00002	<0.0054	<0.0000054	<0.13	<0.00013
Indeno(123:cd)pyrene	<85	<0.085	<0.000085	<0.023	<0.000023	<0.57	<0.00057
Dibenzo(ah)anthracene	<89	<0.089	<0.000089	<0.024	<0.000024	<0.6	<0.0006
Benzo(ghi)perylene	<90	<0.09	<0.00009	<0.024	<0.000024	<0.6	<0.0006
Sum of reported PAH's	**220000**	**220**	**0.22**	**60**	**0.06**	**1500**	**1.5**

Table 29 Stack 6 Speciated Polycyclic Aromatic Hydrocarbons Results,1 July 2016

	Sample Result			Emission		Mass Emission Rate	
	(ng)	(µg)	(mg)	(µg/m^3)	(mg/m^3)	(µg/s)	(mg/s)
Naphthalene	5800	5.8	0.0058	6	0.006	12	0.012
2 - Methylnaphthalene	7800	7.8	0.0078	8.1	0.0081	16	0.016
Acenaphthylene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Acenaphthene	460	0.46	0.00046	0.48	0.00048	0.92	0.00092
Fluorene	250	0.25	0.00025	0.26	0.00026	0.5	0.0005
Phenanthrene	330	0.33	0.00033	0.34	0.00034	0.66	0.00066
Anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Fluoranthene	100	0.1	0.0001	0.1	0.0001	0.2	0.0002
Pyrene	140	0.14	0.00014	0.15	0.00015	0.28	0.00028
Benz(a)anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Chrysene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Benzo(b)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Benzo(k)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Benzo(e)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Benzo(a)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Perylene	310	0.31	0.00031	0.32	0.00032	0.62	0.00062
Indeno(123:cd)pyrene	<150	<0.15	<0.00015	<0.16	<0.00016	<0.3	<0.0003
Dibenzo(ah)anthracene	<140	<0.14	<0.00014	<0.15	<0.00015	<0.28	<0.00028
Benzo(ghi)perylene	<210	<0.21	<0.00021	<0.22	<0.00022	<0.42	<0.00042
Sum of reported PAH's	**15000**	**15**	**0.015**	**16**	**0.016**	**31**	**0.031**

Table 30 Stack 7 Speciated Polycyclic Aromatic Hydrocarbons Results, 3 August 2016

	Sample Result			Emission		Mass Emission Rate	
	(ng)	(µg)	(mg)	(µg/m^3)	(mg/m^3)	(µg/s)	(mg/s)
Naphthalene	100	0.1	0.0001	0.1	0.0001	2.2	0.0022
2 - Methylnaphthalene	2000	2	0.002	2.1	0.0021	43	0.043
Acenaphthylene	43	0.043	0.000043	0.045	0.000045	0.93	0.00093
Acenaphthene	490	0.49	0.00049	0.51	0.00051	11	0.011
Fluorene	210	0.21	0.00021	0.22	0.00022	4.5	0.0045
Phenanthrene	290	0.29	0.00029	0.3	0.0003	6.3	0.0063
Anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Fluoranthene	65	0.065	0.000065	0.068	0.000068	1.4	0.0014
Pyrene	33	0.033	0.000033	0.035	0.000035	0.71	0.00071
Benz(a)anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Chrysene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Benzo(b)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Benzo(k)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Benzo(e)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Benzo(a)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Perylene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Indeno(123:cd)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Dibenzo(ah)anthracene	30	0.03	0.00003	0.031	0.000031	0.65	0.00065
Benzo(ghi)perylene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Sum of reported PAH's	**3300**	**3.3**	**0.0033**	**3.4**	**0.0034**	**71**	**0.071**

Table 31 Stack 5 Speciated Dioxins and Furans Results, 24 June 2016

Analyte	Mass ng	Toxic Equivalency Factor (1 - TEFs)	Total Toxic Equivalence (1 - TEQs) ng	Concentration ng/m^3	Total Toxic Equivalence (1-TEQs) ng/m^3
2,3,7,8-TCDF	<0.002	0.1	0.0001	<0.00054	0.000027
Total TCDF isomers	0.037				
2,3,7,8-TCDD	<0.002	1	0.001	<0.00054	0.00027
Total TCDD isomers	<0.01				
1,2,3,7,8-PeCDF	<0.002	0.05	0.00005	<0.00054	0.000014
2,3,4,7,8-PeCDF	<0.002	0.5	0.0005	<0.00054	0.00014
Total PeCDF isomers	<0.01				
1,2,3,7,8-PeCDD	<0.002	0.5	0.0005	<0.00054	0.00014
Total PeCDD isomers	<0.01				
1,2,3,4,7,8-HxCDF	<0.001	0.1	0.00005	<0.00027	0.000014
1,2,3,6,7,8-HxCDF	<0.001	0.1	0.00005	<0.00027	0.000014
2,3,4,6,7,8-HxCDF	<0.001	0.1	0.00005	<0.00027	0.000014
1,2,3,7,8,9-HxCDF	<0.001	0.1	0.00005	<0.00027	0.000014
Total HxCDF isomers	<0.01				
1,2,3,4,7,8-HxCDD	<0.002	0.1	0.0001	<0.00054	0.000027
1,2,3,6,7,8-HxCDD	<0.002	0.1	0.0001	<0.00054	0.000027
1,2,3,7,8,9-HxCDD	<0.002	0.1	0.0001	<0.00054	0.000027
Total HxCDD isomers	<0.01				
1,2,3,4,6,7,8-HpCDF	<0.002	0.01	0.00001	<0.00054	0.0000027
1,2,3,4,7,8,9-Hp CDF	<0.002	0.01	0.00001	<0.00054	0.0000027
Total HpCDF isomers	<0.008				
1,2,3,4,6,7,8-HpCDD	<0.003	0.01	0.000015	<0.00081	0.0000041
Total HpCDD isomers	<0.01				
OCDF	<0.007	0.001	0.0000035	<0.0019	0.00000095
OCDD	0.017	0.001	0.000017	0.0046	0.0000046

I-TEQ$_{DF}$		
Lower Bound (excluding LOD Values)	0.000017	ng
Middle Bound (including half LOD Values)	0.0027	ng

Table 32 Stack 1 Speciated Volatile Organic Compound Results, 5 July 2016

Analyte	Sample µg	Blank µg	Sample Blank Corrected µg	(mg/m^3)	mg/s
Acetone	<1.0	<1.0	<1.0	<0.18	<3.4
1,1-dichloroethane	<1.0	<1.0	<1.0	<0.18	<3.4
2-Butanone	<1.0	<1.0	<1.0	<0.18	<3.4
Chloroform	<1.0	<1.0	<1.0	<0.18	<3.4
Benzene	<1.0	<1.0	<1.0	<0.18	<3.4
1-heptene	<1.0	<1.0	<1.0	<0.18	<3.4
n-heptane	<1.0	<1.0	<1.0	<0.18	<3.4
Trichloroethene	<1.0	<1.0	<1.0	<0.18	<3.4
MIBK	<1.0	<1.0	<1.0	<0.18	<3.4
Toluene	<1.0	<1.0	<1.0	<0.18	<3.4
2-hexanone	<1.0	<1.0	<1.0	<0.18	<3.4
Chlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
Ethyl Benzene	<1.0	<1.0	<1.0	<0.18	<3.4
m- & p-xylene	<2.0	<0.2	<2.0	<0.36	<6.8
o-xylene	<1.0	<1.0	<1.0	<0.18	<3.4
Styrene	<1.0	<1.0	<1.0	<0.18	<3.4
Cyclohexanone	<1.0	<1.0	<1.0	<0.18	<3.4
Isopropylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
2-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<3.4
4-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<3.4
1,3,5-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
n-decane	<1.0	<1.0	<1.0	<0.18	<3.4
1,2,4-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,3-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,4-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,2-dichlorobenzne	<1.0	<1.0	<1.0	<0.18	<3.4
n-butylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
Hexachlorobutadiene	<1.0	<1.0	<1.0	<0.18	<3.4
Total	**<1**		**<1**	**<0.36**	**<6.8**

Note: Where the blank has returned a less than value, the analysed value has been corrected for half of

Table 33 Stack 5 Speciated Volatile Organic Compound Results, 24 June 2016

Analyte	Sample µg	Blank µg	Sample Blank Corrected µg	(mg/m^3)	mg/s
Acetone	<1.0	<1.0	<1.0	<0.18	<4.9
1,1-dichloroethane	<1.0	<1.0	<1.0	<0.18	<4.9
2-Butanone	<1.0	<1.0	<1.0	<0.18	<4.9
Chloroform	<1.0	<1.0	<1.0	<0.18	<4.9
Benzene	<1.0	<1.0	<1.0	<0.18	<4.9
1-heptene	<1.0	<1.0	<1.0	<0.18	<4.9
n-heptane	<1.0	<1.0	<1.0	<0.18	<4.9
Trichloroethene	<1.0	<1.0	<1.0	<0.18	<4.9
MIBK	<1.0	<1.0	<1.0	<0.18	<4.9
Toluene	2.2	<1.0	1.7	0.3	8.1
2-hexanone	<1.0	<1.0	<1.0	<0.18	<4.9
Chlorobenzene	<1.0	<1.0	<1.0	<0.18	<4.9
Ethyl Benzene	<1.0	<1.0	<1.0	<0.18	<4.9
m- & p-xylene	<2.0	<0.2	<2.0	<0.36	<9.7
o-xylene	<1.0	<1.0	<1.0	<0.18	<4.9
Styrene	<1.0	<1.0	<1.0	<0.18	<4.9
Cyclohexanone	<1.0	<1.0	<1.0	<0.18	<4.9
Isopropylbenzene	<1.0	<1.0	<1.0	<0.18	<4.9
2-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<4.9
4-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<4.9
1,3,5-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<4.9
n-decane	<1.0	<1.0	<1.0	<0.18	<4.9
1,2,4-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<4.9
1,3-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<4.9
1,4-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<4.9
1,2-dichlorobenzne	<1.0	<1.0	<1.0	<0.18	<4.9
n-butylbenzene	<1.0	<1.0	<1.0	<0.18	<4.9
Hexachlorobutadiene	<1.0	<1.0	<1.0	<0.18	<4.9
Total	**2.2**		**1.7**	**0.3**	**8.1**

Note: Where the blank has returned a less than value, the analysed value has been corrected for half of that blank value. ie a blank value of <0.5 has had 0.25 subtracted from the analysed value.

Table 34 Stack 6 Speciated Volatile Organic Compound Results, 1 July 2016

Analyte	Sample µg	Blank µg	Sample Blank Corrected µg	(mg/m^3)	mg/s
Acetone	1.1	<1.0	0.6	0.052	0.094
1,1-dichloroethane	<1.0	<1.0	<1.0	<0.087	<0.16
2-Butanone	<1.0	<1.0	<1.0	<0.087	<0.16
Chloroform	<1.0	<1.0	<1.0	<0.087	<0.16
Benzene	<1.0	<1.0	<1.0	<0.087	<0.16
1-heptene	<1.0	<1.0	<1.0	<0.087	<0.16
n-heptane	<1.0	<1.0	<1.0	<0.087	<0.16
Trichloroethene	<1.0	<1.0	<1.0	<0.087	<0.16
MIBK	<1.0	<1.0	<1.0	<0.087	<0.16
Toluene	26.2	<1.0	25.7	2.2	4
2-hexanone	<1.0	<1.0	<1.0	<0.087	<0.16
Chlorobenzene	<1.0	<1.0	<1.0	<0.087	<0.16
Ethyl Benzene	<1.0	<1.0	<1.0	<0.087	<0.16
m- & p-xylene	<2.0	<0.2	<2.0	<0.17	<0.31
o-xylene	<1.0	<1.0	<1.0	<0.087	<0.16
Styrene	<1.0	<1.0	<1.0	<0.087	<0.16
Cyclohexanone	<1.0	<1.0	<1.0	<0.087	<0.16
Isopropylbenzene	<1.0	<1.0	<1.0	<0.087	<0.16
2-chlorotoluene	<1.0	<1.0	<1.0	<0.087	<0.16
4-chlorotoluene	<1.0	<1.0	<1.0	<0.087	<0.16
1,3,5-trimethylbenzene	<1.0	<1.0	<1.0	<0.087	<0.16
n-decane	<1.0	<1.0	<1.0	<0.087	<0.16
1,2,4-trimethylbenzene	<1.0	<1.0	<1.0	<0.087	<0.16
1,3-dichlorobenzene	<1.0	<1.0	<1.0	<0.087	<0.16
1,4-dichlorobenzene	<1.0	<1.0	<1.0	<0.087	<0.16
1,2-dichlorobenzne	<1.0	<1.0	<1.0	<0.087	<0.16
n-butylbenzene	<1.0	<1.0	<1.0	<0.087	<0.16
Hexachlorobutadiene	<1.0	<1.0	<1.0	<0.087	<0.16
Total	**27.3**		**26.3**	**2.3**	**4.094**

Note: Where the blank has returned a less than value, the analysed value has been corrected for half of that blank value. ie a blank value of <0.5 has had 0.25 subtracted from the analysed value.

Table 35 Stack 7 Speciated Volatile Organic Compound Results, 3 August 2016

Analyte	Sample µg	Blank µg	Sample Blank Corrected µg	(mg/m^3)	mg/s
Acetone	<1.0	<1.0	<1.0	<0.18	<3.4
1,1-dichloroethane	<1.0	<1.0	<1.0	<0.18	<3.4
2-Butanone	<1.0	<1.0	<1.0	<0.18	<3.4
Chloroform	<1.0	<1.0	<1.0	<0.18	<3.4
Benzene	<1.0	<1.0	<1.0	<0.18	<3.4
1-heptene	<1.0	<1.0	<1.0	<0.18	<3.4
n-heptane	<1.0	<1.0	<1.0	<0.18	<3.4
Trichloroethene	<1.0	<1.0	<1.0	<0.18	<3.4
MIBK	<1.0	<1.0	<1.0	<0.18	<3.4
Toluene	<1.0	<1.0	<1.0	<0.18	<3.4
2-hexanone	<1.0	<1.0	<1.0	<0.18	<3.4
Chlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
Ethyl Benzene	<1.0	<1.0	<1.0	<0.18	<3.4
m- & p-xylene	<2.0	<0.2	<2.0	<0.35	<6.7
o-xylene	<1.0	<1.0	<1.0	<0.18	<3.4
Styrene	<1.0	<1.0	<1.0	<0.18	<3.4
Cyclohexanone	<1.0	<1.0	<1.0	<0.18	<3.4
Isopropylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
2-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<3.4
4-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<3.4
1,3,5-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
n-decane	<1.0	<1.0	<1.0	<0.18	<3.4
1,2,4-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,3-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,4-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,2-dichlorobenzne	<1.0	<1.0	<1.0	<0.18	<3.4
n-butylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
Hexachlorobutadiene	<1.0	<1.0	<1.0	<0.18	<3.4
Total	**<1**		**<1**	**<0.35**	**<6.7**

Note: Where the blank has returned a less than value, the analysed value has been corrected for half of that blank value. ie a blank value of <0.5 has had 0.25 subtracted from the analysed value.

Appendix A

Field Sheets and Final Calculations (252 pages)

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 1

Date Sampled: 5-Jul-16

ANALYTE(S)	METHOD
Fine Particulate (PM10)	NSW EPA OM - 5
Total Particulate	NSW EPA TM - 15
Cyanide	USEPA OTM - 29

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

Dylan Turnbull

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Cyanide

Measurement/Observations

Stack Internal Dimensions:

Diameter 1650 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 2.14 m^2

Minimum No. of sampling points= 16

Distance from sampling plane to nearest disturbances:

Upstream (m) = 4
No. Diameters = 2.4
Type of Upstream Disturbance: Fan
Downstream (m) = 6
No. Diameters = 3.6
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 20
PM2.5/10= 12
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 10
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	111	81	73	43
2	195	165	241	211
3	292	262	488	458
4	413	383	1162	1132
5	584	554	1409	1379
6	1066	1036	1577	1547
7	1238	1208		
8	1358	1328		
9	1455	1425		
10	1539	1509		
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

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

General Comments:

Signed: .....

Checked: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Cyanide

Sampling time start:	8:37	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	8:37	3	20.9	0.0
2	8:38	3	20.9	0.0
3	8:39	4	20.9	0.0
4	8:40	3	20.9	0.0
5	8:41	3	20.9	0.0
6	8:42	5	20.9	0.0
7	8:43	4	20.9	0.0
8	8:44	3	20.9	0.0
	Averages:	3.5 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.70 %

Measurements

CO:	0.0004 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0003 %,(wet)	N_2:	77.8 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.5 %,(wet)
H_2O:	1.70 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)	

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Cyanide

Sampling time start:	10:17	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:17	4	20.9	0.0
2	10:18	3	20.9	0.0
3	10:19	3	20.9	0.0
4	10:20	4	20.9	0.0
5	10:21	3	20.9	0.0
6	10:22	4	20.9	0.0
7	10:23	5	20.9	0.0
8	10:24	4	20.9	0.0
	Averages:	3.8 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 0.89 %

Measurements

CO:	0.0004 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0004 %,(wet)	N_2:	78.4 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.7 %,(wet)
H_2O:	0.89 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)	

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Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses
Fine Particulates

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1:Fine Particulate (PM10)

Time :	8:15	Barometric Pressure :		1008	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	43	0.129	59.0	332.2	13.2
1/2	211	0.112	59.0	332.2	12.3
1/3	458	0.126	59.0	332.2	13.0
1/4	1132	0.127	59.0	332.2	13.1
1/5	1379	0.086	59.0	332.2	10.8
1/6	1547	0.094	59.0	332.2	11.3
2/1	43	0.139	59.0	332.2	13.7
2/2	211	0.134	59.0	332.2	13.5
2/3	458	0.142	59.0	332.2	13.9
2/4	1132	0.164	59.0	332.2	14.9
2/5	1379	0.158	59.0	332.2	14.6
2/6	1547	0.151	59.0	332.2	14.3
Average			59.0	332.2	13.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -5 mm
Absolute pressure in stack (hPa) : 1007.51 hPa

Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1

Test 2:Total Particulate
Test 3:Cyanide

Time :	8:15	Barometric Pressure :		1008	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	81	0.153	61.0	334.2	14.4
1/2	165	0.140	61.0	334.2	13.8
1/3	262	0.129	61.0	334.2	13.3
1/4	383	0.112	61.0	334.2	12.3
1/5	554	0.126	61.0	334.2	13.1
1/6	1036	0.127	61.0	334.2	13.1
1/7	1208	0.086	61.0	334.2	10.8
1/8	1328	0.094	61.0	334.2	11.3
1/9	1425	0.100	61.0	334.2	11.7
1/10	1509	0.103	61.0	334.2	11.8
2/1	81	0.166	61.0	334.2	15.0
2/2	165	0.150	61.0	334.2	14.3
2/3	262	0.139	61.0	334.2	13.7
2/4	383	0.134	61.0	334.2	13.5
2/5	554	0.142	61.0	334.2	13.9
2/6	1036	0.164	61.0	334.2	14.9
2/7	1208	0.158	61.0	334.2	14.6
2/8	1328	0.151	61.0	334.2	14.3
2/9	1425	0.155	61.0	334.2	14.5
2/10	1509	0.144	61.0	334.2	14.0
Average			61.0	334.2	13.4

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -5 mm
Absolute pressure in stack (hPa) : 1007.51 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.92 x 10^{-5} m^2
Thimble No: T435
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 196.5980 Meter finish: 196.5980
Time start: 8:33 Time finish: 8:34

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 198.0148 Meter finish: 198.0148
Time start: 10:25 Time finish: 10:26

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 196.6004 Time start: 8:44
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	0:08:15	73	13.5	15.0	11.0		Yes
1/2	0:07:45	241	13.5	18.0	11.0		Yes
1/3	0:08:15	488	13.5	22.0	12.0		Yes
1/4	0:08:15	1162	13.5	24.0	13.0		Yes
1/5	0:06:45	1409	13.5	25.0	14.0		Yes
1/6	0:07:00	1577	13.5	26.0	14.0		Yes
2/1	0:08:45	73	13.5	27.0	15.0		Yes
2/2	0:08:30	241	13.5	28.0	16.0		Yes
2/3	0:08:45	488	13.5	28.0	16.0		Yes
2/4	0:09:30	1162	13.5	29.0	17.0		Yes
2/5	0:09:15	1409	13.5	29.0	17.0		Yes
2/6	0:09:00	1577	13.5	29.0	18.0		Yes
Averages				25.0	14.5	no result	

Meter Finish: 198.0132 Time Finish: 10:24
Total Condensate collected: 0 ml Silica gel No(s) used: Z18

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: s3
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.93 x $10^{-5}m^2$
Thimble No: T444
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 101.7492 Meter finish: 101.7492
Time start: 8:35 Time finish: 8:36

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 103.7422 Meter finish: 103.7422
Time start: 10:27 Time finish: 10:28

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 101.7518 Time start: 8:44
Meter correction factor (GMf) : 1.0050

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	0:05:00	111	22.5	18.0	11.0		Yes
1/2	0:10:00	195	21.6	21.0	12.0		Yes
1/3	0:15:00	292	20.8	23.0	12.0		Yes
1/4	0:20:00	413	19.2	25.0	13.0		Yes
1/5	0:25:00	584	20.5	27.0	14.0		Yes
1/6	0:30:00	1066	20.5	28.0	14.0		Yes
1/7	0:35:00	1238	16.9	29.0	15.0		Yes
1/8	0:40:00	1358	17.6	30.0	16.0		Yes
1/9	0:45:00	1455	18.3	31.0	16.0		Yes
1/10	0:50:00	1539	18.4	31.0	16.0		Yes
2/1	0:55:00	111	23.4	32.0	17.0		Yes
2/2	1:00:00	195	22.3	32.0	18.0		Yes
2/3	1:05:00	292	21.4	33.0	18.0		Yes
2/4	1:10:00	413	21.1	33.0	19.0		Yes
2/5	1:15:00	584	21.7	34.0	19.0		Yes
2/6	1:20:00	1066	23.3	35.0	20.0		Yes
2/7	1:25:00	1238	22.8	35.0	20.0		Yes
2/8	1:30:00	1358	22.3	35.0	20.0		Yes
2/9	1:35:00	1455	22.6	36.0	21.0		Yes
2/10	1:40:00	1539	21.9	36.0	21.0		Yes
Averages				30.2	16.6	no result	

Meter Finish: 103.7408 Time Finish: 10:24
Total Condensate collected: 0 ml Silica gel No(s) used: M300

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF CYANIDE

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: G65
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.54 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 387.4190 Meter finish: 387.4190
Time start: 8:37 Time finish: 8:38

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 388.5764 Meter finish: 388.5764
Time start: 10:29 Time finish: 10:30

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 387.4250 Time start: 8:44
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	0:05:00	111	11.8	18.0	11.0		Yes
1/2	0:10:00	195	11.3	21.0	12.0		Yes
1/3	0:15:00	292	10.9	23.0	12.0		Yes
1/4	0:20:00	413	10.0	25.0	12.0		Yes
1/5	0:25:00	584	10.7	26.0	13.0		Yes
1/6	0:30:00	1066	10.7	27.0	13.0		Yes
1/7	0:35:00	1238	8.8	28.0	14.0		Yes
1/8	0:40:00	1358	9.2	28.0	15.0		Yes
1/9	0:45:00	1455	9.6	29.0	15.0		Yes
1/10	0:50:00	1539	9.6	29.0	16.0		Yes
2/1	0:55:00	111	12.3	30.0	16.0		Yes
2/2	1:00:00	195	11.7	30.0	16.0		Yes
2/3	1:05:00	292	11.2	31.0	17.0		Yes
2/4	1:10:00	413	11.0	31.0	17.0		Yes
2/5	1:15:00	584	11.4	32.0	17.0		Yes
2/6	1:20:00	1066	12.2	32.0	18.0		Yes
2/7	1:25:00	1238	11.9	32.0	18.0		Yes
2/8	1:30:00	1358	11.7	33.0	18.0		Yes
2/9	1:35:00	1455	11.8	33.0	19.0		Yes
2/10	1:40:00	1539	11.4	33.0	19.0		Yes
Averages				28.6	15.4	no result	

Meter Finish: 388.5748 Time Finish: 10:24
Total Condensate collected: 0 ml Silica gel No(s) used: Z12

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses
Fine Particulates

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1:Fine Particulate (PM10)

Time :	10:30	Barometric Pressure :		1008	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	43	0.106	76.0	349.2	12.2
1/2	211	0.085	76.0	349.2	11.0
1/3	458	0.089	76.0	349.2	11.2
1/4	1132	0.083	76.0	349.2	10.9
1/5	1379	0.084	76.0	349.2	10.9
1/6	1547	0.093	76.0	349.2	11.5
2/1	43	0.132	76.0	349.2	13.7
2/2	211	0.134	76.0	349.2	13.8
2/3	458	0.127	76.0	349.2	13.4
2/4	1132	0.108	76.0	349.2	12.4
2/5	1379	0.103	76.0	349.2	12.1
2/6	1547	0.101	76.0	349.2	12.0
Average			76.0	349.2	12.1

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.4 mm
Absolute pressure in stack (hPa) : 1007.51 hPa

ANZ

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1

Test 2:Total Particulate
Test 3:Cyanide

Time :	10:30	Barometric Pressure :	1008	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	81	0.111	76.0	349.2	12.5
1/2	165	0.130	76.0	349.2	13.6
1/3	262	0.106	76.0	349.2	12.2
1/4	383	0.085	76.0	349.2	11.0
1/5	554	0.089	76.0	349.2	11.2
1/6	1036	0.083	76.0	349.2	10.9
1/7	1208	0.084	76.0	349.2	10.9
1/8	1328	0.093	76.0	349.2	11.5
1/9	1425	0.101	76.0	349.2	12.0
1/10	1509	0.095	76.0	349.2	11.6
2/1	81	0.103	76.0	349.2	12.1
2/2	165	0.110	76.0	349.2	12.5
2/3	262	0.132	76.0	349.2	13.7
2/4	383	0.134	76.0	349.2	13.8
2/5	554	0.127	76.0	349.2	13.4
2/6	1036	0.108	76.0	349.2	12.4
2/7	1208	0.103	76.0	349.2	12.1
2/8	1328	0.101	76.0	349.2	12.0
2/9	1425	0.107	76.0	349.2	12.3
2/10	1509	0.090	76.0	349.2	11.3
Average			76.0	349.2	12.2

Static Pressure (Dwyer) (Pa):		kPa
Static Pressure (U-tube, if required) :	-6.4	mm
Absolute pressure in stack (hPa) :	1007.37	hPa

STACK ANALYSIS - PM10 CALCULATIONS

Date: 5-Jul-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

1. Gas Analysis

	%		
$\%CO_2$	0.0		
$\%O_2$	20.9		
$\%N_2+\%CO$	79.1		
Fraction Moisture Content, Bws	0.01	M_s=	0.99

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	28.84
Mol. Wt. of Stack Gas (wet)	28.65

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	100800	29.76
Stack Static Pressure (Pg)	100737	29.74
Absolute Stack Pressure		29.74

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	76.0	168.8
Average Meter Temperature:	19.8	
Stack Gas Viscosity		206.6

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.54	0.0189	18.92	0.32

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	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1	0.132	94.14	30.99	0.760	1.228	71.51	23.46	115.61	37.93
2	0.154	69.11	22.75	0.734	1.244	50.74	16.65	85.98	28.21
3	0.160	64.09	21.10	0.726	1.249	46.52	15.26	80.07	26.27
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.195	43.12	14.19	0.656	1.287	28.28	9.28	55.50	18.21
6	0.219	34.05	11.21	0.576	1.322	19.62	6.44	45.00	14.76
7	0.235	29.64	9.76	0.497	1.347	14.82	4.86	39.94	13.10
8	0.261	24.03	7.91	#NUM!	1.396	12.02	3.94	33.55	11.01
9	0.296	18.73	6.17	#NUM!	1.473	9.37	3.07	27.59	9.05
10	0.341	14.09	4.64	#NUM!	1.592	7.04	2.31	21.13	6.93
11	0.389	10.82	3.56	#NUM!	1.740	5.41	1.78	16.23	5.33

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
5	0.195	0.005	0.000019	13.6

STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 5-Jul-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

7.Sampling Time Total Run Time 100 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
105.95	0.43	0.65	8.4
85.35	0.34	0.59	7.6
89.27	0.36	0.60	7.8
83.39	0.33	0.58	7.5
84.37	0.34	0.58	7.5
93.20	0.37	0.61	7.9
132.44	0.53	0.73	9.4
134.40	0.54	0.73	9.5
126.55	0.51	0.71	9.2
107.91	0.43	0.66	8.5
103.01	0.41	0.64	8.3
101.04	0.41	0.64	8.2
	Average	0.64	100.00
	Square	0.41	

Total time min	Full hours	Full minutes	Seconds
8.3	0	8	15
16.0	0	16	0
24.3	0	24	15
32.5	0	32	30
39.3	0	39	15
46.3	0	46	15
55.0	0	55	0
63.5	1	3	30
72.3	1	12	15
81.8	1	21	45
91.0	1	31	0
100.0	1	40	0

Aerodynamic Cut Size (u_{cyc})
205.9

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0157

Actual D_{50}
9.7

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.4269 m^3	Average barometric pressure (P_{BARO})	1008 hPa	
Average gas meter temp. ($T_{M,2}$):	19.8 °C			
	293.0 K	Average pressure at meter ($P_{M,2}$)	1008.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	1.3236 m^3			

(B) PM10 concentration at standard conditions

Blank thimble No.:	NA	Blank weight:	g
Thimble No. used:	T435	PM10 Weight	0.0008 g
Final PM10 Weight (Mp1):	0.00080 g		
PM10 Concentration (C1):	$=M_{p1}/MV_4=$	0.0006	g/m^3 (0°C, dry gas, 1atm pressure)
	;and C_2 =	0.6	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0006 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.6 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.084 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 84 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z18

V_v = 12.7 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0170

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

B_{ws} = 1.26 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.021 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.22 m/s

(ii) Average of post-sampling velocities: 12.09 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.65 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 = 27.05 m^3/s (stack conditions)

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

Qstd = 21.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.013	g/s (0°C, dry gas, 1 atm pressure)		
	=	13	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.013	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	13	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	1.8	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	1800	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.9989 m^3

Average gas meter temp. ($T_{M,2}$): 23.4 °C

296.6 K

Average barometric pressure (P_{BARO}) 1008 hPa

Average pressure at meter ($P_{M,2}$) 1008.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.8317 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: T444

Blank weight: g

Total Particulate Weight 0.0032 g

Final Total Particulate Weight (Mp1): 0.00320 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.0017 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 1.7 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0017 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 1.7 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.24 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 240 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: M300

V_v = 9.2 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0123

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

B_{ws} = 0.67 %

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

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

= 1.010 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.42 m/s

(ii) Average of post-sampling velocities: 12.15 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.78 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 = 27.33 m^3/s (stack conditions)

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

Qstd = 21.6 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.037	g/s (0°C, dry gas, 1 atm pressure)		
	=	37	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.037	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	37	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	5.1	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	5100	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Cyanide

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.1498 m^3	Average barometric pressure (P_{BARO})	1008 hPa
Average gas meter temp. ($T_{M,2}$):	22.0 °C		
	295.2 K	Average pressure at meter ($P_{M,2}$)	1008.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	1.0586 m^3		

(B) Cyanide concentration at standard conditions

Blank thimble No.:	NA	Blank weight:	g
Thimble No. used:	NA	Cyanide Weight	0.00016 g
Final Cyanide Weight (Mp1):	0.00016 g		

Cyanide Concentration (C1): $=M_{p1}/MV_4=$ 0.00015 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.15 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00015 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.15 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.021 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 21 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z12

V_v = 6 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0080

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

B_{ws} = 0.75 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Cyanide

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

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

= 1.010 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.42 m/s

(ii) Average of post-sampling velocities: 12.15 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.78 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 = 27.33 m^3/s (stack conditions)

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

Qstd = 21.6 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0032	g/s (0°C, dry gas, 1 atm pressure)		
	=	3.2	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0032	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	3.2	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.45	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	450	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 1
WESTON ALUMINIUM
5-Jul-16
FINE PARTICULATE (PM10)
TOTAL PARTICULATE
CYANIDE

Sampling Conditions:			
Stack internal diameter at test location	1650 mm		
Stack gas temperature (average)	68.2 °C		341.4 K
Stack pressure (average)	1007 hPa		
Stack gas velocity (average, stack conditions)	13 m/s		
Stack gas flowrate (stack conditions)	27 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	21 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	8:44	-	10:24
Fine Particulate (PM10) Mass	0.8 mg		
Gas Volume Sampled	1.32 m^3		
Fine Particulate (PM10) Emission*1	0.6 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	13 mg/s		
Regulatory Limit	NA mg/m^3		
Total Particulate Testing			
Test Period	8:44	-	10:24
Total Particulate Mass	3.2 mg		
Gas Volume Sampled	1.83 m^3		
Total Particulate Emission*1	1.7 mg/m^3		
Total Particulate Mass Emission Rate*2	37 mg/s		
Regulatory Limit	25 mg/m^3		
Cyanide Testing			
Test Period	8:44	-	10:24
Cyanide Mass	0.16 mg		
Gas Volume Sampled	1.06 m^3		
Cyanide Emission*1	0.15 mg/m^3		
Cyanide Mass Emission Rate*2	3.2 mg/s		
Regulatory Limit	0.5 mg/m^3		
Moisture Content (%)	0.7		
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 0^0C, 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.

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 1

Date Sampled: 5-Jul-16

ANALYTE(S)	METHOD
Particulate Fluoride	NSW EPA TM - 9
Gaseous Fluoride	NSW EPA TM - 9

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

Dylan Turnbull

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - PRE-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Particulate Fluoride
Test 2: Gaseous Fluoride

Measurement/Observations

Stack Internal Dimensions:

Diameter 1650 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 2.14 m^2

Minimum No. of sampling points= 16

Distance from sampling plane to nearest disturbances:

Upstream (m) = 4
No. Diameters = 2.4
Type of Upstream Disturbance: Fan
Downstream (m) = 6
No. Diameters = 3.6
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 20
PM2.5/10= NA
No. of sampling traverses/ports sampled = 2
PM2.5/10= NA
No. of sampling points on each traverse/port = 10
PM2.5/10= NA

Position of each sampling point, for each traverse:

Exclusion of any sample point numbers - comments:

No.	A Distance from wall	B S-type Pitot distances	PM10/2.5 A Distance from wall	PM2.5/10 B S-Type Pitot distances
1	111	81		
2	195	165		
3	292	262		
4	413	383		
5	584	554		
6	1066	1036		
7	1238	1208		
8	1358	1328		
9	1455	1425		
10	1539	1509		
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

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

General Comments:

Signed: .....

Checked: .....

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Particulate Fluoride
Test 2: Gaseous Fluoride

Sampling time start: 10:34		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:34	2	20.2	0.4
2	10:35	3	20.2	0.4
3	10:36	5	20.2	0.4
4	10:37	4	20.2	0.4
5	10:38	5	20.2	0.4
6	10:39	3	20.2	0.4
7	10:40	3	20.2	0.4
8	10:41	3	20.2	0.4
	Averages:	3.5 ppm	20.2 %	0.4 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.70 %

Measurements

CO:	0.0004 %,(dry)	N_2:	79.4 %,(dry)
CO_2:	0.4 %,(dry)	O_2:	20.2 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0003 %,(wet)	N_2:	78.0 %,(wet)
CO_2:	0.4 %,(wet)	O_2:	19.9 %,(wet)
H_2O:	1.70 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)	

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Particulate Fluoride
Test 2: Gaseous Fluoride

Sampling time start: 12:14		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:14	5	20.9	0.0
2	12:15	6	20.9	0.0
3	12:16	5	20.9	0.0
4	12:17	4	20.9	0.0
5	12:18	4	20.9	0.0
6	12:19	5	20.9	0.0
7	12:20	5	20.9	0.0
8	12:21	4	20.9	0.0
	Averages:	4.8 ppm	20.9 %	0.0 %

Moisture content (M3): 0.97
Moisture percentage (M2): 2.70 %

Measurements

CO:	0.0005 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0005 %,(wet)	N_2:	77.0 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.3 %,(wet)
H_2O:	2.70 %(=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)	

Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1:Particulate Fluoride
Test 2:Gaseous Fluoride

Time :	10:30	Barometric Pressure :	1008	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	81	0.111	76.0	349.2	12.5
1/2	165	0.130	76.0	349.2	13.6
1/3	262	0.106	76.0	349.2	12.2
1/4	383	0.085	76.0	349.2	11.0
1/5	554	0.089	76.0	349.2	11.2
1/6	1036	0.083	76.0	349.2	10.9
1/7	1208	0.084	76.0	349.2	10.9
1/8	1328	0.093	76.0	349.2	11.5
1/9	1425	0.101	76.0	349.2	12.0
1/10	1509	0.095	76.0	349.2	11.6
2/1	81	0.103	76.0	349.2	12.1
2/2	165	0.110	76.0	349.2	12.5
2/3	262	0.132	76.0	349.2	13.7
2/4	383	0.134	76.0	349.2	13.8
2/5	554	0.127	76.0	349.2	13.4
2/6	1036	0.108	76.0	349.2	12.4
2/7	1208	0.103	76.0	349.2	12.1
2/8	1328	0.101	76.0	349.2	12.0
2/9	1425	0.107	76.0	349.2	12.3
2/10	1509	0.090	76.0	349.2	11.3
Average			76.0	349.2	12.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.4 mm
Absolute pressure in stack (hPa) : 1007.37 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF PARTICULATE FLUORIDE

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: S9
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 1.39 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 198.0176 Meter finish: 198.0176
Time start: 10:34 Time finish: 10:35
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 198.9502 Meter finish: 198.9502
Time start: 12:21 Time finish: 12:22
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 198.0215 Time start: 10:41
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	0:05:00	111	8.9	24.0	18.0		Yes
1/2	0:10:00	195	9.7	26.0	18.0		Yes
1/3	0:15:00	292	8.7	27.0	18.0		Yes
1/4	0:20:00	413	7.8	28.0	18.0		Yes
1/5	0:25:00	584	8.0	28.0	18.0		Yes
1/6	0:30:00	1066	7.8	29.0	19.0		Yes
1/7	0:35:00	1238	7.8	29.0	19.0		Yes
1/8	0:40:00	1358	8.2	29.0	19.0		Yes
1/9	0:45:00	1455	8.6	29.0	20.0		Yes
1/10	0:50:00	1539	8.3	30.0	20.0		Yes
2/1	0:55:00	111	8.6	30.0	20.0		Yes
2/2	1:00:00	195	8.9	30.0	20.0		Yes
2/3	1:05:00	292	9.8	30.0	21.0		Yes
2/4	1:10:00	413	9.8	30.0	21.0		Yes
2/5	1:15:00	584	9.5	31.0	21.0		Yes
2/6	1:20:00	1066	8.8	31.0	22.0		Yes
2/7	1:25:00	1238	8.6	31.0	22.0		Yes
2/8	1:30:00	1358	8.6	31.0	22.0		Yes
2/9	1:35:00	1455	8.8	31.0	22.0		Yes
2/10	1:40:00	1539	8.1	31.0	22.0		Yes
Averages				29.3	20.0	no result	

Meter Finish: 198.9488 Time Finish: 12:21
Total Condensate collected: 5 ml Silica gel No(s) used: M301

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF GASEOUS FLUORIDE

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: S9
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.39 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 198.0176 Meter finish: 198.0176
Time start: 10:34 Time finish: 10:35

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 198.9502 Meter finish: 198.9502
Time start: 12:21 Time finish: 12:22

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 198.0215 Time start: 10:41
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	0:05:00	111	8.9	24.0	18.0		Yes
1/2	0:10:00	195	9.7	26.0	18.0		Yes
1/3	0:15:00	292	8.7	27.0	18.0		Yes
1/4	0:20:00	413	7.8	28.0	18.0		Yes
1/5	0:25:00	584	8.0	28.0	18.0		Yes
1/6	0:30:00	1066	7.8	29.0	19.0		Yes
1/7	0:35:00	1238	7.8	29.0	19.0		Yes
1/8	0:40:00	1358	8.2	29.0	19.0		Yes
1/9	0:45:00	1455	8.6	29.0	20.0		Yes
1/10	0:50:00	1539	8.3	30.0	20.0		Yes
2/1	0:55:00	111	8.6	30.0	20.0		Yes
2/2	1:00:00	195	8.9	30.0	20.0		Yes
2/3	1:05:00	292	9.8	30.0	21.0		Yes
2/4	1:10:00	413	9.8	30.0	21.0		Yes
2/5	1:15:00	584	9.5	31.0	21.0		Yes
2/6	1:20:00	1066	8.8	31.0	22.0		Yes
2/7	1:25:00	1238	8.6	31.0	22.0		Yes
2/8	1:30:00	1358	8.6	31.0	22.0		Yes
2/9	1:35:00	1455	8.8	31.0	22.0		Yes
2/10	1:40:00	1539	8.1	31.0	22.0		Yes
Averages				29.3	20.0	no result	

Meter Finish: 198.9488 Time Finish: 12:21
Total Condensate collected: 5 ml Silica gel No(s) used: M301

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1:Particulate Fluoride
Test 2:Gaseous Fluoride

Time :	12:25	Barometric Pressure :		1008	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.27	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	81	0.107	84.0	357.2	12.5
1/2	165	0.114	84.0	357.2	12.9
1/3	262	0.102	84.0	357.2	12.2
1/4	383	0.085	84.0	357.2	11.1
1/5	554	0.096	84.0	357.2	11.8
1/6	1036	0.097	84.0	357.2	11.9
1/7	1208	0.090	84.0	357.2	11.5
1/8	1328	0.085	84.0	357.2	11.1
1/9	1425	0.111	84.0	357.2	12.7
1/10	1509	0.100	84.0	357.2	12.1
2/1	81	0.103	84.0	357.2	12.2
2/2	165	0.114	84.0	357.2	12.9
2/3	262	0.107	84.0	357.2	12.5
2/4	383	0.099	84.0	357.2	12.0
2/5	554	0.096	84.0	357.2	11.8
2/6	1036	0.097	84.0	357.2	11.9
2/7	1208	0.099	84.0	357.2	12.0
2/8	1328	0.085	84.0	357.2	11.1
2/9	1425	0.103	84.0	357.2	12.2
2/10	1509	0.112	84.0	357.2	12.8
Average			84.0	357.2	12.1

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.5 mm
Absolute pressure in stack (hPa) : 1007.36 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Particulate Fluoride

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.9366 m^3

Average gas meter temp. ($T_{M,2}$): 24.6 °C

297.8 K

Average barometric pressure (P_{BARO}) 1008 hPa

Average pressure at meter ($P_{M,2}$) 1008.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.8548 m^3

(B) Particulate Fluoride concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: NA

Blank weight: g

Particulate Fluoride Weight 0.000113 g

Final Particulate Fluoride Weight (Mp1): 0.00011 g

Particulate Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.00013 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.13 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0078 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 7.8 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.004 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 4 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: M301

V_v = 12.8 g (from laboratory report) V_w = 5 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0067

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0171

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

B_{ws} = 2.70 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Particulate Fluoride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.992 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.15 m/s

(ii) Average of post-sampling velocities: 12.06 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.11 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 = 25.89 m^3/s (stack conditions)

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

Qstd = 19.4 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0025	g/s (0°C, dry gas, 1 atm pressure)		
	=	2.5	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.15	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	150	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.078	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	78	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Gaseous Fluoride

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.9366 m^3	Average barometric pressure (P_{BARO})	1008 hPa	
Average gas meter temp. ($T_{M,2}$):	24.6 °C			
	297.8 K	Average pressure at meter ($P_{M,2}$)	1008.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.8548 m^3			

(B) Gaseous Fluoride concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: NA Gaseous Fluoride Weight 0.00004 g

Final Gaseous Fluoride Weight (Mp1): 0.00004 g

Gaseous Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.000047 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.047 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0028 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 2.8 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.0015 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 1.5 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: M301

V_v = 12.8 g (from laboratory report) V_w = 5 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0067

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0171

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

B_{ws} = 2.70 %

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Gaseous Fluoride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.992 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.15 m/s

(ii) Average of post-sampling velocities: 12.06 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.) 12.11 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 = 25.89 m^3/s (stack conditions)

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

Qstd = 19.4 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.00091	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.91	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.055	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	55	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.028	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	28	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 1
WESTON ALUMINIUM
5-Jul-16
PARTICULATE FLUORIDE
GASEOUS FLUORIDE

Sampling Conditions:			
Stack internal diameter at test location	1650 mm		
Stack gas temperature (average)	80.0 °C		353.2 K
Stack pressure (average)	1007 hPa		
Stack gas velocity (average, stack conditions)	12 m/s		
Stack gas flowrate (stack conditions)	26 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	19 m^3/s		
Particulate Fluoride Testing			
Test Period	10:41	-	12:21
Particulate Fluoride Mass	0.113 mg		
Gas Volume Sampled	0.855 m^3		
Particulate Fluoride Emission*1	0.13 mg/m^3		
Particulate Fluoride Mass Emission Rate*2	2.5 mg/s		
Regulatory Limit	NA mg/m^3		
Gaseous Fluoride Testing			
Test Period	10:41	-	12:21
Gaseous Fluoride Mass	0.04 mg		
Gas Volume Sampled	0.855 m^3		
Gaseous Fluoride Emission*1	0.047 mg/m^3		
Gaseous Fluoride Mass Emission Rate*2	0.91 mg/s		
Regulatory Limit	2 mg/m^3		
Moisture Content (%)	2.7		
Gas Density (dry at 1 atmosphere)	1.29 kg/m^3		
Dry Molecular Weight	28.9 g/g-mole		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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.

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 1

Date Sampled: 5-Jul-16

ANALYTE(S)	METHOD
Hazardous Substances (Metals)	NSW EPA TM - 12, 13 & 14
Sulfuric Acid Mist	NSW EPA TM - 3
Sulfur Dioxide	NSW EPA TM - 4

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

for Dylan Turnbull

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Hazardous Substances (Metals)
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Measurement/Observations

Stack Internal Dimensions:

Diameter 1650 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 2.14 m^2

Minimum No. of sampling points= 16

Distance from sampling plane to nearest disturbances:

Upstream (m) = 4
No. Diameters = 2.4
Type of Upstream Disturbance: Fan
Downstream (m) = 6
No. Diameters = 3.6
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 20
PM2.5/10= NA
No. of sampling traverses/ports sampled = 2
PM2.5/10= NA
No. of sampling points on each traverse/port = 10
PM2.5/10= NA

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	111	81		
2	195	165		
3	292	262		
4	413	383		
5	584	554		
6	1066	1036		
7	1238	1208		
8	1358	1328		
9	1455	1425		
10	1539	1509		
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

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

General Comments:

Signed: .....

Checked: .....

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Hazardous Substances (Metals)
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 10:34		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:34	2	20.2	0.4
2	10:35	3	20.2	0.4
3	10:36	5	20.2	0.4
4	10:37	4	20.2	0.4
5	10:38	5	20.2	0.4
6	10:39	3	20.2	0.4
7	10:40	3	20.2	0.4
8	10:41	3	20.2	0.4
	Averages:	3.5 ppm	20.2 %	0.4 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.70 %

Measurements

CO:	0.0004 %,(dry)	N_2:	79.4 %,(dry)
CO_2:	0.4 %,(dry)	O_2:	20.2 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0003 %,(wet)	N_2:	78.0 %,(wet)
CO_2:	0.4 %,(wet)	O_2:	19.9 %,(wet)
H_2O:	1.70 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)	

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Hazardous Substances (Metals)
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 12:14		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:14	5	20.9	0.0
2	12:15	6	20.9	0.0
3	12:16	5	20.9	0.0
4	12:17	4	20.9	0.0
5	12:18	4	20.9	0.0
6	12:19	5	20.9	0.0
7	12:20	5	20.9	0.0
8	12:21	4	20.9	0.0
	Averages:	4.8 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.43 %

Measurements

CO:	0.0005 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0005 %,(wet)	N_2:	78.0 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.43 %(=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)

AECOM

Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1:Hazardous Substances (Metals)
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	10:30	Barometric Pressure :	1008	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	81	0.111	76.0	349.2	12.5
1/2	165	0.130	76.0	349.2	13.6
1/3	262	0.106	76.0	349.2	12.2
1/4	383	0.085	76.0	349.2	11.0
1/5	554	0.089	76.0	349.2	11.2
1/6	1036	0.083	76.0	349.2	10.9
1/7	1208	0.084	76.0	349.2	10.9
1/8	1328	0.093	76.0	349.2	11.5
1/9	1425	0.101	76.0	349.2	12.0
1/10	1509	0.095	76.0	349.2	11.6
2/1	81	0.103	76.0	349.2	12.1
2/2	165	0.110	76.0	349.2	12.5
2/3	262	0.132	76.0	349.2	13.7
2/4	383	0.134	76.0	349.2	13.8
2/5	554	0.127	76.0	349.2	13.4
2/6	1036	0.108	76.0	349.2	12.4
2/7	1208	0.103	76.0	349.2	12.1
2/8	1328	0.101	76.0	349.2	12.0
2/9	1425	0.107	76.0	349.2	12.3
2/10	1509	0.090	76.0	349.2	11.3
Average			76.0	349.2	12.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.4 mm
Absolute pressure in stack (hPa) : 1007.37 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS
SAMPLING OF HAZARDOUS SUBSTANCES (METALS)

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: 6
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.12 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 103.7430 Meter finish: 103.7430
Time start: 10:36 Time finish: 10:37

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 105.0545 Meter finish: 105.0545
Time start: 12:22 Time finish: 12:23

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 103.7450 Time start: 10:41
Meter correction factor (GMf) : 1.0050

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	0:05:00	111	13.5	28.0	18.0		Yes
1/2	0:10:00	195	14.7	31.0	20.0		Yes
1/3	0:15:00	292	13.2	33.0	21.0		Yes
1/4	0:20:00	413	11.9	36.0	22.0		Yes
1/5	0:25:00	584	12.1	36.0	22.0		Yes
1/6	0:30:00	1066	11.8	37.0	22.0		Yes
1/7	0:35:00	1238	11.8	37.0	23.0		Yes
1/8	0:40:00	1358	12.4	37.0	23.0		Yes
1/9	0:45:00	1455	13.0	38.0	24.0		Yes
1/10	0:50:00	1539	12.5	38.0	24.0		Yes
2/1	0:55:00	111	13.1	38.0	24.0		Yes
2/2	1:00:00	195	13.5	39.0	25.0		Yes
2/3	1:05:00	292	14.8	39.0	25.0		Yes
2/4	1:10:00	413	14.9	39.0	25.0		Yes
2/5	1:15:00	584	14.5	40.0	26.0		Yes
2/6	1:20:00	1066	13.4	40.0	26.0		Yes
2/7	1:25:00	1238	13.1	41.0	26.0		Yes
2/8	1:30:00	1358	13.0	41.0	26.0		Yes
2/9	1:35:00	1455	13.3	41.0	26.0		Yes
2/10	1:40:00	1539	12.2	41.0	27.0		Yes
Averages				37.5	23.8	no result	

Meter Finish: 105.0526 Time Finish: 12:21
Total Condensate collected: 0 ml Silica gel No(s) used: vk1

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF SULFURIC ACID MIST (H2SO4 AS SO3)

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.42 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 388.5900 Meter finish: 388.5900
Time start: 10:38 Time finish: 10:39

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 389.4886 Meter finish: 389.4886
Time start: 12:23 Time finish: 12:24

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 388.5922 Time start: 10:41
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	0:05:00	111	9.0	25.0	18.0		Yes
1/2	0:10:00	195	9.8	27.0	18.0		Yes
1/3	0:15:00	292	8.8	30.0	19.0		Yes
1/4	0:20:00	413	7.9	32.0	20.0		Yes
1/5	0:25:00	584	8.1	32.0	20.0		Yes
1/6	0:30:00	1066	7.9	33.0	20.0		Yes
1/7	0:35:00	1238	7.9	33.0	20.0		Yes
1/8	0:40:00	1358	8.3	34.0	20.0		Yes
1/9	0:45:00	1455	8.6	34.0	21.0		Yes
1/10	0:50:00	1539	8.4	34.0	21.0		Yes
2/1	0:55:00	111	8.7	35.0	21.0		Yes
2/2	1:00:00	195	9.0	35.0	22.0		Yes
2/3	1:05:00	292	9.9	35.0	22.0		Yes
2/4	1:10:00	413	9.9	35.0	22.0		Yes
2/5	1:15:00	584	9.7	36.0	23.0		Yes
2/6	1:20:00	1066	8.9	36.0	23.0		Yes
2/7	1:25:00	1238	8.7	36.0	23.0		Yes
2/8	1:30:00	1358	8.6	36.0	23.0		Yes
2/9	1:35:00	1455	8.9	36.0	23.0		Yes
2/10	1:40:00	1539	8.1	36.0	23.0		Yes
Averages				33.5	21.1	no result	

Meter Finish: 389.4862 Time Finish: 12:21
Total Condensate collected: 0 ml Silica gel No(s) used: M302

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF SULFUR DIOXIDE (SO2 AS SO3)

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.42 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 388.5900 Meter finish: 388.5900
Time start: 10:38 Time finish: 10:39

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 389.4886 Meter finish: 389.4886
Time start: 12:23 Time finish: 12:24

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 388.5922 Time start: 10:41
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	0:05:00	111	9.0	25.0	18.0		Yes
1/2	0:10:00	195	9.8	27.0	18.0		Yes
1/3	0:15:00	292	8.8	30.0	19.0		Yes
1/4	0:20:00	413	7.9	32.0	20.0		Yes
1/5	0:25:00	584	8.1	32.0	20.0		Yes
1/6	0:30:00	1066	7.9	33.0	20.0		Yes
1/7	0:35:00	1238	7.9	33.0	20.0		Yes
1/8	0:40:00	1358	8.3	34.0	20.0		Yes
1/9	0:45:00	1455	8.6	34.0	21.0		Yes
1/10	0:50:00	1539	8.4	34.0	21.0		Yes
2/1	0:55:00	111	8.7	35.0	21.0		Yes
2/2	1:00:00	195	9.0	35.0	22.0		Yes
2/3	1:05:00	292	9.9	35.0	22.0		Yes
2/4	1:10:00	413	9.9	35.0	22.0		Yes
2/5	1:15:00	584	9.7	36.0	23.0		Yes
2/6	1:20:00	1066	8.9	36.0	23.0		Yes
2/7	1:25:00	1238	8.7	36.0	23.0		Yes
2/8	1:30:00	1358	8.6	36.0	23.0		Yes
2/9	1:35:00	1455	8.9	36.0	23.0		Yes
2/10	1:40:00	1539	8.1	36.0	23.0		Yes
Averages				33.5	21.1	no result	

Meter Finish: 389.4862 Time Finish: 12:21
Total Condensate collected: 0 ml Silica gel No(s) used: M302

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1:Hazardous Substances (Metals)
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	12:25	Barometric Pressure :	1008	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	81	0.107	84.0	357.2	12.4
1/2	165	0.114	84.0	357.2	12.8
1/3	262	0.102	84.0	357.2	12.2
1/4	383	0.085	84.0	357.2	11.1
1/5	554	0.096	84.0	357.2	11.8
1/6	1036	0.097	84.0	357.2	11.9
1/7	1208	0.090	84.0	357.2	11.4
1/8	1328	0.085	84.0	357.2	11.1
1/9	1425	0.111	84.0	357.2	12.7
1/10	1509	0.100	84.0	357.2	12.0
2/1	81	0.103	84.0	357.2	12.2
2/2	165	0.114	84.0	357.2	12.8
2/3	262	0.107	84.0	357.2	12.4
2/4	383	0.099	84.0	357.2	12.0
2/5	554	0.096	84.0	357.2	11.8
2/6	1036	0.097	84.0	357.2	11.9
2/7	1208	0.099	84.0	357.2	12.0
2/8	1328	0.085	84.0	357.2	11.1
2/9	1425	0.103	84.0	357.2	12.2
2/10	1509	0.112	84.0	357.2	12.7
Average			84.0	357.2	12.0

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.5 mm
Absolute pressure in stack (hPa) : 1007.36 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Hazardous Substances (Metals)

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.3141 m^3

Average gas meter temp. ($T_{M,2}$): 30.6 °C / 303.8 K

Average barometric pressure (P_{BARO}): 1008 hPa

Average pressure at meter ($P_{M,2}$): 1008.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.1756 m^3

(B) Metals concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: NA

Blank weight: g

Final Metals Weight (Mp1): 0.00001 g

Metals Weight 0.000005 g

Metals Concentration (C1): $=M_{p1}/MV_4=$ 4.3E-06 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.0043 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.2 %

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%: 20.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.00013 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.13 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: vk1

V_v = 14.7 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0196

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

B_{ws} = 1.64 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hazardous Substances (Metals)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.984 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.15 m/s

(ii) Average of post-sampling velocities: 12.03 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.)
12.09 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 = 25.85 m^3/s (stack conditions)

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

Qstd = 19.6 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.000084	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.084	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.005	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	5	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.0026	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	2.6	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Sulfuric Acid Mist (H2SO4 as SO3)

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.8940 m^3

Average gas meter temp. ($T_{M,2}$): 27.3 °C

300.5 K

Average barometric pressure (P_{BARO}) 1008 hPa

Average pressure at meter ($P_{M,2}$) 1008.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.8086 m^3

(B) H2SO4 as SO3 concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: NA

Blank weight: g

Final H2SO4 as SO3 Weight (Mp1): <0.002 g

H2SO4 as SO3 Weight <0.002 g

H2SO4 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ <0.0025 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <2.5 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.15 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <150 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.078 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <78 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: M302

V_v = 8.1 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0108

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

B_{ws} = 1.32 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfuric Acid Mist (H2SO4 as SO3)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.984 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.15 m/s

(ii) Average of post-sampling velocities: 12.03 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.) 12.09 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 = 25.85 m^3/s (stack conditions)

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

Qstd = 19.6 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.049	g/s (0°C, dry gas, 1 atm pressure)		
	=	<49	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<2.9	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<2900	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<1.5	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<1500	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Sulfur Dioxide (SO2 as SO3)

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.8940 m^3

Average gas meter temp. ($T_{M,2}$): 27.3 °C

300.5 K

Average barometric pressure (P_{BARO}) 1008 hPa

Average pressure at meter ($P_{M,2}$) 1008.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.8086 m^3

(B) SO2 as SO3 concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: NA

Blank weight: g

Final SO2 as SO3 Weight (Mp1): <0.01 g

SO2 as SO3 Weight <0.01 g

SO2 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ <0.012 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <12 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.72 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <720 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.37 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <370 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: M302

V_v = 8.1 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0108

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

B_{ws} = 1.32 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfur Dioxide (SO2 as SO3)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.984 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.15 m/s

(ii) Average of post-sampling velocities: 12.03 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.) 12.09 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 = 25.85 m^3/s (stack conditions)

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

Qstd = 19.6 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.24	g/s (0°C, dry gas, 1 atm pressure)		
	=	<240	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<14	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<14000	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<7.3	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<7300	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 1
WESTON ALUMINIUM
5-Jul-16
HAZARDOUS SUBSTANCES (METALS)
SULFURIC ACID MIST (H2SO4 AS SO3)
SULFUR DIOXIDE (SO2 AS SO3)

Sampling Conditions:			
Stack internal diameter at test location	1650 mm		
Stack gas temperature (average)	80.0 °C		353.2 K
Stack pressure (average)	1007 hPa		
Stack gas velocity (average, stack conditions)	12 m/s		
Stack gas flowrate (stack conditions)	26 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	20 m^3/s		
Hazardous Substances (Metals) Testing			
Test Period	10:41	-	12:21
Hazardous Substances (Metals) Mass	0.005 mg		
Gas Volume Sampled	1.18 m^3		
Hazardous Substances (Metals) Emission*1	0.0043 mg/m^3		
Hazardous Substances (Metals) Mass Emission Rate*2	0.084 mg/s		
Regulatory Limit	10 mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing			
Test Period	10:41	-	12:21
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2 mg		
Gas Volume Sampled	0.809 m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<2.5 mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<49 mg/s		
Regulatory Limit	100 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing			
Test Period	10:41	-	12:21
Sulfur Dioxide (SO2 as SO3) Mass	<10 mg		
Gas Volume Sampled	0.809 m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	<12 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	<240 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.6		
Gas Density (dry at 1 atmosphere)	1.29 kg/m^3		
Dry Molecular Weight	28.9 g/g-mole		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 1

Date Sampled: 5-Jul-16

ANALYTE(S)	METHOD
Polycyclic Aromatic Hydrocarbons	NSW EPA OM - 6
Hydrogen Chloride	NSW EPA TM - 7 & 8
Chlorine	NSW EPA TM - 7 & 8

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

Dylan Turnbull

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - PRE-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Polycyclic Aromatic Hydrocarbons
Test 2: Hydrogen Chloride
Test 3: Chlorine

Measurement/Observations

Stack Internal Dimensions:

Diameter 1650 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 2.14 m^2

Minimum No. of sampling points= 16

Distance from sampling plane to nearest disturbances:

Upstream (m) = 4
No. Diameters = 2.4
Type of Upstream Disturbance: Fan
Downstream (m) = 6
No. Diameters = 3.6
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 20
PM2.5/10= NA
No. of sampling traverses/ports sampled = 2
PM2.5/10= NA
No. of sampling points on each traverse/port = 10
PM2.5/10= NA

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	111	81		
2	195	165		
3	292	262		
4	413	383		
5	584	554		
6	1066	1036		
7	1238	1208		
8	1358	1328		
9	1455	1425		
10	1539	1509		
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

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

General Comments:

Signed: .....

Checked: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Polycyclic Aromatic Hydrocarbons
Test 2: Hydrogen Chloride
Test 3: Chlorine

Sampling time start: 12:25		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:25	213	20.4	0.3
2	12:26	9	20.5	0.2
3	12:27	5	20.4	0.3
4	12:28	4	20.5	0.2
5	12:29	5	20.5	0.2
6	12:30	4	20.5	0.2
7	12:31	6	20.5	0.2
8	12:32	7	20.5	0.2
	Averages:	31.6 ppm	20.5 %	0.2 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.70 %

Measurements

CO:	0.0032 %,(dry)	N_2:	79.3 %,(dry)
CO_2:	0.2 %,(dry)	O_2:	20.5 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0031 %,(wet)	N_2:	77.9 %,(wet)
CO_2:	0.2 %,(wet)	O_2:	20.1 %,(wet)
H_2O:	1.70 %(=M2)		
Therefore, stack gas density (GD) =		1.28 kg/m^3	(0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =		1.29 kg/m^3	(0°C, dry, 1 atm pressure)

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1: Polycyclic Aromatic Hydrocarbons
Test 2: Hydrogen Chloride
Test 3: Chlorine

Sampling time start: 14:05		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	14:05	14	20.5	0.2
2	14:06	12	20.5	0.2
3	14:07	9	20.5	0.2
4	14:08	5	20.9	0.0
5	14:09	4	20.9	0.0
6	14:10	5	20.9	0.0
7	14:11	3	20.9	0.0
8	14:12	6	20.9	0.0
	Averages:	7.3 ppm	20.8 %	0.1 %

Moisture content (M3): 0.98
Moisture percentage (M2): 2.06 %

Measurements

CO:	0.0007 %,(dry)	N_2:	79.2 %,(dry)
CO_2:	0.1 %,(dry)	O_2:	20.8 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0007 %,(wet)	N_2:	77.5 %,(wet)
CO_2:	0.1 %,(wet)	O_2:	20.3 %,(wet)
H_2O:	2.06 %(=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: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1:Polycyclic Aromatic Hydrocarbons
Test 2:Hydrogen Chloride
Test 3:Chlorine

Time :	12:25	Barometric Pressure :	1008	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	81	0.107	84.0	357.2	12.4
1/2	165	0.114	84.0	357.2	12.8
1/3	262	0.102	84.0	357.2	12.2
1/4	383	0.085	84.0	357.2	11.1
1/5	554	0.096	84.0	357.2	11.8
1/6	1036	0.097	84.0	357.2	11.9
1/7	1208	0.090	84.0	357.2	11.4
1/8	1328	0.085	84.0	357.2	11.1
1/9	1425	0.111	84.0	357.2	12.7
1/10	1509	0.100	84.0	357.2	12.0
2/1	81	0.103	84.0	357.2	12.2
2/2	165	0.114	84.0	357.2	12.8
2/3	262	0.107	84.0	357.2	12.4
2/4	383	0.099	84.0	357.2	12.0
2/5	554	0.096	84.0	357.2	11.8
2/6	1036	0.097	84.0	357.2	11.9
2/7	1208	0.099	84.0	357.2	12.0
2/8	1328	0.085	84.0	357.2	11.1
2/9	1425	0.103	84.0	357.2	12.2
2/10	1509	0.112	84.0	357.2	12.7
Average			84.0	357.2	12.0

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.5 mm
Absolute pressure in stack (hPa) : 1007.36 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF POLYCYCLIC AROMATIC HYDROCARBONS

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: 5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.76 x 10^{-5} m^2
Thimble No: DAU290616N
Blank thimble No: 0

Leak Check (Pre-Sampling)
Meter start: 198.9520 Meter finish: 198.9520
Time start: 12:27 Time finish: 12:28

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 200.0110 Meter finish: 200.0110
Time start: 14:13 Time finish: 14:14

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 198.9544 Time start: 12:32
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	0:05:00	111	10.9	27.0	22.0		Yes
1/2	0:10:00	195	11.3	30.0	22.0		Yes
1/3	0:15:00	292	10.8	32.0	22.0		Yes
1/4	0:20:00	413	9.8	32.0	22.0		Yes
1/5	0:25:00	584	10.4	32.0	22.0		Yes
1/6	0:30:00	1066	10.5	33.0	23.0		Yes
1/7	0:35:00	1238	10.1	33.0	23.0		Yes
1/8	0:40:00	1358	9.8	33.0	23.0		Yes
1/9	0:45:00	1455	11.2	34.0	24.0		Yes
1/10	0:50:00	1539	10.6	34.0	24.0		Yes
2/1	0:55:00	111	10.8	34.0	24.0		Yes
2/2	1:00:00	195	11.3	34.0	24.0		Yes
2/3	1:05:00	292	10.9	34.0	24.0		Yes
2/4	1:10:00	413	10.6	34.0	24.0		Yes
2/5	1:15:00	584	10.4	34.0	24.0		Yes
2/6	1:20:00	1066	10.5	34.0	24.0		Yes
2/7	1:25:00	1238	10.6	34.0	25.0		Yes
2/8	1:30:00	1358	9.8	35.0	25.0		Yes
2/9	1:35:00	1455	10.8	35.0	25.0		Yes
2/10	1:40:00	1539	11.2	34.0	25.0		Yes
Averages				33.1	23.6	no result	

Meter Finish: 200.0088 Time Finish: 14:12
Total Condensate collected: 8 ml Silica gel No(s) used: Z6

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF HYDROGEN CHLORIDE

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: G65
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.54 x 10^{-5} m^2
Thimble No: 0
Blank thimble No:

Leak Check (Pre-Sampling)
Meter start: 105.0540 Meter finish: 105.0540
Time start: 12:29 Time finish: 12:30

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 106.0456 Meter finish: 106.0456
Time start: 14:15 Time finish: 14:16

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 105.0565 Time start: 12:32
Meter correction factor (GMf) : 1.0050

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	0:05:00	111	9.5	34.0	26.0		Yes
1/2	0:10:00	195	9.8	37.0	26.0		Yes
1/3	0:15:00	292	9.4	40.0	27.0		Yes
1/4	0:20:00	413	8.5	40.0	27.0		Yes
1/5	0:25:00	584	9.1	41.0	27.0		Yes
1/6	0:30:00	1066	9.1	41.0	28.0		Yes
1/7	0:35:00	1238	8.8	42.0	28.0		Yes
1/8	0:40:00	1358	8.5	42.0	28.0		Yes
1/9	0:45:00	1455	9.8	42.0	29.0		Yes
1/10	0:50:00	1539	9.2	43.0	29.0		Yes
2/1	0:55:00	111	9.4	43.0	29.0		Yes
2/2	1:00:00	195	9.8	43.0	29.0		Yes
2/3	1:05:00	292	9.5	43.0	29.0		Yes
2/4	1:10:00	413	9.2	43.0	29.0		Yes
2/5	1:15:00	584	9.1	43.0	29.0		Yes
2/6	1:20:00	1066	9.1	43.0	29.0		Yes
2/7	1:25:00	1238	9.2	43.0	30.0		Yes
2/8	1:30:00	1358	8.5	43.0	30.0		Yes
2/9	1:35:00	1455	9.4	43.0	30.0		Yes
2/10	1:40:00	1539	9.8	43.0	29.0		Yes
Averages				41.6	28.4	no result	

Meter Finish: 106.0436 Time Finish: 14:12
Total Condensate collected: 2 ml Silica gel No(s) used: F23

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS
SAMPLING OF CHLORINE

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 1
Sample Nozzle No.: G65
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.54 x 10^{-5} m^2
Thimble No: 0
Blank thimble No:

Leak Check (Pre-Sampling)
Meter start: 105.0540 Meter finish: 105.0540
Time start: 12:29 Time finish: 12:30

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 106.0456 Meter finish: 106.0456
Time start: 14:15 Time finish: 14:16

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1008 hPa (start); 1008 hPa (finish)
Meter start: 105.0565 Time start: 12:32
Meter correction factor (GMf) : 1.0050

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	0:05:00	111	9.5	34.0	26.0		Yes
1/2	0:10:00	195	9.8	37.0	26.0		Yes
1/3	0:15:00	292	9.4	40.0	27.0		Yes
1/4	0:20:00	413	8.5	40.0	27.0		Yes
1/5	0:25:00	584	9.1	41.0	27.0		Yes
1/6	0:30:00	1066	9.1	41.0	28.0		Yes
1/7	0:35:00	1238	8.8	42.0	28.0		Yes
1/8	0:40:00	1358	8.5	42.0	28.0		Yes
1/9	0:45:00	1455	9.8	42.0	29.0		Yes
1/10	0:50:00	1539	9.2	43.0	29.0		Yes
2/1	0:55:00	111	9.4	43.0	29.0		Yes
2/2	1:00:00	195	9.8	43.0	29.0		Yes
2/3	1:05:00	292	9.5	43.0	29.0		Yes
2/4	1:10:00	413	9.2	43.0	29.0		Yes
2/5	1:15:00	584	9.1	43.0	29.0		Yes
2/6	1:20:00	1066	9.1	43.0	29.0		Yes
2/7	1:25:00	1238	9.2	43.0	30.0		Yes
2/8	1:30:00	1358	8.5	43.0	30.0		Yes
2/9	1:35:00	1455	9.4	43.0	30.0		Yes
2/10	1:40:00	1539	9.8	43.0	29.0		Yes
Averages				41.6	28.4	no result	

Meter Finish: 106.0436 Time Finish: 14:12
Total Condensate collected: 2 ml Silica gel No(s) used: F23

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1
Test 1:Polycyclic Aromatic Hydrocarbons
Test 2:Hydrogen Chloride
Test 3:Chlorine

Time :	14:20	Barometric Pressure :	1008	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	81	0.115	78.0	351.2	12.8
1/2	165	0.104	78.0	351.2	12.2
1/3	262	0.152	78.0	351.2	14.7
1/4	383	0.120	78.0	351.2	13.1
1/5	554	0.077	78.0	351.2	10.5
1/6	1036	0.114	78.0	351.2	12.7
1/7	1208	0.081	78.0	351.2	10.8
1/8	1328	0.084	78.0	351.2	11.0
1/9	1425	0.077	78.0	351.2	10.5
1/10	1509	0.084	78.0	351.2	11.0
2/1	81	0.121	78.0	351.2	13.1
2/2	165	0.119	78.0	351.2	13.0
2/3	262	0.103	78.0	351.2	12.1
2/4	383	0.131	78.0	351.2	13.7
2/5	554	0.125	78.0	351.2	13.3
2/6	1036	0.097	78.0	351.2	11.8
2/7	1208	0.085	78.0	351.2	11.0
2/8	1328	0.094	78.0	351.2	11.6
2/9	1425	0.103	78.0	351.2	12.1
2/10	1509	0.101	78.0	351.2	12.0
Average			78.0	351.2	12.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.9 mm
Absolute pressure in stack (hPa) : 1007.32 hPa

Emission Measurement Calculations Spreadsheet

Stack Analysis - Speciated Polycyclic Aromatic Hydrocarbons (PAH) Results

Date: 5-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 1

	Sample Result			Emission		Mass Emission Rate	
	(ng)	(µg)	(mg)	($\mu g/m^3$)	(mg/m^3)	(µg/s)	(mg/s)
Naphthalene	11000	11	0.011	11	0.011	220	0.22
2 - Methylnapthalene	12000	12	0.012	13	0.013	240	0.24
Acenaphthylene	180	0.18	0.00018	0.19	0.00019	3.6	0.0036
Acenaphthene	700	0.7	0.0007	0.73	0.00073	14	0.014
Fluorene	280	0.28	0.00028	0.29	0.00029	5.6	0.0056
Phenanthrene	290	0.29	0.00029	0.3	0.0003	5.8	0.0058
Anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Fluoranthene	190	0.19	0.00019	0.2	0.0002	3.8	0.0038
Pyrene	210	0.21	0.00021	0.22	0.00022	4.2	0.0042
Benz(a)anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Chrysene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Benzo(b)fluoranthene	27	0.027	0.000027	0.028	0.000028	0.54	0.00054
Benzo(k)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Benzo(e)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Benzo(a)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.4	<0.0004
Perylene	420	0.42	0.00042	0.44	0.00044	8.4	0.0084
Indeno(123:cd)pyrene	<150	<0.15	<0.00015	<0.16	<0.00016	<3	<0.003
Dibenzo(ah)anthracene	<140	<0.14	<0.00014	<0.15	<0.00015	<2.8	<0.0028
Benzo(ghi)perylene	<210	<0.21	<0.00021	<0.22	<0.00022	<4.2	<0.0042
Sum of reported PAH's	25000	25	0.025	26	0.026	510	0.51

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Polycyclic Aromatic Hydrocarbons

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.0649 m^3

Average gas meter temp. ($T_{M,2}$): 28.3 °C / 301.5 K

Average barometric pressure (P_{BARO}) 1008 hPa

Average pressure at meter ($P_{M,2}$) 1008.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.9599 m^3

(B) PAH concentration at standard conditions

Blank thimble No.: 0

Thimble No. used: DAU290616N

Blank weight: g

PAH Weight 0.000025 g

Final PAH Weight (Mp1): 0.00003 g

PAH Concentration (C1): $=M_{p1}/MV_4=$ 0.000026 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.026 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0021 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 2.1 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.00094 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.94 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z6

V_v = 12.6 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 ($V_{wsg(std)}$) = 0.0168

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

B_{ws} = 2.78 %

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Polycyclic Aromatic Hydrocarbons

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.989 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.03 m/s

(ii) Average of post-sampling velocities: 12.15 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.) 12.09 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 = 25.85 m^3/s (stack conditions)

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

Qstd = 19.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0005	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.5	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.04	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	40	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.018	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	18	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Hydrogen Chloride

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.9920 m^3

Average gas meter temp. ($T_{M,2}$): 35.0 °C / 308.2 K

Average barometric pressure (P_{BARO}) 1008 hPa

Average pressure at meter ($P_{M,2}$) 1008.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.8748 m^3

(B) Hydrogen Chloride concentration at standard conditions

Blank thimble No.:

Thimble No. used: 0

Blank weight: g

Hydrogen Chloride Weight <0.01 g

Final Hydrogen Chloride Weight (Mp1): <0.01 g

Hydrogen Chloride Concentration (C1): $=M_{p1}/MV_4=$ <0.011 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <11 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.88 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <880 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.4 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <400 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F23

V_v = 9.3 g (from laboratory report) V_w = 2 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0027

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0124

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

B_{ws} = 1.69 %

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hydrogen Chloride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.982 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.03 m/s

(ii) Average of post-sampling velocities: 12.15 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.09 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 = 25.85 m^3/s (stack conditions)

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

Qstd = 19.5 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.21	g/s (0°C, dry gas, 1 atm pressure)		
	=	<210	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<17	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<17000	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<7.7	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<7700	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Chlorine

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

Date: 5-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.9920 m^3

Average gas meter temp. ($T_{M,2}$): 35.0 °C / 308.2 K

Average barometric pressure (P_{BARO}) 1008 hPa

Average pressure at meter ($P_{M,2}$) 1008.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.8748 m^3

(B) Chlorine concentration at standard conditions

Blank thimble No.:

Blank weight: g

Thimble No. used: 0

Chlorine Weight <0.002 g

Final Chlorine Weight (Mp1): <0.002 g

Chlorine Concentration (C1): $=M_{p1}/MV_4=$ <0.0023 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <2.3 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.18 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <180 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.083 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <83 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F23

V_v = 9.3 g (from laboratory report) V_w = 2 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0027

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0124

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

B_{ws} = 1.69 %

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Chlorine

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.982 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.03 m/s

(ii) Average of post-sampling velocities: 12.15 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.09 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 = 25.85 m^3/s (stack conditions)

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

Qstd = 19.5 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.045	g/s (0°C, dry gas, 1 atm pressure	)		
	=	<45	mg/s (0°C, dry gas, 1 atm pressure	)		
	C_{1a} x Qstd =	<3.6	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)	
	=	<3600	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)	
	C_{1a} x Qstd =	<1.6	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)	
	=	<1600	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)	

EMISSION MONITORING RESULTS, STACK 1
WESTON ALUMINIUM
5-Jul-16
POLYCYCLIC AROMATIC HYDROCARBONS
HYDROGEN CHLORIDE
CHLORINE

Sampling Conditions:			
Stack internal diameter at test location	1650 mm		
Stack gas temperature (average)	81.0 °C		354.2 K
Stack pressure (average)	1007 hPa		
Stack gas velocity (average, stack conditions)	12 m/s		
Stack gas flowrate (stack conditions)	26 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	19 m^3/s		
Polycyclic Aromatic Hydrocarbons Testing			
Test Period	12:32	-	14:12
Polycyclic Aromatic Hydrocarbons Mass	0.025 mg		
Gas Volume Sampled	0.96 m^3		
Polycyclic Aromatic Hydrocarbons Emission*1	0.026 mg/m^3		
Polycyclic Aromatic Hydrocarbons Mass Emission Rate*2	0.5 mg/s		
Regulatory Limit	NA mg/m^3		
Hydrogen Chloride Testing			
Test Period	12:32	-	14:12
Hydrogen Chloride Mass	<10 mg		
Gas Volume Sampled	0.875 m^3		
Hydrogen Chloride Emission*1	<11 mg/m^3		
Hydrogen Chloride Mass Emission Rate*2	<210 mg/s		
Regulatory Limit	400 mg/m^3		
Chlorine Testing			
Test Period	12:32	-	14:12
Chlorine Mass	<2 mg		
Gas Volume Sampled	0.875 m^3		
Chlorine Emission*1	<2.3 mg/m^3		
Chlorine Mass Emission Rate*2	<45 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	2.1		
Gas Density (dry at 1 atmosphere)	1.29 kg/m^3		
Dry Molecular Weight	28.8 g/g-mole		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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.

STACK ANALYSIS - SAMPLING OF VOLATILE ORGANIC COMPOUNDS

AECOM

Client:	Weston Aluminium
Project Number:	60489919
Stack Description:	Stack 1
Date:	05-Jul-16
Rotameter Correction Factor:	1.01
Time Start:	12:35
Time Finish:	13:05
Sample Flow Rate:	0.2 L/min
Sample Time:	30 min
Sampled Volume:	6.06 litres
	0.00606 m^3
Ambient Temperature:	16 °C
Barometric Pressure:	1008 hPa
Stack Gas Moisture:	2.1 %
Corrected Volume:	0.00558 m^3 (0°C, dry gas, 1 atmosphere pressure)
Stack Flow Rate	19 m^3/s (0°C, dry gas, 1 atmosphere pressure)

VOC AIR EMISSION TEST RESULTS

Analyte	Sample µg	Blank µg	Sample Blank Corrected µg	(mg/m^3)	mg/s
Acetone	<1.0	<1.0	<1.0	<0.18	<3.4
1,1-dichloroethane	<1.0	<1.0	<1.0	<0.18	<3.4
2-Butanone	<1.0	<1.0	<1.0	<0.18	<3.4
Chloroform	<1.0	<1.0	<1.0	<0.18	<3.4
Benzene	<1.0	<1.0	<1.0	<0.18	<3.4
1-heptene	<1.0	<1.0	<1.0	<0.18	<3.4
n-heptane	<1.0	<1.0	<1.0	<0.18	<3.4
Trichloroethene	<1.0	<1.0	<1.0	<0.18	<3.4
MIBK	<1.0	<1.0	<1.0	<0.18	<3.4
Toluene	<1.0	<1.0	<1.0	<0.18	<3.4
2-hexanone	<1.0	<1.0	<1.0	<0.18	<3.4
Chlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
Ethyl Benzene	<1.0	<1.0	<1.0	<0.18	<3.4
m- & p-xylene	<2.0	<0.2	<2.0	<0.36	<6.8
o-xylene	<1.0	<1.0	<1.0	<0.18	<3.4
Styrene	<1.0	<1.0	<1.0	<0.18	<3.4
Cyclohexanone	<1.0	<1.0	<1.0	<0.18	<3.4
Isopropylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
2-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<3.4
4-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<3.4
1,3,5-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
n-decane	<1.0	<1.0	<1.0	<0.18	<3.4
1,2,4-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,3-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,4-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,2-dichlorobenzne	<1.0	<1.0	<1.0	<0.18	<3.4
n-butylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
Hexachlorobutadiene	<1.0	<1.0	<1.0	<0.18	<3.4
Total	<1		<1	<0.36	<6.8

Note: Where the blank has returned a less than value, the analysed value has been corrected for half of that blank value. ie a blank value of <0.5 has had 0.25 subtracted from the analysed value.

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 2

Date Sampled: 29-Jun-16

ANALYTE(S)	METHOD
Fine Particulate (PM10)	NSW EPA OM - 5
Total Particulate	NSW EPA TM - 15
Total Fluoride	NSW EPA TM - 9

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

Dylan Turnbull

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Measurement/Observations

Stack Internal Dimensions:

Diameter 1265 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 1.26 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 7
No. Diameters = 5.5
Type of Upstream Disturbance: Fan
Downstream (m) = 7
No. Diameters = 5.5
Type of Down Stream Disturbance: Stack Exit

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	56	26	56	26
2	185	155	185	155
3	374	344	374	344
4	891	861	891	861
5	1080	1050	1080	1050
6	1209	1179	1209	1179
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Sampling time start: 13:33		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	13:33	0	20.9	0.0
2	13:34	0	20.9	0.0
3	13:35	0	20.9	0.0
4	13:36	0	20.9	0.0
5	13:37	0	20.9	0.0
6	13:38	0	20.9	0.0
7	13:39	0	20.9	0.0
8	13:40	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.40 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	78.0 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.40 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)	

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Sampling time start: 14:33		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	14:33	0	20.9	0.0
2	14:34	0	20.9	0.0
3	14:35	0	20.9	0.0
4	14:36	0	20.9	0.0
5	14:37	0	20.9	0.0
6	14:38	0	20.9	0.0
7	14:39	0	20.9	0.0
8	14:40	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.12 %

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:	78.2 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.7 %,(wet)
H_2O:	1.12 %(=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: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 2
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate
Test 3:Total Fluoride

Time :	12:15	Barometric Pressure :	1025	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	26	0.087	23.0	296.2	10.2
1/2	155	0.093	23.0	296.2	10.5
1/3	344	0.101	23.0	296.2	10.9
1/4	861	0.094	23.0	296.2	10.5
1/5	1050	0.096	23.0	296.2	10.7
1/6	1179	0.115	23.0	296.2	11.6
2/1	26	0.085	23.0	296.2	10.0
2/2	155	0.116	23.0	296.2	11.7
2/3	344	0.101	23.0	296.2	10.9
2/4	861	0.098	23.0	296.2	10.8
2/5	1050	0.124	23.0	296.2	12.1
2/6	1179	0.128	23.0	296.2	12.3
Average			23.0	296.2	11.0

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -4 mm
Absolute pressure in stack (hPa) : 1024.61 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 2
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.92 x $10^{-5}m^2$
Thimble No: T441
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 98.6598 Meter finish: 98.6598
Time start: 13:33 Time finish: 13:34

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 99.4850 Meter finish: 99.4850
Time start: 13:41 Time finish: 13:42

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 98.6634 Time start: 12:40
Meter correction factor (GMf) : 1.0050

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	0:04:30	56	13.4	25.0	19.0		Yes
1/2	0:04:45	185	13.4	27.0	19.0		Yes
1/3	0:05:00	374	13.4	29.0	19.0		Yes
1/4	0:04:45	891	13.4	30.0	19.0		Yes
1/5	0:04:45	1080	13.4	31.0	19.0		Yes
1/6	0:05:15	1209	13.4	32.0	20.0		Yes
2/1	0:04:45	56	13.4	32.0	20.0		Yes
2/2	0:05:15	185	13.4	32.0	20.0		Yes
2/3	0:05:00	374	13.4	32.0	21.0		Yes
2/4	0:05:00	891	13.4	32.0	21.0		Yes
2/5	0:05:30	1080	13.4	33.0	21.0		Yes
2/6	0:05:30	1209	13.4	34.0	21.0		Yes
Averages				30.8	19.9	no result	

Meter Finish: 99.4823 Time Finish: 13:40
Total Condensate collected: 2 ml Silica gel No(s) used: cc12

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 2
Sample Nozzle No.: S2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.42 x 10^{-5} m^2
Thimble No: T462
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 385.7996 Meter finish: 385.7996
Time start: 13:35 Time finish: 13:36

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 386.3401 Meter finish: 386.3401
Time start: 13:43 Time finish: 13:44

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 385.8022 Time start: 12:40
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	0:05:00	56	8.7	23.0	19.0		Yes
1/2	0:10:00	185	9.0	25.0	19.0		Yes
1/3	0:15:00	374	9.3	27.0	19.0		Yes
1/4	0:20:00	891	9.0	28.0	19.0		Yes
1/5	0:25:00	1080	9.1	28.0	19.0		Yes
1/6	0:30:00	1209	9.9	29.0	20.0		Yes
2/1	0:35:00	56	8.5	29.0	20.0		Yes
2/2	0:40:00	185	10.0	29.0	20.0		Yes
2/3	0:45:00	374	9.3	30.0	20.0		Yes
2/4	0:50:00	891	9.2	30.0	20.0		Yes
2/5	0:55:00	1080	10.3	31.0	21.0		Yes
2/6	1:00:00	1209	10.5	32.0	21.0		Yes
Averages				28.4	19.8	no result	

Meter Finish: 386.3377 Time Finish: 13:40
Total Condensate collected: 0 ml Silica gel No(s) used: p35

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

#N/A

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 2
Sample Nozzle No.: S9
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.39 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 190.7836 Meter finish: 190.7836
Time start: 13:37 Time finish: 13:38

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 191.3702 Meter finish: 191.3702
Time start: 13:45 Time finish: 13:46

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 190.7900 Time start: 12:40
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	0:05:00	56	8.6	26.0	18.0		Yes
1/2	0:10:00	185	8.8	28.0	18.0		Yes
1/3	0:15:00	374	9.2	29.0	18.0		Yes
1/4	0:20:00	891	8.8	30.0	19.0		Yes
1/5	0:25:00	1080	9.0	31.0	19.0		Yes
1/6	0:30:00	1209	9.8	32.0	19.0		Yes
2/1	0:35:00	56	8.4	32.0	19.0		Yes
2/2	0:40:00	185	9.9	32.0	19.0		Yes
2/3	0:45:00	374	9.2	33.0	20.0		Yes
2/4	0:50:00	891	9.1	33.0	20.0		Yes
2/5	0:55:00	1080	10.2	34.0	20.0		Yes
2/6	1:00:00	1209	10.4	34.0	20.0		Yes
Averages				31.2	19.1	no result	

Meter Finish: 191.3682 Time Finish: 13:40
Total Condensate collected: 1 ml Silica gel No(s) used: F28

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 2
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate
Test 3:Total Fluoride

Time :	13:50	Barometric Pressure :		1025	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	26	0.095	24.0	297.2	10.6
1/2	155	0.098	24.0	297.2	10.8
1/3	344	0.102	24.0	297.2	11.0
1/4	861	0.097	24.0	297.2	10.7
1/5	1050	0.114	24.0	297.2	11.6
1/6	1179	0.118	24.0	297.2	11.8
2/1	26	0.095	24.0	297.2	10.6
2/2	155	0.097	24.0	297.2	10.7
2/3	344	0.113	24.0	297.2	11.6
2/4	861	0.121	24.0	297.2	12.0
2/5	1050	0.108	24.0	297.2	11.3
2/6	1179	0.084	24.0	297.2	10.0
Average			24.0	297.2	11.1

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -5.1 mm
Absolute pressure in stack (hPa) : 1024.50 hPa

STACK ANALYSIS - PM10 CALCULATIONS

Date:	29-Jun-16	Client:	Weston Aluminium
AECOM's Project No:	60489919	Stack/Duct Description:	Stack 2

1. Gas Analysis

	%		
$\%CO_2$	0.0		
$\%O_2$	20.9		
$\%N_2+\%CO$	79.1		
Fraction Moisture Content, Bws	0.01	M_s=	0.99

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	28.84
Mol. Wt. of Stack Gas (wet)	28.68

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	102500	30.26
Stack Static Pressure (Pg)	102450	30.24
Absolute Stack Pressure		30.24

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	24.0	75.2
Average Meter Temperature:	25.3	
Stack Gas Viscosity		182.0

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.45	0.0158	15.81	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	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1	0.132	78.66	25.89	0.757	1.230	59.57	19.54	96.71	31.73
2	0.154	57.74	19.01	0.730	1.246	42.18	13.84	71.97	23.61
3	0.160	53.55	17.63	0.721	1.252	38.63	12.68	67.04	21.99
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.195	36.03	11.86	0.646	1.292	23.29	7.64	46.53	15.27
6	0.219	28.45	9.37	0.559	1.328	15.91	5.22	37.78	12.39
7	0.235	24.77	8.15	0.469	1.355	12.38	4.06	33.55	11.01
8	0.261	20.08	6.61	#NUM!	1.405	10.04	3.29	28.22	9.26
9	0.296	15.65	5.15	#NUM!	1.485	7.83	2.57	23.25	7.63
10	0.341	11.77	3.87	#NUM!	1.609	5.89	1.93	17.66	5.79
11	0.389	9.04	2.98	#NUM!	1.763	4.52	1.48	13.56	4.45

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
5	0.195	0.005	0.000019	13.5

STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 29-Jun-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 2

7.Sampling Time Total Run Time 60 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
95.16	0.38	0.62	4.8
98.10	0.39	0.63	4.9
102.02	0.41	0.64	5.0
97.12	0.39	0.62	4.8
113.80	0.46	0.68	5.2
117.72	0.47	0.69	5.3
95.16	0.38	0.62	4.8
97.12	0.39	0.62	4.8
112.82	0.45	0.67	5.2
120.66	0.48	0.70	5.4
107.91	0.43	0.66	5.1
84.37	0.34	0.58	4.5
	Average	0.64	60.00
	Square	0.41	

Total time min	Full hours	Full minutes	Seconds
4.5	0	4	30
9.3	0	9	15
14.3	0	14	15
19.0	0	19	0
23.8	0	23	45
29.0	0	29	0
33.8	0	33	45
39.0	0	39	0
44.0	0	44	0
49.0	0	49	0
54.5	0	54	30
60.0	1	0	0

Aerodynamic Cut Size (u_{cyc})
183.0

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0129

Actual D_{50}
9.9

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 29-Jun-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8230	m^3	Average barometric pressure (P_{BARO})	1025 hPa
Average gas meter temp. ($T_{M,2}$):	25.3	°C		
	298.5	K	Average pressure at meter ($P_{M,2}$)	1025.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7620	m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: T441 PM10 Weight <0.0002 g

Final PM10 Weight (Mp1): <0.0002 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: cc12

V_v = 5.2 g (from laboratory report) V_w = 2 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0027

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0069

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

B_{ws} = 1.25 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.192 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 11.02 m/s

(ii) Average of post-sampling velocities: 11.06 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 11.04 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 = 13.88 m^3/s (stack conditions)

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

Qstd = 12.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.0033	g/s (0°C, dry gas, 1 atm pressure)		
	=	<3.3	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.0033	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<3.3	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<0.46	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<460	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 29-Jun-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.5355 m^3

Average gas meter temp. ($T_{M,2}$): 24.1 °C

297.3 K

Average barometric pressure (P_{BARO}) 1025 hPa

Average pressure at meter ($P_{M,2}$) 1025.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.4978 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: T462

Blank weight: g

Total Particulate Weight 0.0002 g

Final Total Particulate Weight (Mp1): 0.00020 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.0004 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.4 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0004 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.4 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.056 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 56 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: p35

V_v = 2.7 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0036

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

B_{ws} = 0.72 %

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

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

= 1.192 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 11.02 m/s

(ii) Average of post-sampling velocities: 11.06 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 11.04 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 = 13.88 m^3/s (stack conditions)

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

Qstd = 12.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0051	g/s (0°C, dry gas, 1 atm pressure)		
	=	5.1	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0051	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	5.1	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.72	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	720	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Total Fluoride

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

Date: 29-Jun-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.5840 m^3
Average gas meter temp. ($T_{M,2}$): 25.1 °C
298.3 K
Average barometric pressure (P_{BARO}) 1025 hPa
Average pressure at meter ($P_{M,2}$) 1025.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.5411 m^3

(B) Total Fluoride concentration at standard conditions

Blank thimble No.: NA
Thimble No. used: NA
Blank weight: g
Total Fluoride Weight 0.00004 g
Final Total Fluoride Weight (Mp1): 0.00004 g
Total Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.000074 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.074 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %
Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.000074 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.074 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %
Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.01 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 10 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F28
V_v = 4.7 g (from laboratory report) V_w = 1 mL (=grams) (recorded on Laboratory Form 108)
Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0013
Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0063
Therefore, $B_{ws} = \frac{(V_{wc(std)}+V_{wsg(std)})}{(V_{wc(std)}+V_{wsg(std)}+V_{m(std)})}$

B_{ws} = 1.39 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Fluoride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.192 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 11.02 m/s

(ii) Average of post-sampling velocities: 11.06 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 11.04 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 = 13.88 m^3/s (stack conditions)

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

Qstd = 12.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.00094	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.94	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.00094	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.94	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.13	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	130	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 2
WESTON ALUMINIUM
29-Jun-16
FINE PARTICULATE (PM10)
TOTAL PARTICULATE
TOTAL FLUORIDE

Sampling Conditions:			
Stack internal diameter at test location	1265 mm		
Stack gas temperature (average)	23.5 °C		296.7 K
Stack pressure (average)	1025 hPa		
Stack gas velocity (average, stack conditions)	11 m/s		
Stack gas flowrate (stack conditions)	14 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	13 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	12:40	-	13:40
Fine Particulate (PM10) Mass	<0.2 mg		
Gas Volume Sampled	0.762 m^3		
Fine Particulate (PM10) Emission*1	<0.26 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	<3.3 mg/s		
Regulatory Limit	NA mg/m^3		
Total Particulate Testing			
Test Period	12:40	-	13:40
Total Particulate Mass	0.2 mg		
Gas Volume Sampled	0.498 m^3		
Total Particulate Emission*1	0.4 mg/m^3		
Total Particulate Mass Emission Rate*2	5.1 mg/s		
Regulatory Limit	35 mg/m^3		
Total Fluoride Testing			
Test Period	12:40	-	13:40
Total Fluoride Mass	0.04 mg		
Gas Volume Sampled	0.541 m^3		
Total Fluoride Emission*1	0.074 mg/m^3		
Total Fluoride Mass Emission Rate*2	0.94 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.1		
Gas Density (dry at 1 atmosphere)	1.29 kg/m^3		
Dry Molecular Weight	28.8 g/g-mole		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 3

Date Sampled: 29-Jun-16

ANALYTE(S)	METHOD
Fine Particulate (PM10)	NSW EPA OM - 5
Total Particulate	NSW EPA TM - 15
Total Fluoride	NSW EPA TM - 9

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

Dylan Turnbull

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - PRE-SAMPLING

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 3
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Measurement/Observations

Stack Internal Dimensions:

Diameter 1000 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 0.79 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 6
No. Diameters = 6.0
Type of Upstream Disturbance: Fan
Downstream (m) = 3
No. Diameters = 3.0
Type of Down Stream Disturbance: Stack Exit

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:

No.	A Distance from wall	B S-type Pitot distances	PM10/2.5 A Distance from wall	PM2.5/10 B S-Type Pitot distances
1	44	14	44	14
2	146	116	146	116
3	296	266	296	266
4	704	674	704	674
5	854	824	854	824
6	956	926	956	926
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 3
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Sampling time start: 10:20		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:20	0	20.9	0.0
2	10:21	0	20.9	0.0
3	10:22	0	20.9	0.0
4	10:23	0	20.9	0.0
5	10:24	0	20.9	0.0
6	10:25	0	20.9	0.0
7	10:26	0	20.9	0.0
8	10:27	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.40 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	78.0 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.40 %(=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: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 3
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Sampling time start: 11:30		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:30	0	20.9	0.0
2	11:31	0	20.9	0.0
3	11:32	0	20.9	0.0
4	11:33	0	20.9	0.0
5	11:34	0	20.9	0.0
6	11:35	0	20.9	0.0
7	11:36	0	20.9	0.0
8	11:37	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.45 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	78.0 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.45 %(=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: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 3
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate
Test 3:Total Fluoride

Time :	10:20	Barometric Pressure :		1025	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	14	0.072	20.0	293.2	9.1
1/2	116	0.077	20.0	293.2	9.5
1/3	266	0.079	20.0	293.2	9.6
1/4	674	0.100	20.0	293.2	10.8
1/5	824	0.110	20.0	293.2	11.3
1/6	926	0.117	20.0	293.2	11.7
2/1	14	0.100	20.0	293.2	10.8
2/2	116	0.106	20.0	293.2	11.1
2/3	266	0.098	20.0	293.2	10.7
2/4	674	0.107	20.0	293.2	11.2
2/5	824	0.096	20.0	293.2	10.6
2/6	926	0.099	20.0	293.2	10.8
Average			20.0	293.2	10.6

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 1 mm
Absolute pressure in stack (hPa) : 1025.10 hPa

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 3
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.92 x $10^{-5}m^2$
Thimble No: T452
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 97.8725 Meter finish: 97.8725
Time start: 10:41 Time finish: 10:42

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 98.6592 Meter finish: 98.6592
Time start: 11:55 Time finish: 11:56

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 97.8738 Time start: 10:54
Meter correction factor (GMf) : 1.0005

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	0:04:15	44	13.3	21.0	15.0		Yes
1/2	0:04:30	146	13.3	24.0	15.0		Yes
1/3	0:04:30	296	13.3	26.0	16.0		Yes
1/4	0:05:00	704	13.3	28.0	16.0		Yes
1/5	0:05:30	854	13.3	28.0	17.0		Yes
1/6	0:05:30	956	13.3	29.0	17.0		Yes
2/1	0:05:00	44	13.3	29.0	17.0		Yes
2/2	0:05:15	146	13.3	30.0	17.0		Yes
2/3	0:05:00	296	13.3	30.0	18.0		Yes
2/4	0:05:15	704	13.3	31.0	18.0		Yes
2/5	0:05:00	854	13.3	31.0	18.0		Yes
2/6	0:05:15	956	13.3	31.0	18.0		Yes
Averages				28.2	16.8	no result	

Meter Finish: 98.6584 Time Finish: 11:54
Total Condensate collected: 0 ml Silica gel No(s) used: P5

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 3
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.42 x $10^{-6}m^2$
Thimble No: T461
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 358.2114 Meter finish: 358.2114
Time start: 10:43 Time finish: 10:44

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 385.7983 Meter finish: 385.7983
Time start: 11:57 Time finish: 11:58

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 385.2125 Time start: 10:54
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	0:05:00	44	7.8	20.0	15.0		Yes
1/2	0:10:00	146	8.2	24.0	15.0		Yes
1/3	0:15:00	296	8.3	25.0	16.0		Yes
1/4	0:20:00	704	9.3	27.0	16.0		Yes
1/5	0:25:00	854	9.7	27.0	16.0		Yes
1/6	0:30:00	956	10.1	27.0	16.0		Yes
2/1	0:35:00	44	9.3	28.0	17.0		Yes
2/2	0:40:00	146	9.6	28.0	18.0		Yes
2/3	0:45:00	296	9.2	29.0	18.0		Yes
2/4	0:50:00	704	9.7	30.0	18.0		Yes
2/5	0:55:00	854	9.1	30.0	18.0		Yes
2/6	1:00:00	956	9.3	30.0	18.0		Yes
Averages				27.1	16.8	no result	

Meter Finish: 385.7977 Time Finish: 11:54
Total Condensate collected: 0 ml Silica gel No(s) used: P32

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

#N/A

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 3
Sample Nozzle No.: s9
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 1.39 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 190.2512 Meter finish: 190.2512
Time start: 10:45 Time finish: 10:46

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 190.7799 Meter finish: 190.7799
Time start: 11:59 Time finish: 12:00

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 190.2525 Time start: 10:54
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	0:05:00	44	7.8	21.0	15.0		Yes
1/2	0:10:00	146	8.1	23.0	15.0		Yes
1/3	0:15:00	296	8.2	25.0	15.0		Yes
1/4	0:20:00	704	9.2	28.0	16.0		Yes
1/5	0:25:00	854	9.6	28.0	16.0		Yes
1/6	0:30:00	956	10.0	28.0	16.0		Yes
2/1	0:35:00	44	9.2	28.0	16.0		Yes
2/2	0:40:00	146	9.5	29.0	17.0		Yes
2/3	0:45:00	296	9.1	30.0	18.0		Yes
2/4	0:50:00	704	9.5	31.0	19.0		Yes
2/5	0:55:00	854	9.0	31.0	19.0		Yes
2/6	1:00:00	956	9.2	31.0	19.0		Yes
Averages				27.8	16.8	no result	

Meter Finish: 190.7791 Time Finish: 11:54
Total Condensate collected: 1 ml Silica gel No(s) used: VK2

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 3
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate
Test 3:Total Fluoride

Time :	12:00	Barometric Pressure :		1025	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	14	0.074	24.0	297.2	9.3
1/2	116	0.087	24.0	297.2	10.2
1/3	266	0.098	24.0	297.2	10.8
1/4	674	0.107	24.0	297.2	11.3
1/5	824	0.111	24.0	297.2	11.5
1/6	926	0.131	24.0	297.2	12.5
2/1	14	0.091	24.0	297.2	10.4
2/2	116	0.088	24.0	297.2	10.2
2/3	266	0.099	24.0	297.2	10.8
2/4	674	0.101	24.0	297.2	10.9
2/5	824	0.107	24.0	297.2	11.3
2/6	926	0.114	24.0	297.2	11.6
Average			24.0	297.2	10.9

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 9 mm
Absolute pressure in stack (hPa) : 1025.88 hPa

STACK ANALYSIS - PM10 CALCULATIONS

Date:	29-Jun-16	Client:	Weston Aluminium
AECOM's Project No:	60489919	Stack/Duct Description:	Stack 3

1. Gas Analysis

	%		
$\%CO_2$	0.0		
$\%O_2$	20.9		
$\%N_2+\%CO$	79.1		
Fraction Moisture Content, Bws	0.02	M_s=	0.98

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	28.84
Mol. Wt. of Stack Gas (wet)	28.68

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	102500	30.26
Stack Static Pressure (Pg)	102588	30.29
Absolute Stack Pressure		30.29

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	24.0	75.2
Average Meter Temperature:	22.5	
Stack Gas Viscosity		181.4

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.45	0.0158	15.76	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	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1	0.132	78.39	25.80	0.757	1.230	59.37	19.48	96.39	31.62
2	0.154	57.54	18.94	0.730	1.246	42.03	13.79	71.73	23.53
3	0.160	53.37	17.57	0.721	1.252	38.50	12.63	66.81	21.92
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.195	35.90	11.82	0.646	1.292	23.21	7.61	46.38	15.22
6	0.219	28.36	9.33	0.559	1.328	15.86	5.20	37.65	12.35
7	0.235	24.68	8.12	0.469	1.355	12.34	4.05	33.44	10.97
8	0.261	20.01	6.59	#NUM!	1.406	10.01	3.28	28.13	9.23
9	0.296	15.60	5.13	#NUM!	1.485	7.80	2.56	23.17	7.60
10	0.341	11.73	3.86	#NUM!	1.609	5.87	1.92	17.60	5.77
11	0.389	9.01	2.97	#NUM!	1.763	4.51	1.48	13.52	4.44

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
5	0.195	0.005	0.000019	13.1

STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 29-Jun-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 3

7.Sampling Time Total Run Time 60 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
73.58	0.30	0.54	4.3
87.31	0.35	0.59	4.7
96.10	0.39	0.63	4.9
106.93	0.43	0.66	5.2
110.85	0.44	0.67	5.3
131.45	0.53	0.73	5.7
91.23	0.37	0.61	4.8
88.29	0.35	0.60	4.7
99.08	0.40	0.63	5.0
101.04	0.41	0.64	5.0
106.93	0.43	0.66	5.2
113.80	0.46	0.68	5.3
	Average	0.63	60.00
	Square	0.40	

Total time min	Full hours	Full minutes	Seconds
4.3	0	4	15
8.8	0	8	45
13.3	0	13	15
18.3	0	18	15
23.8	0	23	45
29.3	0	29	15
34.3	0	34	15
39.5	0	39	30
44.5	0	44	30
49.8	0	49	45
54.8	0	54	45
60.0	1	0	0

Aerodynamic Cut Size (u_{ovc})
183.5

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0124

Actual D_{50}
10.1

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 29-Jun-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 3

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.7850	m^3	Average barometric pressure (P_{BARO})	1025 hPa
Average gas meter temp. ($T_{M,2}$):	22.5	°C		
	295.7	K	Average pressure at meter ($P_{M,2}$)	1025.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7337	m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.:	NA		Blank weight:	g
Thimble No. used:	T452		PM10 Weight	<0.0002 g
Final PM10 Weight (Mp1):	<0.0002	g		
PM10 Concentration (C1):		$=M_{p1}/MV_4=$	<0.00027	g/m^3 (0°C, dry gas, 1atm pressure)
		;and C_2 =	<0.27	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.00027 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <0.27 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.038 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <38 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P5

V_v = 11.1 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0148

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

B_{ws} = 1.98 %

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

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

= 1.208 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 10.60 m/s

(ii) Average of post-sampling velocities: 10.90 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 10.75 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 = 8.44 m^3/s (stack conditions)

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

Qstd = 7.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.0021	g/s (0°C, dry gas, 1 atm pressure)		
	=	<2.1	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.0021	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<2.1	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<0.29	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<290	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 29-Jun-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 3

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.5852 m^3
Average gas meter temp. ($T_{M,2}$): 21.9 °C
295.1 K
Average barometric pressure (P_{BARO}) 1025 hPa
Average pressure at meter ($P_{M,2}$) 1025.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.5481 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: NA
Thimble No. used: T461
Blank weight: g
Total Particulate Weight 0.0003 g
Final Total Particulate Weight (Mp1): 0.00030 g
Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.00055 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.55 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %
Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00055 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.55 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %
Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.077 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 77 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P32
V_v = 4 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)
Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000
Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0053
Therefore, $B_{ws} = \frac{(V_{wc(std)}+V_{wsg(std)})}{(V_{wc(std)}+V_{wsg(std)}+V_{m(std)})}$

B_{ws} = 0.96 %

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

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

= 1.199 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 10.60 m/s

(ii) Average of post-sampling velocities: 10.90 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 10.75 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 = 8.44 m^3/s (stack conditions)

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

Qstd = 7.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0043	g/s (0°C, dry gas, 1 atm pressure)		
	=	4.3	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0043	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	4.3	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.6	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	600	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Total Fluoride

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

Date: 29-Jun-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 3

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.5319 m^3
Average gas meter temp. ($T_{M,2}$): 22.3 °C
295.5 K
Average barometric pressure (P_{BARO}) 1025 hPa
Average pressure at meter ($P_{M,2}$) 1025.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.4975 m^3

(B) Total Fluoride concentration at standard conditions

Blank thimble No.: NA
Thimble No. used: NA
Blank weight: g
Total Fluoride Weight 0.00004 g
Final Total Fluoride Weight (Mp1): 0.00004 g
Total Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.00008 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.08 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %
Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00008 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.08 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %
Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.011 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 11 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: VK2
V_s = 4.3 g (from laboratory report) V_w = 1 mL (=grams) (recorded on Laboratory Form 108)
Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0013
Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0057
Therefore, $B_{ws} = \frac{(V_{wc(std)}+V_{wsg(std)})}{(V_{wc(std)}+V_{wsg(std)}+V_{m(std)})}$

B_{ws} = 1.40 %

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Fluoride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.199 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 10.60 m/s

(ii) Average of post-sampling velocities: 10.90 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 10.75 m/s (stack conditions, wet)
(**Note**: (Vs) is from all individual data, **not** from (i) and (ii) alone.) N/A m/s (stack conditions, wet)

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

Qstack = Vs x A = 8.44 m^3/s (stack conditions)

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

Qstd = 7.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.00062	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.62	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.00062	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.62	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.087	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	87	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

ANZ

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 3
WESTON ALUMINIUM
29-Jun-16
FINE PARTICULATE (PM10)
TOTAL PARTICULATE
TOTAL FLUORIDE

Sampling Conditions:			
Stack internal diameter at test location	1000 mm		
Stack gas temperature (average)	22.0 °C		295.2 K
Stack pressure (average)	1025 hPa		
Stack gas velocity (average, stack conditions)	11 m/s		
Stack gas flowrate (stack conditions)	8.4 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	7.8 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	10:54	-	11:54
Fine Particulate (PM10) Mass	<0.2 mg		
Gas Volume Sampled	0.734 m^3		
Fine Particulate (PM10) Emission*1	<0.27 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	<2.1 mg/s		
Regulatory Limit	NA mg/m^3		
Total Particulate Testing			
Test Period	10:54	-	11:54
Total Particulate Mass	0.3 mg		
Gas Volume Sampled	0.548 m^3		
Total Particulate Emission*1	0.55 mg/m^3		
Total Particulate Mass Emission Rate*2	4.3 mg/s		
Regulatory Limit	50 mg/m^3		
Total Fluoride Testing			
Test Period	10:54	-	11:54
Total Fluoride Mass	0.04 mg		
Gas Volume Sampled	0.497 m^3		
Total Fluoride Emission*1	0.08 mg/m^3		
Total Fluoride Mass Emission Rate*2	0.62 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.2		
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 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 4

Date Sampled: 29-Jun-16

ANALYTE(S)	METHOD
Fine Particulate (PM10)	NSW EPA OM - 5
Total Particulate	NSW EPA TM - 15
Total Fluoride	NSW EPA TM - 9

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

Dylan Turnbull

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 4
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Measurement/Observations

Stack Internal Dimensions:

Diameter 1395 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 1.53 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 8
No. Diameters = 5.7
Type of Upstream Disturbance: Fan
Downstream (m) = 5
No. Diameters = 3.6
Type of Down Stream Disturbance: Stack Exit

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	61	31	61	31
2	204	174	204	174
3	413	383	413	383
4	982	952	982	952
5	1191	1161	1191	1161
6	1334	1304	1334	1304
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 4
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Sampling time start: 8:49		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	8:49	0	20.9	0.0
2	8:50	0	20.9	0.0
3	8:51	0	20.9	0.0
4	8:52	0	20.9	0.0
5	8:53	0	20.9	0.0
6	8:54	0	20.9	0.0
7	8:55	0	20.9	0.0
8	8:56	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.40 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	78.0 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.40 %(=M2)		

Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 4
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Sampling time start:	9:49	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	9:49	0	20.9	0.0
2	9:50	0	20.9	0.0
3	9:51	0	20.9	0.0
4	9:52	0	20.9	0.0
5	9:53	0	20.9	0.0
6	9:54	0	20.9	0.0
7	9:55	0	20.9	0.0
8	9:56	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.11 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	78.2 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.7 %,(wet)
H_2O:	1.11 %(=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: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 4
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate
Test 3:Total Fluoride

Time :	8:28	Barometric Pressure :	1025	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	31	0.253	25.0	298.2	17.4
1/2	174	0.236	25.0	298.2	16.8
1/3	383	0.230	25.0	298.2	16.5
1/4	952	0.242	25.0	298.2	17.0
1/5	1161	0.247	25.0	298.2	17.2
1/6	1304	0.246	25.0	298.2	17.1
2/1	31	0.240	25.0	298.2	16.9
2/2	174	0.235	25.0	298.2	16.7
2/3	383	0.251	25.0	298.2	17.3
2/4	952	0.264	25.0	298.2	17.7
2/5	1161	0.228	25.0	298.2	16.5
2/6	1304	0.240	25.0	298.2	16.9
Average			25.0	298.2	17.0

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -14 mm
Absolute pressure in stack (hPa) : 1023.63 hPa

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 4
Sample Nozzle No.: fine3
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.29 x $10^{-5}m^2$
Thimble No: T411
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 97.0920 Meter finish: 97.0920
Time start: 8:45 Time finish: 8:46

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 97.8712 Meter finish: 97.8712
Time start: 9:57 Time finish: 9:58

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 97.0938 Time start: 8:56
Meter correction factor (GMf) : 1.0005

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	0:05:00	61	13.3	16.0	9.0		Yes
1/2	0:05:00	204	13.3	18.0	9.0		Yes
1/3	0:04:45	413	13.3	20.0	9.0		Yes
1/4	0:05:00	982	13.3	22.0	10.0		Yes
1/5	0:05:00	1191	13.3	24.0	10.0		Yes
1/6	0:05:00	1334	13.3	25.0	11.0		Yes
2/1	0:05:00	61	13.3	26.0	12.0		Yes
2/2	0:05:00	204	13.3	27.0	13.0		Yes
2/3	0:05:00	413	13.3	28.0	14.0		Yes
2/4	0:05:15	982	13.3	28.0	14.0		Yes
2/5	0:05:00	1191	13.3	29.0	15.0		Yes
2/6	0:05:00	1334	13.3	30.0	15.0		Yes
Averages				24.4	11.8	no result	

Meter Finish: 97.8702 Time Finish: 9:56
Total Condensate collected: 1 ml Silica gel No(s) used: 134

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 4
Sample Nozzle No.: S2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.42 x 10^{-5} m^2
Thimble No: T448
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 384.3518 Meter finish: 384.3518
Time start: 8:47 Time finish: 8:48

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 385.2081 Meter finish: 385.2081
Time start: 9:59 Time finish: 10:00

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 384.3536 Time start: 8:56
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	0:05:00	61	14.7	17.0	9.0		Yes
1/2	0:10:00	204	14.2	19.0	9.0		Yes
1/3	0:15:00	413	14.0	21.0	10.0		Yes
1/4	0:20:00	982	14.4	24.0	11.0		Yes
1/5	0:25:00	1191	14.6	25.0	11.0		Yes
1/6	0:30:00	1334	14.5	27.0	12.0		Yes
2/1	0:35:00	61	14.3	28.0	12.0		Yes
2/2	0:40:00	204	14.1	29.0	13.0		Yes
2/3	0:45:00	413	14.6	30.0	14.0		Yes
2/4	0:50:00	982	15.0	30.0	14.0		Yes
2/5	0:55:00	1191	14.0	31.0	15.0		Yes
2/6	1:00:00	1334	14.3	31.0	16.0		Yes
Averages				26.0	12.2	no result	

Meter Finish: 385.2073 Time Finish: 9:56
Total Condensate collected: 1 ml Silica gel No(s) used: z9

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL FLUORIDE

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 4
Sample Nozzle No.: S9
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 1.39 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 189.3918 Meter finish: 189.3918
Time start: 8:49 Time finish: 8:50
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 190.2499 Meter finish: 190.2499
Time start: 10:01 Time finish: 10:02
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1025 hPa (start); 1025 hPa (finish)
Meter start: 189.3932 Time start: 8:56
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	0:05:00	61	14.6	18.0	9.0		Yes
1/2	0:10:00	204	14.1	20.0	10.0		Yes
1/3	0:15:00	413	13.8	23.0	11.0		Yes
1/4	0:20:00	982	14.2	25.0	11.0		Yes
1/5	0:25:00	1191	14.4	26.0	12.0		Yes
1/6	0:30:00	1334	14.3	27.0	12.0		Yes
2/1	0:35:00	61	14.1	28.0	13.0		Yes
2/2	0:40:00	204	14.0	29.0	13.0		Yes
2/3	0:45:00	413	14.5	30.0	14.0		Yes
2/4	0:50:00	982	14.8	30.0	14.0		Yes
2/5	0:55:00	1191	13.8	31.0	15.0		Yes
2/6	1:00:00	1334	14.1	32.0	16.0		Yes
Averages				26.6	12.5	no result	

Meter Finish: 190.2493 Time Finish: 9:56
Total Condensate collected: 0 ml Silica gel No(s) used: JL308

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Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 29-Jun-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 4
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate
Test 3:Total Fluoride

Time :	10:05	Barometric Pressure :		1025	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	31	0.219	23.0	296.2	16.1
1/2	174	0.251	23.0	296.2	17.2
1/3	383	0.239	23.0	296.2	16.8
1/4	952	0.255	23.0	296.2	17.4
1/5	1161	0.233	23.0	296.2	16.6
1/6	1304	0.244	23.0	296.2	17.0
2/1	31	0.245	23.0	296.2	17.0
2/2	174	0.230	23.0	296.2	16.5
2/3	383	0.240	23.0	296.2	16.8
2/4	952	0.252	23.0	296.2	17.3
2/5	1161	0.264	23.0	296.2	17.7
2/6	1304	0.220	23.0	296.2	16.1
Average			23.0	296.2	16.9

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -13 mm
Absolute pressure in stack (hPa) : 1023.72 hPa

STACK ANALYSIS - PM10 CALCULATIONS

Date:	29-Jun-16	Client:	Weston Aluminium
AECOM's Project No:	60489919	Stack/Duct Description:	Stack 4

1. Gas Analysis

	%		
$\%CO_2$	0.0		
$\%O_2$	20.9		
$\%N_2+\%CO$	79.1		
Fraction Moisture Content, Bws	0.01	M_s=	0.99

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	28.84
Mol. Wt. of Stack Gas (wet)	28.68

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	102500	30.26
Stack Static Pressure (Pg)	102372	30.22
Absolute Stack Pressure		30.22

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	23.0	73.4
Average Meter Temperature:	18.1	
Stack Gas Viscosity		181.4

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.45	0.0157	15.75	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	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1	0.132	78.35	25.79	0.757	1.230	59.33	19.47	96.34	31.61
2	0.154	57.51	18.93	0.730	1.247	42.01	13.78	71.69	23.52
3	0.160	53.34	17.56	0.721	1.252	38.48	12.62	66.78	21.91
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.195	35.88	11.81	0.646	1.292	23.19	7.61	46.35	15.21
6	0.219	28.34	9.33	0.559	1.328	15.84	5.20	37.63	12.35
7	0.235	24.67	8.12	0.469	1.355	12.33	4.05	33.42	10.96
8	0.261	20.00	6.58	#NUM!	1.406	10.00	3.28	28.12	9.22
9	0.296	15.59	5.13	#NUM!	1.486	7.79	2.56	23.16	7.60
10	0.341	11.72	3.86	#NUM!	1.610	5.86	1.92	17.59	5.77
11	0.389	9.01	2.96	#NUM!	1.763	4.50	1.48	13.51	4.43

Selected Nozzle	Nozzle Diameter (inches)	Nozzle Diameter (m)	Nozzle Area (m^2)	Sample Rate (L/min)
3	0.160	0.004	0.000013	13.1

STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 29-Jun-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 4

7.Sampling Time Total Run Time 60 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
218.76	0.88	0.94	4.8
251.14	1.01	1.00	5.1
239.36	0.96	0.98	5.0
255.06	1.02	1.01	5.1
233.48	0.94	0.97	4.9
244.27	0.98	0.99	5.0
245.25	0.98	0.99	5.0
229.55	0.92	0.96	4.9
240.35	0.96	0.98	5.0
252.12	1.01	1.01	5.1
263.89	1.06	1.03	5.2
219.74	0.88	0.94	4.8
	Average	0.96	60.00
	Square	0.97	

Total time min	Full hours	Full minutes	Seconds
5.0	0	5	0
10.0	0	10	0
14.8	0	14	45
19.8	0	19	45
24.8	0	24	45
29.8	0	29	45
34.8	0	34	45
39.8	0	39	45
44.8	0	44	45
50.0	0	50	0
55.0	0	55	0
60.0	1	0	0

Aerodynamic Cut Size (u_{cyc})
182.7

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0125

Actual D_{50}
10.1

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 29-Jun-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 4

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.7768	m^3	Average barometric pressure (P_{BARO})	1025 hPa
Average gas meter temp. ($T_{M,2}$):	18.1	°C		
	291.3	K	Average pressure at meter ($P_{M,2}$)	1025.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7370	m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.:	NA		Blank weight:	g
Thimble No. used:	T411		PM10 Weight	0.0005 g
Final PM10 Weight (Mp1):	0.00050	g		
PM10 Concentration (C1):		$=M_{p1}/MV_4=$	0.00068	g/m^3 (0°C, dry gas, 1atm pressure)
		;and C_2 =	0.68	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00068 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.68 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.095 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 95 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: 134

V_v = 6.8 g (from laboratory report) V_w = 1 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0013

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0091

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

B_{ws} = 1.39 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.189 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 17.00 m/s

(ii) Average of post-sampling velocities: 16.88 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 16.94 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 = 25.89 m^3/s (stack conditions)

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

Qstd = 23.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.016	g/s (0°C, dry gas, 1 atm pressure)		
	=	16	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.016	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	16	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	2.3	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	2300	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 29-Jun-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 4

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8537	m^3	Average barometric pressure (P_{BARO})	1025 hPa
Average gas meter temp. ($T_{M,2}$):	19.1	°C		
	292.3	K	Average pressure at meter ($P_{M,2}$)	1025.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.8072	m^3		

(B) Total Particulate concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: T448 Total Particulate Weight 0.0015 g

Final Total Particulate Weight (Mp1): 0.00150 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.0019 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 1.9 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0019 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 1.9 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.27 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 270 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: z9

V_v = 5 g (from laboratory report) V_w = 1 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0013

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0067

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

B_{ws} = 0.98 %

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

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

= 1.189 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 17.00 m/s

(ii) Average of post-sampling velocities: 16.88 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 16.94 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 = 25.89 m^3/s (stack conditions)

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

Qstd = 23.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.045	g/s (0°C, dry gas, 1 atm pressure)		
	=	45	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.045	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	45	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	6.3	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	6300	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Total Fluoride

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

Date: 29-Jun-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 4

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.8647 m^3

Average gas meter temp. ($T_{M,2}$): 19.5 °C

292.7 K

Average barometric pressure (P_{BARO}) 1025 hPa

Average pressure at meter ($P_{M,2}$) 1025.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.8165 m^3

(B) Total Fluoride concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: NA

Blank weight: g

Total Fluoride Weight 0.00008 g

Final Total Fluoride Weight (Mp1): 0.00008 g

Total Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.000098 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.098 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.000098 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.098 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.014 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 14 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: JL308

V_v = 5.9 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0079

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

B_{ws} = 0.96 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Fluoride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.189 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 17.00 m/s

(ii) Average of post-sampling velocities: 16.88 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 16.94 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 = 25.89 m^3/s (stack conditions)

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

Qstd = 23.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0023	g/s (0°C, dry gas, 1 atm pressure)		
	=	2.3	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0023	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	2.3	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.33	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	330	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, STACK 4
WESTON ALUMINIUM
29-Jun-16
FINE PARTICULATE (PM10)
TOTAL PARTICULATE
TOTAL FLUORIDE

Sampling Conditions:			
Stack internal diameter at test location	1395 mm		
Stack gas temperature (average)	24.0 °C		297.2 K
Stack pressure (average)	1024 hPa		
Stack gas velocity (average, stack conditions)	17 m/s		
Stack gas flowrate (stack conditions)	26 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	24 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	8:56	-	9:56
Fine Particulate (PM10) Mass	0.5 mg		
Gas Volume Sampled	0.737 m^3		
Fine Particulate (PM10) Emission*1	0.68 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	16 mg/s		
Regulatory Limit	NA mg/m^3		
Total Particulate Testing			
Test Period	8:56	-	9:56
Total Particulate Mass	1.5 mg		
Gas Volume Sampled	0.807 m^3		
Total Particulate Emission*1	1.9 mg/m^3		
Total Particulate Mass Emission Rate*2	45 mg/s		
Regulatory Limit	24 mg/m^3		
Total Fluoride Testing			
Test Period	8:56	-	9:56
Total Fluoride Mass	0.08 mg		
Gas Volume Sampled	0.816 m^3		
Total Fluoride Emission*1	0.098 mg/m^3		
Total Fluoride Mass Emission Rate*2	2.3 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.0		
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 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminum

AECOM's Project Number: 60489919

Emission Source: Stack 5

Date Sampled: 24-Jun-16

ANALYTE(S)	METHOD
Fine Particulate (PM10)	NSW EPA OM - 5
Total Particulate	NSW EPA TM - 15

Observations made during testing period:

Sampling Performed By:

Colin Clarke

Dylan Turnbull

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - PRE-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Measurement/Observations				
Stack Internal Dimensions:			Cross Sectional Area :	1.74 m^2
Diameter	1490 mm			
OR	Length	Width		
Length/Width (mm)			Minimum No. of	
Equivalent Diameter	N/A	mm	sampling points=	12
Distance from sampling plane to nearest disturbances:			Total No. of sampling points =	12
			PM2.5/10=	12
Upstream (m) =	10		No. of sampling traverses/ports sampled =	2
No. Diameters =	6.7		PM2.5/10=	2
Type of Upstream Disturbance:	Junction		No. of sampling points on each traverse/port =	6
Downstream (m) =	10		PM2.5/10=	6
No. Diameters =	6.7			
Type of Down Stream Disturbance:	Stack Exit			

Position of each sampling point, for each traverse:

Exclusion of any sample point numbers - comments:

	A	B	PM10/2.5 A	PM2.5/10 B
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot distances
1	66	36	66	36
2	218	188	218	188
3	441	411	441	411
4	1049	1019	1049	1019
5	1272	1242	1272	1242
6	1424	1394	1424	1394
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start: 9:51		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	9:51	36	20.6	0.0
2	9:52	21	20.6	0.0
3	9:53	17	20.7	0.0
4	9:54	8	20.7	0.0
5	9:55	6	20.8	0.0
6	9:56	10	20.8	0.0
7	9:57	11	20.8	0.0
8	9:58	8	20.8	0.0
	Averages:	14.6 ppm	20.7 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.30 %

Measurements

CO:	0.0015 %,(dry)	N_2:	79.3 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.7 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0014 %,(wet)	N_2:	78.2 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.5 %,(wet)
H_2O:	1.30 %(=M2)		

Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start: 10:51		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:51	12	20.9	0.0
2	10:52	10	20.9	0.0
3	10:53	6	20.9	0.0
4	10:54	8	20.9	0.0
5	10:55	4	20.9	0.0
6	10:56	11	20.9	0.0
7	10:57	12	20.9	0.0
8	10:58	9	20.9	0.0
	Averages:	9.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.73 %

Measurements

CO:	0.0009 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0009 %,(wet)	N_2:	77.7 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.5 %,(wet)
H_2O:	1.73 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)	

Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	9:00	Barometric Pressure :	1004	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	36	0.258	70.0	343.2	19.0
1/2	188	0.209	70.0	343.2	17.1
1/3	411	0.213	70.0	343.2	17.2
1/4	1019	0.208	70.0	343.2	17.0
1/5	1242	0.161	70.0	343.2	15.0
1/6	1394	0.193	70.0	343.2	16.4
2/1	36	0.211	70.0	343.2	17.2
2/2	188	0.240	70.0	343.2	18.3
2/3	411	0.223	70.0	343.2	17.6
2/4	1019	0.197	70.0	343.2	16.6
2/5	1242	0.194	70.0	343.2	16.5
2/6	1394	0.182	70.0	343.2	16.0
Average			70.0	343.2	17.0

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.7 mm
Absolute pressure in stack (hPa) : 1003.34 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: fine4
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.6 x 10^{-5} m^2
Thimble No: T423
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 380.2176 Meter finish: 380.2176
Time start: 9:46 Time finish: 9:47

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 381.0634 Meter finish: 381.0634
Time start: 10:59 Time finish: 11:00

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1004 hPa (start); 1004 hPa (finish)
Meter start: 380.2215 Time start: 9:58
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	0:05:30	66	13.5	22.0	16.0		Yes
1/2	0:05:00	218	13.5	23.0	16.0		Yes
1/3	0:05:00	441	13.5	24.0	16.0		Yes
1/4	0:05:00	1049	13.5	25.0	16.0		Yes
1/5	0:04:30	1272	13.5	26.0	17.0		Yes
1/6	0:04:45	1424	13.5	26.0	17.0		Yes
2/1	0:05:00	66	13.5	27.0	18.0		Yes
2/2	0:05:30	218	13.5	27.0	18.0		Yes
2/3	0:05:15	441	13.5	27.0	18.0		Yes
2/4	0:05:00	1049	13.5	28.0	19.0		Yes
2/5	0:04:45	1272	13.5	28.0	19.0		Yes
2/6	0:04:45	1424	13.5	28.0	19.0		Yes
Averages				25.9	17.4	no result	

Meter Finish: 381.0612 Time Finish: 10:58
Total Condensate collected: 4 ml Silica gel No(s) used: P3

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: S9
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.49 x $10^{-5}m^2$
Thimble No: T447
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 5249.5360 Meter finish: 5249.5360
Time start: 9:48 Time finish: 9:49

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 5250.3332 Meter finish: 5250.3332
Time start: 11:01 Time finish: 11:02

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1004 hPa (start); 1004 hPa (finish)
Meter start: 5249.5387 Time start: 9:58
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	0:05:00	66	14.4	23.0	16.0		Yes
1/2	0:10:00	218	13.0	26.0	17.0		Yes
1/3	0:15:00	441	13.1	28.0	17.0		Yes
1/4	0:20:00	1049	12.9	29.0	17.0		Yes
1/5	0:25:00	1272	11.4	31.0	18.0		Yes
1/6	0:30:00	1424	12.5	32.0	18.0		Yes
2/1	0:35:00	66	13.1	33.0	19.0		Yes
2/2	0:40:00	218	13.9	33.0	20.0		Yes
2/3	0:45:00	441	13.4	34.0	20.0		Yes
2/4	0:50:00	1049	12.6	34.0	20.0		Yes
2/5	0:55:00	1272	12.5	35.0	21.0		Yes
2/6	1:00:00	1424	12.2	35.0	21.0		Yes
Averages				31.1	18.7	no result	

Meter Finish: 5250.3309 Time Finish: 10:58
Total Condensate collected: 4 ml Silica gel No(s) used: I34

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	11:30	Barometric Pressure :		1004	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	36	0.241	68.0	341.2	18.3
1/2	188	0.223	68.0	341.2	17.6
1/3	411	0.209	68.0	341.2	17.0
1/4	1019	0.203	68.0	341.2	16.8
1/5	1242	0.211	68.0	341.2	17.1
1/6	1394	0.194	68.0	341.2	16.4
2/1	36	0.219	68.0	341.2	17.4
2/2	188	0.211	68.0	341.2	17.1
2/3	411	0.198	68.0	341.2	16.6
2/4	1019	0.195	68.0	341.2	16.5
2/5	1242	0.182	68.0	341.2	15.9
2/6	1394	0.174	68.0	341.2	15.5
Average			68.0	341.2	16.9

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -7.5 mm
Absolute pressure in stack (hPa) : 1003.26 hPa

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8481	m^3	Average barometric pressure (P_{BARO})	1004 hPa
Average gas meter temp. ($T_{M,2}$):	21.7	°C		
	294.9	K	Average pressure at meter ($P_{M,2}$)	1004.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7785	m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: T423 PM10 Weight 0.0002 g

Final PM10 Weight (Mp1): 0.00020 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%: 20.8 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.019 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 19 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P3

V_v = 6.3 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 ($V_{wsg(std)}$) = 0.0084

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

B_{ws} = 1.73 %

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

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

= 1.012 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 16.99 m/s

(ii) Average of post-sampling velocities: 16.85 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.) 16.92 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 = 29.50 m^3/s (stack conditions)

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

Qstd = 22.9 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.006	g/s (0°C, dry gas, 1 atm pressure)		
	=	6	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.006	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	6	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.44	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	440	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.7922 m^3

Average gas meter temp. ($T_{M,2}$): 24.9 °C

298.1 K

Average barometric pressure (P_{BARO}) 1004 hPa

Average pressure at meter ($P_{M,2}$) 1004.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.7194 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: T447

Blank weight: g

Total Particulate Weight 0.0002 g

Final Total Particulate Weight (Mp1): 0.00020 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.00028 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.28 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00028 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.28 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.8 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.021 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 21 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: I34

V_v = 5.5 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 ($V_{wsg(std)}$) = 0.0073

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

B_{ws} = 1.73 %

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

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

= 1.012 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 16.99 m/s

(ii) Average of post-sampling velocities: 16.85 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 16.92 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 = 29.50 m^3/s (stack conditions)

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

Qstd = 22.9 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0064	g/s (0°C, dry gas, 1 atm pressure)		
	=	6.4	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0064	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	6.4	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.48	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	480	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 5
WESTON ALUMINUM
24-Jun-16
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:			
Stack internal diameter at test location	1490 mm		
Stack gas temperature (average)	69.0 °C		342.2 K
Stack pressure (average)	1003 hPa		
Stack gas velocity (average, stack conditions)	17 m/s		
Stack gas flowrate (stack conditions)	30 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	23 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	9:58	-	10:58
Fine Particulate (PM10) Mass	0.2 mg		
Gas Volume Sampled	0.779 m^3		
Fine Particulate (PM10) Emission*1	0.26 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	6 mg/s		
Regulatory Limit	NA mg/m^3		
Total Particulate Testing			
Test Period	9:58	-	10:58
Total Particulate Mass	0.2 mg		
Gas Volume Sampled	0.719 m^3		
Total Particulate Emission*1	0.28 mg/m^3		
Total Particulate Mass Emission Rate*2	6.4 mg/s		
Regulatory Limit	10 mg/m^3		
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 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminum

AECOM's Project Number: 60489919

Emission Source: Stack 5

Date Sampled: 24-Jun-16

ANALYTE(S)	METHOD
Hazardous Substances (Metals)	NSW EPA TM - 12, 13 & 14
Hydrogen Chloride	NSW EPA TM - 7 & 8
Chlorine	NSW EPA TM - 7 & 8

Observations made during testing period:

Sampling Performed By:

Colin Clarke

Dylan Turnbull

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - PRE-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Hazardous Substances (Metals)
Test 2: Hydrogen Chloride
Test 3: Chlorine

Measurement/Observations

Stack Internal Dimensions:

Diameter 1490 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 1.74 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 10
No. Diameters = 6.7
Type of Upstream Disturbance: Junction
Downstream (m) = 10
No. Diameters = 6.7
Type of Down Stream Disturbance: Stack Exit

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

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	66	36		
2	218	188		
3	441	411		
4	1049	1019		
5	1272	1242		
6	1424	1394		
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Hazardous Substances (Metals)
Test 2: Hydrogen Chloride
Test 3: Chlorine

Sampling time start: 12:58		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:58	0	20.9	0.0
2	12:59	0	20.9	0.0
3	13:00	0	20.9	0.0
4	13:01	0	20.9	0.0
5	13:02	0	20.9	0.0
6	13:03	0	20.9	0.0
7	13:04	0	20.9	0.0
8	13:05	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.30 %

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:	78.1 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.30 %(=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: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Hazardous Substances (Metals)
Test 2: Hydrogen Chloride
Test 3: Chlorine

Sampling time start: 15:29		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	15:29	0	20.9	0.0
2	15:30	0	20.9	0.0
3	15:31	0	20.9	0.0
4	15:32	0	20.9	0.0
5	15:33	0	20.9	0.0
6	15:34	0	20.9	0.0
7	15:35	0	20.9	0.0
8	15:36	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.23 %

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:	78.1 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.23 %(=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: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1:Hazardous Substances (Metals)
Test 2:Hydrogen Chloride
Test 3:Chlorine

Time :	0:00	Barometric Pressure :		1005	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	36	0.290	35.0	308.2	19.1
1/2	188	0.291	35.0	308.2	19.1
1/3	411	0.281	35.0	308.2	18.8
1/4	1019	0.250	35.0	308.2	17.7
1/5	1242	0.270	35.0	308.2	18.4
1/6	1394	0.229	35.0	308.2	16.9
2/1	36	0.240	35.0	308.2	17.4
2/2	188	0.257	35.0	308.2	17.9
2/3	411	0.273	35.0	308.2	18.5
2/4	1019	0.218	35.0	308.2	16.5
2/5	1242	0.271	35.0	308.2	18.4
2/6	1394	0.284	35.0	308.2	18.9
Average			35.0	308.2	18.1

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -8.5 mm
Absolute pressure in stack (hPa) : 1004.17 hPa

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF HAZARDOUS SUBSTANCES (METALS)

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: 4
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.36 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 381.9224 Meter finish: 381.9224
Time start: 13:01 Time finish: 13:02

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 383.2246 Meter finish: 383.2246
Time start: 15:37 Time finish: 15:38

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 381.9251 Time start: 13:06
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	66	14.9	25.0	17.0		Yes
1/2	0:15:00	218	14.9	26.0	18.0		Yes
1/3	0:22:30	441	14.7	28.0	18.0		Yes
1/4	0:30:00	1049	13.8	29.0	18.0		Yes
1/5	0:37:30	1272	14.3	29.0	18.0		Yes
1/6	0:45:00	1424	13.2	30.0	18.0		Yes
2/1	0:52:30	66	13.6	30.0	19.0		Yes
2/2	1:00:00	218	14.0	30.0	19.0		Yes
2/3	1:07:30	441	14.4	30.0	20.0		Yes
2/4	1:15:00	1049	12.9	30.0	20.0		Yes
2/5	1:22:30	1272	14.3	30.0	20.0		Yes
2/6	1:30:00	1424	14.7	30.0	20.0		Yes
Averages				28.9	18.8	no result	

Meter Finish: 383.2210 Time Finish: 14:06
Total Condensate collected: 0 ml Silica gel No(s) used: Ia

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF HYDROGEN CHLORIDE

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: g4
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.26 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 5251.1996 Meter finish: 5251.1996
Time start: 13:02 Time finish: 13:03

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 5252.4090 Meter finish: 5252.4090
Time start: 15:39 Time finish: 15:40

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 5251.2005 Time start: 13:06
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	0:07:30	66	13.7	30.0	18.0		Yes
1/2	0:15:00	218	13.7	32.0	19.0		Yes
1/3	0:22:30	441	13.4	33.0	20.0		Yes
1/4	0:30:00	1049	12.7	35.0	20.0		Yes
1/5	0:37:30	1272	13.2	36.0	21.0		Yes
1/6	0:45:00	1424	12.1	36.0	22.0		Yes
2/1	0:52:30	66	12.4	37.0	23.0		Yes
2/2	1:00:00	218	12.8	37.0	23.0		Yes
2/3	1:07:30	441	13.2	37.0	24.0		Yes
2/4	1:15:00	1049	11.8	38.0	24.0		Yes
2/5	1:22:30	1272	13.2	38.0	24.0		Yes
2/6	1:30:00	1424	13.5	38.0	24.0		Yes
Averages				35.6	21.8	no result	

Meter Finish: 5252.4062 Time Finish: 14:06
Total Condensate collected: 1 ml Silica gel No(s) used: Fa8

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF CHLORINE

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: g4
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.26 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 5251.1996 Meter finish: 5251.1996
Time start: 13:02 Time finish: 13:03

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 5252.4090 Meter finish: 5252.4090
Time start: 15:39 Time finish: 15:40

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 5251.2005 Time start: 13:06
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	0:07:30	66	13.7	30.0	18.0		Yes
1/2	0:15:00	218	13.7	32.0	19.0		Yes
1/3	0:22:30	441	13.4	33.0	20.0		Yes
1/4	0:30:00	1049	12.7	35.0	20.0		Yes
1/5	0:37:30	1272	13.2	36.0	21.0		Yes
1/6	0:45:00	1424	12.1	36.0	22.0		Yes
2/1	0:52:30	66	12.4	37.0	23.0		Yes
2/2	1:00:00	218	12.8	37.0	23.0		Yes
2/3	1:07:30	441	13.2	37.0	24.0		Yes
2/4	1:15:00	1049	11.8	38.0	24.0		Yes
2/5	1:22:30	1272	13.2	38.0	24.0		Yes
2/6	1:30:00	1424	13.5	38.0	24.0		Yes
Averages				35.6	21.8	no result	

Meter Finish: 5252.4062 Time Finish: 14:06
Total Condensate collected: 1 ml Silica gel No(s) used: Fa8

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1:Hazardous Substances (Metals)
Test 2:Hydrogen Chloride
Test 3:Chlorine

Time :	14:40	Barometric Pressure :		1005	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	36	0.253	28.0	301.2	17.6
1/2	188	0.286	28.0	301.2	18.7
1/3	411	0.236	28.0	301.2	17.0
1/4	1019	0.270	28.0	301.2	18.2
1/5	1242	0.264	28.0	301.2	18.0
1/6	1394	0.220	28.0	301.2	16.4
2/1	36	0.231	28.0	301.2	16.8
2/2	188	0.269	28.0	301.2	18.1
2/3	411	0.257	28.0	301.2	17.7
2/4	1019	0.252	28.0	301.2	17.6
2/5	1242	0.251	28.0	301.2	17.5
2/6	1394	0.225	28.0	301.2	16.6
Average			28.0	301.2	17.5

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -8.5 mm
Absolute pressure in stack (hPa) : 1004.17 hPa

Emission Measurement Calculations Spreadsheet

Stack Analysis - Hazardous Substances Elemental Analysis Results

Date: 24-Jun-16 Client: Weston Aluminum
AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

	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	<0.0001			
Arsenic	<0.0002	0.00035			
Beryllium	<0.0002	<0.0001			
Cadmium	<0.0002	<0.0001			
Chromium	0.0002	0.079			
Cobalt	<0.0002	<0.0001			
Copper	<0.0008	0.029			
Lead	0.0002	0.026			
Magnesium	<0.05	<0.043			
Manganese	<0.0002	<0.0001			
Mercury	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	<0.0002	0.0033			
Selenium	<0.0002	<0.0001			
Thallium	<0.0002	<0.0001			
Tin	<0.0002	<0.0001			
Vanadium	<0.0002	<0.0001			
Zinc	0.014	0.0077			

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: 24-Jun-16 Client: Weston Aluminum
AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

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	<0.000084			<0.0002	<0.00017	<0.0046
Arsenic	<0.0002	<0.00017	0.00035	0.00029			0.00035	0.00029	0.0079
Beryllium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Cadmium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Chromium	0.0002	0.00017	0.079	0.066			0.08	0.067	1.8
Cobalt	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Copper	<0.0008	<0.00067	0.029	0.024			0.029	0.024	0.65
Lead	0.0002	0.00017	0.026	0.022			0.03	0.025	0.68
Magnesium	<0.05	<0.042	<0.043	<0.036			<0.002	<0.0017	<0.046
Manganese	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Mercury	<0.0002	<0.00017	<0.0001	<0.000084	<0.0001	<0.000084	<0.0005	<0.00042	<0.011
Nickel	<0.0002	<0.00017	0.0033	0.0028			0.0033	0.0028	0.076
Selenium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Thallium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Tin	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Vanadium	<0.0002	<0.00017	<0.0001	<0.000084			<0.0002	<0.00017	<0.0046
Zinc	0.014	0.012	0.0077	0.0064			0.02	0.017	0.46
Total Hazardous Metals*	0.0004	0.00034	0.11	0.091	<0.0001	<0.000084	0.11	0.095	2.6
Total Metals	0.014	0.012	0.15	0.12			0.16	0.14	3.7

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

STACK ANALYSIS - FINAL CALCULATIONS

Hazardous Substances (Metals)

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.3089 m^3	Average barometric pressure (P_{BARO})	1005 hPa	
Average gas meter temp. ($T_{M,2}$):	23.8 °C			
	297.0 K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	1.1942 m^3			

(B) Metals concentration at standard conditions

Blank thimble No.:	NA		Blank weight:	g
Thimble No. used:	NA		Metals Weight	0.00011 g
Final Metals Weight (Mp1):	0.00011 g			
Metals Concentration (C1):		$=M_{p1}/MV_4=$	0.000095	g/m^3 (0°C, dry gas, 1atm pressure)
		;and C_2 =	0.095	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.000095 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.095 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.013 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 13 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Ia

V_v = 11.9 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0159

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

B_{ws} = 1.31 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hazardous Substances (Metals)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.137 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 18.13 m/s

(ii) Average of post-sampling velocities: 17.52 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.83 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 = 31.09 m^3/s (stack conditions)

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

Qstd = 27.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0026	g/s (0°C, dry gas, 1 atm pressure)		
	=	2.6	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0026	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	2.6	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.36	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	360	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Hydrogen Chloride

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.2057 m^3	Average barometric pressure (P_{BARO})	1005 hPa	
Average gas meter temp. ($T_{M,2}$):	28.7 °C			
	301.9 K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	1.0822 m^3			

(B) Hydrogen Chloride concentration at standard conditions

Blank thimble No.:	NA	Blank weight:	g
Thimble No. used:	NA	Hydrogen Chloride Weight	<0.01 g

Final Hydrogen Chloride Weight (Mp1): <0.01 g

Hydrogen Chloride Concentration (C1): $=M_{p1}/MV_4=$ <0.0092 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <9.2 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.0092 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <9.2 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <1.3 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <1300 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Fa8

V_v = 8.8 g (from laboratory report) V_w = 1 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0013

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0117

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

B_{ws} = 1.19 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hydrogen Chloride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.137 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 18.13 m/s

(ii) Average of post-sampling velocities: 17.52 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.83 m/s (stack conditions, wet)
(**Note**: (Vs) is from all individual data, **not** from (i) and (ii) alone.) N/A m/s (stack conditions, wet)

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

Qstack = Vs x A = 31.09 m^3/s (stack conditions)

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

Qstd = 27.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.25	g/s (0°C, dry gas, 1 atm pressure)		
	=	<250	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.25	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<250	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<35	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<35000	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Chlorine

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.2057 m^3	Average barometric pressure (P_{BARO})	1005 hPa	
Average gas meter temp. ($T_{M,2}$):	28.7 °C			
	301.9 K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	1.0822 m^3			

(B) Chlorine concentration at standard conditions

Blank thimble No.:	NA	Blank weight:	g
Thimble No. used:	NA	Chlorine Weight	<0.002 g
Final Chlorine Weight (Mp1):	<0.002 g		
Chlorine Concentration (C1):	$=M_{p1}/MV_4=$	<0.0018	g/m^3 (0°C, dry gas, 1atm pressure)
	;and C_2 =	<1.8	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.0018 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <1.8 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.25 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <250 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Fa8

V_v = 8.8 g (from laboratory report) V_w = 1 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0013

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0117

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

B_{ws} = 1.19 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Chlorine

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.137 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 18.13 m/s

(ii) Average of post-sampling velocities: 17.52 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.83 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 = 31.09 m^3/s (stack conditions)

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

Qstd = 27.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.049	g/s (0°C, dry gas, 1 atm pressure)		
	=	<49	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.049	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<49	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<6.9	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<6900	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, STACK 5
WESTON ALUMINUM
24-Jun-16
HAZARDOUS SUBSTANCES (METALS)
HYDROGEN CHLORIDE
CHLORINE

Sampling Conditions:			
Stack internal diameter at test location	1490 mm		
Stack gas temperature (average)	31.5 °C		304.7 K
Stack pressure (average)	1004 hPa		
Stack gas velocity (average, stack conditions)	18 m/s		
Stack gas flowrate (stack conditions)	31 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	27 m^3/s		
Hazardous Substances (Metals) Testing			
Test Period	13:06	-	14:06
Hazardous Substances (Metals) Mass	0.11 mg		
Gas Volume Sampled	1.19 m^3		
Hazardous Substances (Metals) Emission*1	0.095 mg/m^3		
Hazardous Substances (Metals) Mass Emission Rate*2	2.6 mg/s		
Regulatory Limit	5 mg/m^3		
Hydrogen Chloride Testing			
Test Period	13:06	-	14:06
Hydrogen Chloride Mass	<10 mg		
Gas Volume Sampled	1.08 m^3		
Hydrogen Chloride Emission*1	<9.2 mg/m^3		
Hydrogen Chloride Mass Emission Rate*2	<250 mg/s		
Regulatory Limit	10 mg/m^3		
Chlorine Testing			
Test Period	13:06	-	14:06
Chlorine Mass	<2 mg		
Gas Volume Sampled	1.08 m^3		
Chlorine Emission*1	<1.8 mg/m^3		
Chlorine Mass Emission Rate*2	<49 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.2		
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 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminum

AECOM's Project Number: 60489919

Emission Source: Stack 5

Date Sampled: 24-Jun-16

ANALYTE(S)	METHOD
Total Fluoride	NSW EPA TM - 9
Sulfuric Acid Mist	NSW EPA TM - 3
Sulfur Dioxide	NSW EPA TM - 4

Observations made during testing period:

Sampling Performed By:

Colin Clarke

Dylan Turnbull

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Total Fluoride
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Measurement/Observations

Stack Internal Dimensions:

Diameter 1490 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 1.74 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 10
No. Diameters = 6.7
Type of Upstream Disturbance: Junction
Downstream (m) = 10
No. Diameters = 6.7
Type of Down Stream Disturbance: Stack Exit

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

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	66	36		
2	218	188		
3	441	411		
4	1049	1019		
5	1272	1242		
6	1424	1394		
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Total Fluoride
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 11:41		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:41	2	20.8	0.0
2	11:42	11	20.8	0.0
3	11:43	21	20.8	0.0
4	11:44	25	20.8	0.0
5	11:45	29	20.8	0.0
6	11:46	35	20.8	0.0
7	11:47	41	20.8	0.0
8	11:48	43	20.8	0.0
	Averages:	25.9 ppm	20.8 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.30 %

Measurements

CO:	0.0026 %,(dry)	N_2:	79.2 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.8 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0026 %,(wet)	N_2:	78.2 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.5 %,(wet)
H_2O:	1.30 %(=M2)		
Therefore, stack gas density (GD) =		1.28 kg/m^3	(0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =		1.29 kg/m^3	(0°C, dry, 1 atm pressure)

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Total Fluoride
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 12:41		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:41	0	20.9	0.0
2	12:42	0	20.9	0.0
3	12:43	0	20.9	0.0
4	12:44	0	20.9	0.0
5	12:45	0	20.9	0.0
6	12:46	0	20.9	0.0
7	12:47	0	20.9	0.0
8	12:48	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.56 %

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:	77.9 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.56 %(=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: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1:Total Fluoride
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	11:30	Barometric Pressure :		1005	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	36	0.241	68.0	341.2	18.3
1/2	188	0.223	68.0	341.2	17.6
1/3	411	0.209	68.0	341.2	17.0
1/4	1019	0.203	68.0	341.2	16.8
1/5	1242	0.211	68.0	341.2	17.1
1/6	1394	0.194	68.0	341.2	16.4
2/1	36	0.219	68.0	341.2	17.4
2/2	188	0.211	68.0	341.2	17.1
2/3	411	0.198	68.0	341.2	16.6
2/4	1019	0.195	68.0	341.2	16.5
2/5	1242	0.182	68.0	341.2	15.9
2/6	1394	0.174	68.0	341.2	15.5
Average			68.0	341.2	16.9

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -7.5 mm
Absolute pressure in stack (hPa) : 1004.26 hPa

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL FLUORIDE

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: S2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.53 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 381.0672 Meter finish: 381.0672
Time start: 11:44 Time finish: 11:45

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 381.9174 Meter finish: 381.9174
Time start: 12:49 Time finish: 12:50

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 381.0696 Time start: 11:48
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	0:05:00	66	14.5	21.0	15.0		Yes
1/2	0:10:00	218	13.9	23.0	15.0		Yes
1/3	0:15:00	441	13.5	25.0	15.0		Yes
1/4	0:20:00	1049	13.3	26.0	15.0		Yes
1/5	0:25:00	1272	13.6	26.0	15.0		Yes
1/6	0:30:00	1424	13.0	27.0	16.0		Yes
2/1	0:35:00	66	13.8	27.0	16.0		Yes
2/2	0:40:00	218	13.6	28.0	16.0		Yes
2/3	0:45:00	441	13.2	28.0	17.0		Yes
2/4	0:50:00	1049	13.1	28.0	17.0		Yes
2/5	0:55:00	1272	12.6	29.0	18.0		Yes
2/6	1:00:00	1424	12.3	29.0	18.0		Yes
Averages				26.4	16.1	no result	

Meter Finish: 381.9146 Time Finish: 12:48
Total Condensate collected: 4 ml Silica gel No(s) used: F99

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF SULFURIC ACID MIST (H2SO4 AS SO3)

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: S9
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.49 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 5250.3496 Meter finish: 5250.3496
Time start: 11:46 Time finish: 11:47

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 5251.1925 Meter finish: 5251.1925
Time start: 12:51 Time finish: 12:52

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 5250.3533 Time start: 11:48
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	0:05:00	66	14.0	24.0	18.0		Yes
1/2	0:10:00	218	13.4	25.0	18.0		Yes
1/3	0:15:00	441	13.0	26.0	18.0		Yes
1/4	0:20:00	1049	12.8	27.0	18.0		Yes
1/5	0:25:00	1272	13.1	28.0	18.0		Yes
1/6	0:30:00	1424	12.5	28.0	18.0		Yes
2/1	0:35:00	66	13.3	29.0	18.0		Yes
2/2	0:40:00	218	13.1	29.0	18.0		Yes
2/3	0:45:00	441	12.7	29.0	19.0		Yes
2/4	0:50:00	1049	12.6	30.0	19.0		Yes
2/5	0:55:00	1272	12.1	30.0	19.0		Yes
2/6	1:00:00	1424	11.8	30.0	19.0		Yes
Averages				27.9	18.3	no result	

Meter Finish: 5251.1898 Time Finish: 12:48
Total Condensate collected: 0 ml Silica gel No(s) used: M99

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF SULFUR DIOXIDE (SO2 AS SO3)

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: S9
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.49 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 5250.3496 Meter finish: 5250.3496
Time start: 11:46 Time finish: 11:47

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 5251.1925 Meter finish: 5251.1925
Time start: 12:51 Time finish: 12:52

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 5250.3533 Time start: 11:48
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	0:05:00	66	14.0	24.0	18.0		Yes
1/2	0:10:00	218	13.4	25.0	18.0		Yes
1/3	0:15:00	441	13.0	26.0	18.0		Yes
1/4	0:20:00	1049	12.8	27.0	18.0		Yes
1/5	0:25:00	1272	13.1	28.0	18.0		Yes
1/6	0:30:00	1424	12.5	28.0	18.0		Yes
2/1	0:35:00	66	13.3	29.0	18.0		Yes
2/2	0:40:00	218	13.1	29.0	18.0		Yes
2/3	0:45:00	441	12.7	29.0	19.0		Yes
2/4	0:50:00	1049	12.6	30.0	19.0		Yes
2/5	0:55:00	1272	12.1	30.0	19.0		Yes
2/6	1:00:00	1424	11.8	30.0	19.0		Yes
Averages				27.9	18.3	no result	

Meter Finish: 5251.1898 Time Finish: 12:48
Total Condensate collected: 0 ml Silica gel No(s) used: M99

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1:Total Fluoride
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	12:55	Barometric Pressure :		1005	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	36	0.290	35.0	308.2	19.1
1/2	188	0.291	35.0	308.2	19.1
1/3	411	0.281	35.0	308.2	18.8
1/4	1019	0.250	35.0	308.2	17.7
1/5	1242	0.270	35.0	308.2	18.4
1/6	1394	0.229	35.0	308.2	16.9
2/1	36	0.240	35.0	308.2	17.4
2/2	188	0.257	35.0	308.2	18.0
2/3	411	0.273	35.0	308.2	18.5
2/4	1019	0.218	35.0	308.2	16.5
2/5	1242	0.271	35.0	308.2	18.4
2/6	1394	0.284	35.0	308.2	18.9
Average			35.0	308.2	18.1

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -8.5 mm
Absolute pressure in stack (hPa) : 1004.17 hPa

STACK ANALYSIS - FINAL CALCULATIONS

Total Fluoride

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8535	m^3	Average barometric pressure (P_{BARO})	1005 hPa
Average gas meter temp. ($T_{M,2}$):	21.3	°C		
	294.5	K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7853	m^3		

(B) Total Fluoride concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: NA Total Fluoride Weight 0.00003 g

Final Total Fluoride Weight (Mp1): 0.00003 g

Total Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.000038 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.038 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.000038 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.038 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.0035 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 3.5 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F99

V_v = 4.4 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 ($V_{wsg(std)}$) = 0.0059

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

B_{ws} = 1.41 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Fluoride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.067 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 16.85 m/s

(ii) Average of post-sampling velocities: 18.14 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.50 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 = 30.51 m^3/s (stack conditions)

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

Qstd = 25.1 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.00095	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.95	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.00095	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.95	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.089	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	89	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Sulfuric Acid Mist (H2SO4 as SO3)

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.8365 m^3

Average gas meter temp. ($T_{M,2}$): 23.1 °C / 296.3 K

Average barometric pressure (P_{BARO}) 1005 hPa

Average pressure at meter ($P_{M,2}$) 1005.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.7650 m^3

(B) H2SO4 as SO3 concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: NA

Blank weight: g

H2SO4 as SO3 Weight <0.002 g

Final H2SO4 as SO3 Weight (Mp1): <0.002 g

H2SO4 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ <0.0026 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <2.6 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.0026 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <2.6 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.24 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <240 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: M99

V_v = 9.5 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0127

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

B_{ws} = 1.63 %

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfuric Acid Mist (H2SO4 as SO3)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.067 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 16.85 m/s

(ii) Average of post-sampling velocities: 18.14 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.50 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 = 30.51 m^3/s (stack conditions)

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

Qstd = 25.0 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.065	g/s (0°C, dry gas, 1 atm pressure)		
	=	<65	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.065	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<65	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<6.1	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<6100	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Sulfur Dioxide (SO2 as SO3)

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8365	m^3	Average barometric pressure (P_{BARO})	1005 hPa
Average gas meter temp. ($T_{M,2}$):	23.1	°C		
	296.3	K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7650	m^3		

(B) SO2 as SO3 concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: NA SO2 as SO3 Weight <0.01 g

Final SO2 as SO3 Weight (Mp1): <0.01 g

SO2 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ <0.013 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <13 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.013 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <13 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <1.2 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <1200 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: M99

V_v = 9.5 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0127

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

B_{ws} = 1.63 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfur Dioxide (SO2 as SO3)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.067 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 16.85 m/s

(ii) Average of post-sampling velocities: 18.14 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.50 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 = 30.51 m^3/s (stack conditions)

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

Qstd = 25.0 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.33	g/s (0°C, dry gas, 1 atm pressure	)		
	=	<330	mg/s (0°C, dry gas, 1 atm pressure	)		
	C_{1a} x Qstd =	<0.33	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)	
	=	<330	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)	
	C_{1a} x Qstd =	<30	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)	
	=	<30000	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)	

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 5
WESTON ALUMINUM
24-Jun-16
TOTAL FLUORIDE
SULFURIC ACID MIST (H2SO4 AS SO3)
SULFUR DIOXIDE (SO2 AS SO3)

Sampling Conditions:			
Stack internal diameter at test location	1490 mm		
Stack gas temperature (average)	51.5 °C		324.7 K
Stack pressure (average)	1004 hPa		
Stack gas velocity (average, stack conditions)	17 m/s		
Stack gas flowrate (stack conditions)	31 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	25 m^3/s		
Total Fluoride Testing			
Test Period	11:48	-	12:48
Total Fluoride Mass	0.03 mg		
Gas Volume Sampled	0.785 m^3		
Total Fluoride Emission*1	0.038 mg/m^3		
Total Fluoride Mass Emission Rate*2	0.95 mg/s		
Regulatory Limit	NA mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing			
Test Period	11:48	-	12:48
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2 mg		
Gas Volume Sampled	0.765 m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<2.6 mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<65 mg/s		
Regulatory Limit	100 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing			
Test Period	11:48	-	12:48
Sulfur Dioxide (SO2 as SO3) Mass	<10 mg		
Gas Volume Sampled	0.765 m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	<13 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	<330 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.4		
Gas Density (dry at 1 atmosphere)	1.29 kg/m^3		
Dry Molecular Weight	28.8 g/g-mole		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminum

AECOM's Project Number: 60489919

Emission Source: Stack 5

Date Sampled: 24-Jun-16

ANALYTE(S)	METHOD
Dioxins and Furans	NSW EPA TM - 18
Polycyclic Aromatic Hydrocarbons	NSW EPA OM - 6

Observations made during testing period:

Sampling Performed By:

Colin Clarke

Dylan Turnbull

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Dioxins and Furans Lower Bound
Test 2: Dioxins and Furans Middle Bound
Test 3: Polycyclic Aromatic Hydrocarbons

Measurement/Observations	
Stack Internal Dimensions: Diameter 1490 mm OR Length Width Length/Width (mm) Equivalent Diameter N/A mm	Cross Sectional Area : 1.74 m^2 Minimum No. of sampling points= 12
Distance from sampling plane to nearest disturbances: Upstream (m) = 10 No. Diameters = 6.7 Type of Upstream Disturbance: Junction Downstream (m) = 10 No. Diameters = 6.7 Type of Down Stream Disturbance: Stack Exit	Total No. of sampling points = 12 PM2.5/10= NA No. of sampling traverses/ports sampled = 2 PM2.5/10= NA No. of sampling points on each traverse/port = 6 PM2.5/10= NA
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	66	36		
2	218	188		
3	441	411		
4	1049	1019		
5	1272	1242		
6	1424	1394		
7				
8				
9				
10			Check of total points against minimum, (yes/no) - comments:	
11				
12				
13				
14				
15				
16				
17				
18				
19			General Comments:	
20				

Signed: .....

Checked: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Dioxins and Furans Lower Bound
Test 2: Dioxins and Furans Middle Bound
Test 3: Polycyclic Aromatic Hydrocarbons

Sampling time start: 9:01		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	9:01	27	20.6	0.0
2	9:02	24	20.6	0.0
3	9:03	26	20.6	0.0
4	9:04	25	20.6	0.0
5	9:05	22	20.7	0.0
6	9:06	24	20.7	0.0
7	9:07	20	20.7	0.0
8	9:08	19	20.7	0.0
	Averages:	23.4 ppm	20.7 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.30 %

Measurements

CO:	0.0023 %,(dry)	N_2:	79.3 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.7 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0023 %,(wet)	N_2:	78.3 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.4 %,(wet)
H_2O:	1.30 %(=M2)		
Therefore, stack gas density (GD) =		1.28 kg/m^3	(0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =		1.29 kg/m^3	(0°C, dry, 1 atm pressure)

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1: Dioxins and Furans Lower Bound
Test 2: Dioxins and Furans Middle Bound
Test 3: Polycyclic Aromatic Hydrocarbons

Sampling time start: 15:15		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	15:15	0	20.9	0.0
2	15:16	0	20.9	0.0
3	15:17	0	20.9	0.0
4	15:18	0	20.9	0.0
5	15:19	0	20.9	0.0
6	15:20	0	20.9	0.0
7	15:21	0	20.9	0.0
8	15:22	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
Moisture percentage (M2): 2.38 %

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:	2.38 %(=M2)		

Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)

Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1:Dioxins and Furans Lower Bound
Test 2:Dioxins and Furans Middle Bound
Test 3:Polycyclic Aromatic Hydrocarbons

Time :	9:00	Barometric Pressure :		1004	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	36	0.258	70.0	343.2	19.0
1/2	188	0.209	70.0	343.2	17.1
1/3	411	0.213	70.0	343.2	17.2
1/4	1019	0.208	70.0	343.2	17.0
1/5	1242	0.161	70.0	343.2	15.0
1/6	1394	0.193	70.0	343.2	16.4
2/1	36	0.211	70.0	343.2	17.2
2/2	188	0.240	70.0	343.2	18.3
2/3	411	0.223	70.0	343.2	17.6
2/4	1019	0.197	70.0	343.2	16.6
2/5	1242	0.194	70.0	343.2	16.5
2/6	1394	0.182	70.0	343.2	16.0
Average			70.0	343.2	17.0

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.7 mm
Absolute pressure in stack (hPa) : 1003.34 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF DIOXINS AND FURANS

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: g4
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.26 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 91.8770 Meter finish: 91.8770
Time start: 9:06 Time finish: 9:07

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 95.9929 Meter finish: 95.9929
Time start: 15:12 Time finish: 15:13

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1004 hPa (start); 1004 hPa (finish)
Meter start: 91.8812 Time start: 9:08
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	0:30:00	66	12.2	30.0	18.0		Yes
1/2	1:00:00	218	11.0	31.0	20.0		Yes
1/3	1:30:00	441	11.1	32.0	22.0		Yes
1/4	2:00:00	1049	10.9	34.0	23.0		Yes
1/5	2:30:00	1272	9.6	34.0	22.0		Yes
1/6	3:00:00	1424	10.5	34.0	22.0		Yes
2/1	3:30:00	66	11.1	35.0	23.0		Yes
2/2	4:00:00	218	11.8	35.0	23.0		Yes
2/3	4:30:00	441	11.3	36.0	24.0		Yes
2/4	5:00:00	1049	10.7	37.0	24.0		Yes
2/5	5:30:00	1272	10.6	37.0	24.0		Yes
2/6	6:00:00	1424	10.3	38.0	25.0		Yes
Averages				34.4	22.5	no result	

Meter Finish: 95.9901 Time Finish: 15:10
Total Condensate collected: 35 ml Silica gel No(s) used: FA9

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF POLYCYCLIC AROMATIC HYDROCARBONS

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack Description No.: Stack 5
Sample Nozzle No.: g4
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.26 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 91.8770 Meter finish: 91.8770
Time start: 9:06 Time finish: 9:07

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 95.9929 Meter finish: 95.9929
Time start: 15:12 Time finish: 15:13

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1004 hPa (start); 1004 hPa (finish)
Meter start: 91.8812 Time start: 9:08
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	0:30:00	66	12.2	30.0	18.0		Yes
1/2	1:00:00	218	11.0	31.0	20.0		Yes
1/3	1:30:00	441	11.1	32.0	22.0		Yes
1/4	2:00:00	1049	10.9	34.0	23.0		Yes
1/5	2:30:00	1272	9.6	34.0	22.0		Yes
1/6	3:00:00	1424	10.5	34.0	22.0		Yes
2/1	3:30:00	66	11.1	35.0	23.0		Yes
2/2	4:00:00	218	11.8	35.0	23.0		Yes
2/3	4:30:00	441	11.3	36.0	24.0		Yes
2/4	5:00:00	1049	10.7	37.0	24.0		Yes
2/5	5:30:00	1272	10.6	37.0	24.0		Yes
2/6	6:00:00	1424	10.3	38.0	25.0		Yes
Averages				34.4	22.5	no result	

Meter Finish: 95.9901 Time Finish: 15:10
Total Condensate collected: 35 ml Silica gel No(s) used: FA9

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5
Test 1:Dioxins and Furans Lower Bound
Test 2:Dioxins and Furans Middle Bound
Test 3:Polycyclic Aromatic Hydrocarbons

Time :	15:15	Barometric Pressure :		1004	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	36	0.253	28.0	301.2	17.7
1/2	188	0.286	28.0	301.2	18.8
1/3	411	0.236	28.0	301.2	17.1
1/4	1019	0.270	28.0	301.2	18.2
1/5	1242	0.264	28.0	301.2	18.0
1/6	1394	0.220	28.0	301.2	16.4
2/1	36	0.231	28.0	301.2	16.8
2/2	188	0.269	28.0	301.2	18.2
2/3	411	0.257	28.0	301.2	17.8
2/4	1019	0.252	28.0	301.2	17.6
2/5	1242	0.251	28.0	301.2	17.6
2/6	1394	0.225	28.0	301.2	16.6
Average			28.0	301.2	17.6

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -8.5 mm
Absolute pressure in stack (hPa) : 1003.17 hPa

Stack Analysis - Speciated Polycyclic Aromatic Hydrocarbons (PAH) Results

Date: 24-Jun-16
Client: Weston Aluminum
AECOM's Project No: 60489919
Stack/Duct Description: Stack 5

	Sample Result			Emission		Mass Emission Rate	
	(ng)	(µg)	(mg)	(µg/m^3)	(mg/m^3)	(µg/s)	(mg/s)
Naphthalene	140000	140	0.14	38	0.038	940	0.94
2 - Methylnapthalene	18000	18	0.018	4.9	0.0049	120	0.12
Acenaphthylene	32000	32	0.032	8.7	0.0087	210	0.21
Acenaphthene	730	0.73	0.00073	0.2	0.0002	4.9	0.0049
Fluorene	13000	13	0.013	3.5	0.0035	87	0.087
Phenanthrene	14000	14	0.014	3.8	0.0038	94	0.094
Anthracene	1400	1.4	0.0014	0.38	0.00038	9.4	0.0094
Fluoranthene	770	0.77	0.00077	0.21	0.00021	5.2	0.0052
Pyrene	520	0.52	0.00052	0.14	0.00014	3.5	0.0035
Benz(a)anthracene	42	0.042	0.000042	0.011	0.000011	0.28	0.00028
Chrysene	22	0.022	0.000022	0.006	0.000006	0.15	0.00015
Benzo(b)fluoranthene	49	0.049	0.000049	0.013	0.000013	0.33	0.00033
Benzo(k)fluoranthene	<20	<0.02	<0.00002	<0.0054	<0.0000054	<0.13	<0.00013
Benzo(e)pyrene	34	0.034	0.000034	0.0092	0.0000092	0.23	0.00023
Benzo(a)pyrene	<20	<0.02	<0.00002	<0.0054	<0.0000054	<0.13	<0.00013
Perylene	<20	<0.02	<0.00002	<0.0054	<0.0000054	<0.13	<0.00013
Indeno(123:cd)pyrene	<85	<0.085	<0.000085	<0.023	<0.000023	<0.57	<0.00057
Dibenzo(ah)anthracene	<89	<0.089	<0.000089	<0.024	<0.000024	<0.6	<0.0006
Benzo(ghi)perylene	<90	<0.09	<0.00009	<0.024	<0.000024	<0.6	<0.0006
Sum of reported PAH's	220000	220	0.22	60	0.06	1500	1.5

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Emission Measurement Calculations Spreadsheet

60489919 Weston Aluminum Stack 5 Speciated Dioxins and Furans Results					
Analyte	**Mass ng**	**Toxic Equivalency Factor (1 - TEFs)**	**Total Toxic Equivalence (1 - TEQs) ng**	**Concentration ng/m^3**	**Total Toxic Equivalence (1-TEQs) ng/m^3**
2,3,7,8-TCDF	<0.002	0.1	0.0001	<0.00054	0.000027
Total TCDF isomers	0.037				
2,3,7,8-TCDD	<0.002	1	0.001	<0.00054	0.00027
Total TCDD isomers	<0.01				
1,2,3,7,8-PeCDF	<0.002	0.05	0.00005	<0.00054	0.000014
2,3,4,7,8-PeCDF	<0.002	0.5	0.0005	<0.00054	0.00014
Total PeCDF isomers	<0.01				
1,2,3,7,8-PeCDD	<0.002	0.5	0.0005	<0.00054	0.00014
Total PeCDD isomers	<0.01				
1,2,3,4,7,8-HxCDF	<0.001	0.1	0.00005	<0.00027	0.000014
1,2,3,6,7,8-HxCDF	<0.001	0.1	0.00005	<0.00027	0.000014
2,3,4,6,7,8-HxCDF	<0.001	0.1	0.00005	<0.00027	0.000014
1,2,3,7,8,9-HxCDF	<0.001	0.1	0.00005	<0.00027	0.000014
Total HxCDF isomers	<0.01				
1,2,3,4,7,8-HxCDD	<0.002	0.1	0.0001	<0.00054	0.000027
1,2,3,6,7,8-HxCDD	<0.002	0.1	0.0001	<0.00054	0.000027
1,2,3,7,8,9-HxCDD	<0.002	0.1	0.0001	<0.00054	0.000027
Total HxCDD isomers	<0.01				
1,2,3,4,6,7,8-HpCDF	<0.002	0.01	0.00001	<0.00054	0.0000027
1,2,3,4,7,8,9-Hp CDF	<0.002	0.01	0.00001	<0.00054	0.0000027
Total HpCDF isomers	<0.008				
1,2,3,4,6,7,8-HpCDD	<0.003	0.01	0.000015	<0.00081	0.0000041
Total HpCDD isomers	<0.01				
OCDF	<0.007	0.001	0.0000035	<0.0019	0.00000095
OCDD	0.017	0.001	0.000017	0.0046	0.0000046

I-TEQ$_{DF}$

Lower Bound (excluding LOD Values)	0.000017 ng
Middle Bound (including half LOD Values)	0.0027 ng
Date Tested **24-Jun-16**	

STACK ANALYSIS - FINAL CALCULATIONS

Polycyclic Aromatic Hydrocarbons

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	4.1089	m^3	Average barometric pressure (P_{BARO})	1004 hPa
Average gas meter temp. ($T_{M,2}$):	28.5	°C		
	301.7	K	Average pressure at meter ($P_{M,2}$)	1004.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	3.6868	m^3		

(B) PAH concentration at standard conditions

Blank thimble No.:	NA		Blank weight:	g
Thimble No. used:	NA		PAH Weight	0.00022 g
Final PAH Weight (Mp1):	0.00022	g		
PAH Concentration (C1):		$=M_{p1}/MV_4=$	0.00006	g/m^3 (0°C, dry gas, 1atm pressure)
		;and C_2 =	0.06	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00006 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.06 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.8 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.0037 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 3.7 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: FA9

V_v = 32.3 g (from laboratory report) V_w = 35 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0467

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0431

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

B_{ws} = 2.38 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Polycyclic Aromatic Hydrocarbons

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0^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 $\frac{(Ps)}{(1013.25)}$

= 1.083 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 16.99 m/s

(ii) Average of post-sampling velocities: 17.57 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.28 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 = 30.13 m^3/s (stack conditions)

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

Qstd = 24.7 m^3/s (0^oC, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0015	g/s (0^oC, dry gas, 1 atm pressure)		
	=	1.5	mg/s (0^oC, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0015	g/s (0^oC, dry gas, 1 atm pressure	12%	CO_2)
	=	1.5	mg/s (0^oC, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.092	g/s (0^oC, dry gas, 1 atm pressure	7%	O_2)
	=	92	mg/s (0^oC, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Dioxins and Furans Lower Bound

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 4.1089 m^3

Average gas meter temp. ($T_{M,2}$): 28.5 °C

301.7 K

Average barometric pressure (P_{BARO}) 1004 hPa

Average pressure at meter ($P_{M,2}$) 1004.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 3.6868 m^3

(B) Lower Bound concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: NA

Blank weight: µg

Lower Bound Weight 0.000000017 µg

Final Lower Bound Weight (Mp1): 0.00000 µg

Lower Bound Concentration (C1): $=M_{p1}/MV_4=$ 0.0000000046 µg/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.0000046 ng/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.000000005 µg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.000005 ng/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.8 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.0000003 µg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.0003 ng/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: FA9

V_v = 32.3 g (from laboratory report) V_w = 35 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0467

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0431

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

B_{ws} = 2.38 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Dioxins and Furans Lower Bound

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.083 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 16.99 m/s

(ii) Average of post-sampling velocities: 17.57 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.28 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 = 30.13 m^3/s (stack conditions)

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

Qstd = 24.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.00000011	µg/s (0°C, dry gas, 1 atm pressure)		
	=	0.00011	ng/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.00000011	µg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.00011	ng/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.0000071	µg/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	0.0071	ng/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Dioxins and Furans Middle Bound

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

Date: 24-Jun-16 Client: Weston Aluminum

AECOM's Project No: 60489919 Stack/Duct Description: Stack 5

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	4.1089 m^3	Average barometric pressure (P_{BARO})	1004 hPa	
Average gas meter temp. ($T_{M,2}$):	28.5 °C			
	301.7 K	Average pressure at meter ($P_{M,2}$)	1004.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	3.6868 m^3			

(B) Middle Bound concentration at standard conditions

Blank thimble No.:	NA	Blank weight:	µg
Thimble No. used:	NA	Middle Bound Weight	0.0000027 µg

Final Middle Bound Weight (Mp1): 0.00000 µg

Middle Bound Concentration (C1): $=M_{p1}/MV_4=$ 0.00000073 $\mu g/m^3$ (0°C, dry gas, 1atm pressure)

;and C_2 = 0.00073 ng/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0000007 $\mu g/m^3$ (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.0007 ng/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.8 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.00005 $\mu g/m^3$ (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.05 ng/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: FA9

V_v = 32.3 g (from laboratory report) V_w = 35 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0467

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0431

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

B_{ws} = 2.38 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

ANZ

Emission Measurement Calculations Spreadsheet

Dioxins and Furans Middle Bound

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.083 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 16.99 m/s

(ii) Average of post-sampling velocities: 17.57 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 17.28 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 = 30.13 m^3/s (stack conditions)

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

Qstd = 24.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.000018	µg/s (0°C, dry gas, 1 atm pressure)		
	=	0.018	ng/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.000018	µg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.018	ng/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.0011	µg/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	1.1	ng/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 5
WESTON ALUMINUM
24-Jun-16
DIOXINS AND FURANS

POLYCYCLIC AROMATIC HYDROCARBONS

Sampling Conditions:			
Stack internal diameter at test location	1490 mm		
Stack gas temperature (average)	49.0 °C		322.2 K
Stack pressure (average)	1003 hPa		
Stack gas velocity (average, stack conditions)	17 m/s		
Stack gas flowrate (stack conditions)	30 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	25 m^3/s		
Dioxins and Furans Lower Bound Testing			
Test Period	9:08	-	15:10
Dioxins and Furans Lower Bound Mass	0.000017 ng		
Gas Volume Sampled	3.69 m^3		
Dioxins and Furans Lower Bound Emission*1	0.0000046 ng/m^3		
Dioxins and Furans Lower Bound Mass Emission Rate*2	0.00011 ng/s		
Regulatory Limit	0.1 ng/m^3		
Dioxins and Furans Middle Bound Testing			
Test Period	9:08	-	15:10
Dioxins and Furans Middle Bound Mass	0.0027 ng		
Gas Volume Sampled	3.69 m^3		
Dioxins and Furans Middle Bound Emission*1	0.00073 ng/m^3		
Dioxins and Furans Middle Bound Mass Emission Rate*2	0.018 ng/s		
Regulatory Limit	0.1 ng/m^3		
Polycyclic Aromatic Hydrocarbons Testing			
Test Period	9:08	-	15:10
Polycyclic Aromatic Hydrocarbons Mass	0.22 mg		
Gas Volume Sampled	3.69 m^3		
Polycyclic Aromatic Hydrocarbons Emission*1	0.06 mg/m^3		
Polycyclic Aromatic Hydrocarbons Mass Emission Rate*2	1.5 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	2.4		
Gas Density (dry at 1 atmosphere)	1.29 kg/m^3		
Dry Molecular Weight	28.8 g/g-mole		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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.

STACK ANALYSIS - SAMPLING OF VOLATILE ORGANIC COMPOUNDS

AECOM

Client:	Weston Aluminium	
Project Number:	60489919	
Stack Description:	Stack 5	
Date:	24-Jun-16	
Rotameter Correction Factor:	1.01	
Time Start:	13:25	
Time Finish:	13:55	
Sample Flow Rate:	0.2	L/min
Sample Time:	30	min
Sampled Volume:	6.06	litres
	0.00606	m^3
Ambient Temperature:	15	°C
Barometric Pressure:	1004	hPa
Stack Gas Moisture:	1.2	%
Corrected Volume:	0.00562	m^3 (0°C, dry gas, 1 atmosphere pressure)
Stack Flow Rate	27	m^3/s (0°C, dry gas, 1 atmosphere pressure)

VOC AIR EMISSION TEST RESULTS

Analyte	Sample µg	Blank µg	Sample Blank Corrected µg	(mg/m³)	mg/s
Acetone	<1.0	<1.0	<1.0	<0.18	<4.9
1,1-dichloroethane	<1.0	<1.0	<1.0	<0.18	<4.9
2-Butanone	<1.0	<1.0	<1.0	<0.18	<4.9
Chloroform	<1.0	<1.0	<1.0	<0.18	<4.9
Benzene	<1.0	<1.0	<1.0	<0.18	<4.9
1-heptene	<1.0	<1.0	<1.0	<0.18	<4.9
n-heptane	<1.0	<1.0	<1.0	<0.18	<4.9
Trichloroethene	<1.0	<1.0	<1.0	<0.18	<4.9
MIBK	<1.0	<1.0	<1.0	<0.18	<4.9
Toluene	2.2	<1.0	1.7	0.3	8.1
2-hexanone	<1.0	<1.0	<1.0	<0.18	<4.9
Chlorobenzene	<1.0	<1.0	<1.0	<0.18	<4.9
Ethyl Benzene	<1.0	<1.0	<1.0	<0.18	<4.9
m- & p-xylene	<2.0	<0.2	<2.0	<0.36	<9.7
o-xylene	<1.0	<1.0	<1.0	<0.18	<4.9
Styrene	<1.0	<1.0	<1.0	<0.18	<4.9
Cyclohexanone	<1.0	<1.0	<1.0	<0.18	<4.9
Isopropylbenzene	<1.0	<1.0	<1.0	<0.18	<4.9
2-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<4.9
4-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<4.9
1,3,5-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<4.9
n-decane	<1.0	<1.0	<1.0	<0.18	<4.9
1,2,4-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<4.9
1,3-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<4.9
1,4-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<4.9
1,2-dichlorobenzne	<1.0	<1.0	<1.0	<0.18	<4.9
n-butylbenzene	<1.0	<1.0	<1.0	<0.18	<4.9
Hexachlorobutadiene	<1.0	<1.0	<1.0	<0.18	<4.9
Total	2.2		1.7	0.3	8.1

Note: Where the blank has returned a less than value, the analysed value has been corrected for half of that blank value. ie a blank value of <0.5 has had 0.25 subtracted from the analysed value.

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 6

Date Sampled: 1-Jul-16

ANALYTE(S)	METHOD
Total Particulate	NSW EPA TM - 15
Total Fluoride	NSW EPA TM - 9

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

Dylan Turnbull

ANZ

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - PRE-SAMPLING

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1: Total Particulate
Test 2: Total Fluoride

Measurement/Observations

Stack Internal Dimensions:

Diameter 580 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 0.26 m^2

Minimum No. of sampling points= 8

Distance from sampling plane to nearest disturbances:

Upstream (m) = 5
No. Diameters = 8.6
Type of Upstream Disturbance: Bend
Downstream (m) = 3
No. Diameters = 5.2
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 8
PM2.5/10= NA
No. of sampling traverses/ports sampled = 2
PM2.5/10= NA
No. of sampling points on each traverse/port = 4
PM2.5/10= NA

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	39		9		
2	145		115		
3	435		405		
4	541		511		
5					
6					
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: .....

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1: Total Particulate
Test 2: Total Fluoride

Sampling time start: 8:59		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	8:59	2	16.4	2.5
2	9:00	2	16.4	2.5
3	9:01	1	16.4	2.5
4	9:02	1	16.4	2.5
5	9:03	1	16.4	2.5
6	9:04	2	16.4	2.5
7	9:05	1	16.4	2.5
8	9:06	1	16.4	2.5
	Averages:	1.4 ppm	16.4 %	2.5 %

Moisture content (M3): 0.98
Moisture percentage (M2): 2.20 %

Measurements

CO:	0.0001 %,(dry)	N_2:	81.1 %,(dry)
CO_2:	2.5 %,(dry)	O_2:	16.4 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0001 %,(wet)	N_2:	79.3 %,(wet)
CO_2:	2.4 %,(wet)	O_2:	16.0 %,(wet)
H_2O:	2.20 %(=M2)		

Therefore, stack gas density (GD) =	1.29 kg/m^3	(0^oC, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.30 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: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1: Total Particulate
Test 2: Total Fluoride

Sampling time start: 10:07		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:07	1	16.7	2.4
2	10:08	2	16.7	2.4
3	10:09	2	16.7	2.4
4	10:10	2	16.7	2.4
5	10:11	1	16.7	2.4
6	10:12	1	16.7	2.4
7	10:13	1	16.7	2.4
8	10:14	1	16.7	2.4
	Averages:	1.4 ppm	16.7 %	2.4 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.52 %

Measurements

CO:	0.0001 %,(dry)	N_2:	80.9 %,(dry)
CO_2:	2.4 %,(dry)	O_2:	16.7 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0001 %,(wet)	N_2:	79.7 %,(wet)
CO_2:	2.4 %,(wet)	O_2:	16.4 %,(wet)
H_2O:	1.52 %(=M2)		

Therefore, stack gas density (GD) =	1.29 kg/m^3	(0^oC, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.30 kg/m^3	(0^oC, dry, 1 atm pressure)

Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1:Total Particulate
Test 2:Total Fluoride

Time :	8:55	Barometric Pressure :		1005	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.29	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	9	0.053	181.0	454.2	9.9
1/2	115	0.056	181.0	454.2	10.1
1/3	405	0.073	181.0	454.2	11.6
1/4	511	0.075	181.0	454.2	11.7
2/1	9	0.066	181.0	454.2	11.0
2/2	115	0.062	181.0	454.2	10.7
2/3	405	0.066	181.0	454.2	11.0
2/4	511	0.059	181.0	454.2	10.4
Average			181.0	454.2	10.8

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -4.8 mm
Absolute pressure in stack (hPa) : 1004.53 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 6
Sample Nozzle No.: S4
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 4.54 x 10^{-5} m^2
Thimble No: S44
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 452.9276 Meter finish: 452.9276
Time start: 9:01 Time finish: 9:02

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 454.4590 Meter finish: 454.4590
Time start: 10:00 Time finish: 10:09

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 452.9292 Time start: 9:06
Meter correction factor (GMf) : 0.9800

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	39	17.4	20.0	18.0		Yes
1/2	0:15:00	145	17.7	21.0	19.0		Yes
1/3	0:22:30	435	20.4	23.0	19.0		Yes
1/4	0:30:00	541	20.5	25.0	20.0		Yes
2/1	0:37:30	39	19.3	26.0	20.0		Yes
2/2	0:45:00	145	18.8	26.0	20.0		Yes
2/3	0:52:30	435	19.3	27.0	21.0		Yes
2/4	1:00:00	541	18.3	27.0	21.0		Yes
Averages				24.4	19.8	no result	

Meter Finish: 454.4566 Time Finish: 10:07
Total Condensate collected: 3 ml Silica gel No(s) used: 135

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL FLUORIDE

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 6
Sample Nozzle No.: S10
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.87 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 195.1510 Meter finish: 195.1510
Time start: 9:03 Time finish: 9:04

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 195.7154 Meter finish: 195.7154
Time start: 9:50 Time finish: 9:51

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 195.1526 Time start: 9:06
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	39	11.3	18.0	18.0		Yes
1/2	0:15:00	145	11.6	19.0	19.0		Yes
1/3	0:22:30	435	13.3	21.0	19.0		Yes
1/4	0:30:00	541	13.4	23.0	20.0		Yes
2/1	0:37:30	39	12.6	23.0	20.0		Yes
2/2	0:45:00	145	12.2	24.0	20.0		Yes
2/3	0:52:30	435	12.6	24.0	21.0		Yes
2/4	1:00:00	541	11.9	25.0	21.0		Yes
Averages				22.1	19.8	no result	

Meter Finish: 195.7136 Time Finish: 10:07
Total Condensate collected: 3 ml Silica gel No(s) used: L16

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Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1:Total Particulate
Test 2:Total Fluoride

Time :	9:56	Barometric Pressure :		1005	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.29	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	9	0.066	182.0	455.2	11.0
1/2	115	0.083	182.0	455.2	12.4
1/3	405	0.079	182.0	455.2	12.1
1/4	511	0.087	182.0	455.2	12.7
2/1	9	0.089	182.0	455.2	12.8
2/2	115	0.077	182.0	455.2	11.9
2/3	405	0.083	182.0	455.2	12.4
2/4	511	0.067	182.0	455.2	11.1
Average			182.0	455.2	12.1

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -5 mm
Absolute pressure in stack (hPa) : 1004.51 hPa

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 1-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 6

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.4969	m^3	Average barometric pressure (P_{BARO})	1005 hPa
Average gas meter temp. ($T_{M,2}$):	22.1	°C		
	295.3	K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.3736 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: S44 Total Particulate Weight 0.0030 g

Final Total Particulate Weight (Mp1): 0.00300 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.0022 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 2.2 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.5 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.011 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 11 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 3 %

Average O_2%: 16.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.0089 g/m^3 (0°C, dry gas, 1atm pressure, 3% O_2)

;and C_{b1} = 8.9 mg/m^3 (0°C, dry gas, 1atm pressure, 3% O_2)

(C) Moisture content

Silica Gel Number: 135

V_v = 5.4 g (from laboratory report) V_w = 3 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0040

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0072

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

B_{ws} = 0.81 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

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

(i) Initial gas density for sampling: 1.29 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.30 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.762 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 10.80 m/s

(ii) Average of post-sampling velocities: 12.05 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 11.43 m/s (stack conditions, wet)
(**Note**: (Vs) is from all individual data, **not** from (i) and (ii) alone.) N/A m/s (stack conditions, wet)

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

Qstack = Vs x A = 3.02 m^3/s (stack conditions)

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

Qstd = 1.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0039	g/s (0°C, dry gas, 1 atm pressure)		
	=	3.9	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.019	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	19	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.016	g/s (0°C, dry gas, 1 atm pressure	3%	O_2)
	=	16	mg/s (0°C, dry gas, 1 atm pressure	3%	O_2)

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Total Fluoride

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

Date: 1-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 6

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.5666 m^3	Average barometric pressure (P_{BARO})	1005 hPa	
Average gas meter temp. ($T_{M,2}$):	20.9 °C			
	294.1 K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.5220 m^3			

(B) Total Fluoride concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: NA Total Fluoride Weight 0.00007 g

Final Total Fluoride Weight (Mp1): 0.00007 g

Total Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.00013 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.13 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.5 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00064 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.64 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 16.6 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.00041 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.41 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: L16

V_v = 5.9 g (from laboratory report) V_w = 3 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0040

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0079

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

B_{ws} = 2.22 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Fluoride

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

(i) Initial gas density for sampling: 1.29 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.30 kg/m^3 (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

$$\text{(ii)} \times \frac{(273.2)}{(273.2+Ts)} \times \frac{(Ps)}{(1013.25)}$$

= 0.768 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 10.80 m/s

(ii) Average of post-sampling velocities: 12.05 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 11.43 m/s (stack conditions, wet)
(**Note**: (Vs) is from all individual data, **not** from (i) and (ii) alone.) N/A m/s (stack conditions, wet)

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

Qstack = Vs x A = 3.02 m^3/s (stack conditions)

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

Qstd = 1.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.00023	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.23	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0011	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	1.1	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.00072	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	0.72	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, STACK 6
WESTON ALUMINIUM
1-Jul-16
TOTAL PARTICULATE
TOTAL FLUORIDE

Sampling Conditions:			
Stack internal diameter at test location	580 mm		
Stack gas temperature (average)	181.5 °C		454.7 K
Stack pressure (average)	1005 hPa		
Stack gas velocity (average, stack conditions)	11 m/s		
Stack gas flowrate (stack conditions)	3 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	1.8 m^3/s		
Total Particulate Testing			
Test Period	9:06	-	10:07
Total Particulate Mass	3.0 mg		
Gas Volume Sampled	1.37 m^3		
Total Particulate Emission*1 at 3% O2	8.9 mg/m^3		
Total Particulate Mass Emission Rate*2	3.9 mg/s		
Regulatory Limit at 3% O2	10 mg/m^3		
Total Fluoride Testing			
Test Period	9:06	-	10:07
Total Fluoride Mass	0.07 mg		
Gas Volume Sampled	0.522 m^3		
Total Fluoride Emission*1	0.13 mg/m^3		
Total Fluoride Mass Emission Rate*2	0.23 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.5		
Gas Density (dry at 1 atmosphere)	1.30 kg/m^3		
Dry Molecular Weight	29.1 g/g-mole		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 6

Date Sampled: 1-Jul-16

ANALYTE(S)	METHOD
Polycyclic Aromatic Hydrocarbons	NSW EPA OM - 6
Sulfuric Acid Mist	NSW EPA TM - 3
Sulfur Dioxide	NSW EPA TM - 4

Observations made during testing period:

Sampling Performed By:

Vilai Kelemete-Manua

Dylan Turnbull

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - PRE-SAMPLING

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1: Polycyclic Aromatic Hydrocarbons
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Measurement/Observations

Stack Internal Dimensions:

Diameter 580 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 0.26 m^2

Minimum No. of sampling points= 8

Distance from sampling plane to nearest disturbances:

Upstream (m) = 5
No. Diameters = 8.6
Type of Upstream Disturbance: Bend
Downstream (m) = 3
No. Diameters = 5.2
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 8
PM2.5/10= NA
No. of sampling traverses/ports sampled = 2
PM2.5/10= NA
No. of sampling points on each traverse/port = 4
PM2.5/10= NA

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	39	9		
2	145	115		
3	435	405		
4	541	511		
5				
6				
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1: Polycyclic Aromatic Hydrocarbons
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 10:07		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:07	1	16.7	2.4
2	10:08	2	16.7	2.4
3	10:09	2	16.7	2.4
4	10:10	2	16.7	2.4
5	10:11	1	16.7	2.4
6	10:12	1	16.7	2.4
7	10:13	1	16.7	2.4
8	10:14	1	16.7	2.4
	Averages:	1.4 ppm	16.7 %	2.4 %

Moisture content (M3): 0.98
Moisture percentage (M2): 2.20 %

Measurements

CO:	0.0001 %,(dry)	N_2:	80.9 %,(dry)
CO_2:	2.4 %,(dry)	O_2:	16.7 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0001 %,(wet)	N_2:	79.1 %,(wet)
CO_2:	2.3 %,(wet)	O_2:	16.3 %,(wet)
H_2O:	2.20 %(=M2)		

Therefore, stack gas density (GD) =	1.29 kg/m^3	(0^oC, wet, 1 atm pressure)
Therefore, stack gas density (GD) =	1.30 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: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1: Polycyclic Aromatic Hydrocarbons
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 11:30		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:30	0	17.8	1.8
2	11:31	0	17.8	1.8
3	11:32	0	17.7	1.8
4	11:33	0	17.7	1.8
5	11:34	0	17.6	1.9
6	11:35	0	17.5	1.9
7	11:36	0	17.4	2.0
8	11:37	0	17.4	2.0
	Averages:	0.0 ppm	17.6 %	1.9 %

Moisture content (M3): 0.98
Moisture percentage (M2): 2.24 %

Measurements

CO:	0.0000 %,(dry)	N_2:	80.5 %,(dry)
CO_2:	1.9 %,(dry)	O_2:	17.6 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	78.7 %,(wet)
CO_2:	1.8 %,(wet)	O_2:	17.2 %,(wet)
H_2O:	2.24 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0^oC, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.30 kg/m^3	(0^oC, dry, 1 atm pressure)	

Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1:Polycyclic Aromatic Hydrocarbons
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	9:56	Barometric Pressure :		1005	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.29	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	9	0.066	182.0	455.2	11.0
1/2	115	0.083	182.0	455.2	12.4
1/3	405	0.079	182.0	455.2	12.1
1/4	511	0.087	182.0	455.2	12.7
2/1	9	0.089	182.0	455.2	12.8
2/2	115	0.077	182.0	455.2	11.9
2/3	405	0.083	182.0	455.2	12.4
2/4	511	0.067	182.0	455.2	11.1
Average			182.0	455.2	12.1

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -5 mm
Absolute pressure in stack (hPa) : 1004.51 hPa

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF POLYCYCLIC AROMATIC HYDROCARBONS

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 6
Sample Nozzle No.: G7
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 3.58 x $10^{-5}m^2$
Thimble No: DAU150616C
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 454.4598 Meter finish: 454.4598
Time start: 10:20 Time finish: 10:21

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 455.5388 Meter finish: 455.5388
Time start: 11:35 Time finish: 11:36

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 454.4625 Time start: 10:24
Meter correction factor (GMf) : 0.9800

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	0:08:00	39	15.2	24.0	20.0		Yes
1/2	0:16:00	145	17.1	26.0	20.0		Yes
1/3	0:24:00	435	16.7	27.0	20.0		Yes
1/4	0:32:00	541	17.6	25.0	19.0		Yes
2/1	0:40:00	39	17.7	25.0	20.0		Yes
2/2	0:48:00	145	16.4	26.0	20.0		Yes
2/3	0:56:00	435	17.1	25.0	20.0		Yes
2/4	1:04:00	541	15.3	27.0	20.0		Yes
Averages				25.6	19.9	no result	

Meter Finish: 455.5363 Time Finish: 11:28
Total Condensate collected: 0 ml Silica gel No(s) used: P1

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF SULFURIC ACID MIST (H2SO4 AS SO3)

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 6
Sample Nozzle No.: S10
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 2.87 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 195.7498 Meter finish: 195.7498
Time start: 10:22 Time finish: 10:23
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 196.5968 Meter finish: 196.5968
Time start: 11:37 Time finish: 11:38
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 195.7510 Time start: 10:24
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	0:08:00	39	12.6	22.0	19.0		Yes
1/2	0:16:00	145	14.2	23.0	20.0		Yes
1/3	0:24:00	435	13.8	24.0	20.0		Yes
1/4	0:32:00	541	14.5	22.0	19.0		Yes
2/1	0:40:00	39	14.6	22.0	19.0		Yes
2/2	0:48:00	145	13.6	23.0	19.0		Yes
2/3	0:56:00	435	14.2	22.0	19.0		Yes
2/4	1:04:00	541	12.7	23.0	19.0		Yes
Averages				22.6	19.3	no result	

Meter Finish: 196.5950 Time Finish: 11:28
Total Condensate collected: 0 ml Silica gel No(s) used: P8

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF SULFUR DIOXIDE (SO2 AS SO3)

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 6
Sample Nozzle No.: S10
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.87 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 195.7498 Meter finish: 195.7498
Time start: 10:22 Time finish: 10:23

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 196.5968 Meter finish: 196.5968
Time start: 11:37 Time finish: 11:38

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1005 hPa (start); 1005 hPa (finish)
Meter start: 195.7510 Time start: 10:24
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	0:08:00	39	12.6	22.0	19.0		Yes
1/2	0:16:00	145	14.2	23.0	20.0		Yes
1/3	0:24:00	435	13.8	24.0	20.0		Yes
1/4	0:32:00	541	14.5	22.0	19.0		Yes
2/1	0:40:00	39	14.6	22.0	19.0		Yes
2/2	0:48:00	145	13.6	23.0	19.0		Yes
2/3	0:56:00	435	14.2	22.0	19.0		Yes
2/4	1:04:00	541	12.7	23.0	19.0		Yes
Averages				22.6	19.3	no result	

Meter Finish: 196.5950 Time Finish: 11:28
Total Condensate collected: 0 ml Silica gel No(s) used: P8

ANZ

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6
Test 1:Polycyclic Aromatic Hydrocarbons
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	11:25	Barometric Pressure :		1005	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	9	0.090	179.0	452.2	12.9
1/2	115	0.095	179.0	452.2	13.2
1/3	405	0.087	179.0	452.2	12.7
1/4	511	0.085	179.0	452.2	12.5
2/1	9	0.087	179.0	452.2	12.7
2/2	115	0.087	179.0	452.2	12.7
2/3	405	0.088	179.0	452.2	12.7
2/4	511	0.085	179.0	452.2	12.5
Average			179.0	452.2	12.7

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6.3 mm
Absolute pressure in stack (hPa) : 1004.38 hPa

Emission Measurement Calculations Spreadsheet

Stack Analysis - Speciated Polycyclic Aromatic Hydrocarbons (PAH) Results

Date: 1-Jul-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 6

	Sample Result			Emission		Mass Emission Rate	
	(ng)	(µg)	(mg)	(µg/m^3)	(mg/m^3)	(µg/s)	(mg/s)
Naphthalene	5800	5.8	0.0058	6	0.006	12	0.012
2 - Methylnapthalene	7800	7.8	0.0078	8.1	0.0081	16	0.016
Acenaphthylene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Acenaphthene	460	0.46	0.00046	0.48	0.00048	0.92	0.00092
Fluorene	250	0.25	0.00025	0.26	0.00026	0.5	0.0005
Phenanthrene	330	0.33	0.00033	0.34	0.00034	0.66	0.00066
Anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Fluoranthene	100	0.1	0.0001	0.1	0.0001	0.2	0.0002
Pyrene	140	0.14	0.00014	0.15	0.00015	0.28	0.00028
Benz(a)anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Chrysene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Benzo(b)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Benzo(k)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Benzo(e)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Benzo(a)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.04	<0.00004
Perylene	310	0.31	0.00031	0.32	0.00032	0.62	0.00062
Indeno(123:cd)pyrene	<150	<0.15	<0.00015	<0.16	<0.00016	<0.3	<0.0003
Dibenzo(ah)anthracene	<140	<0.14	<0.00014	<0.15	<0.00015	<0.28	<0.00028
Benzo(ghi)perylene	<210	<0.21	<0.00021	<0.22	<0.00022	<0.42	<0.00042
Sum of reported PAH's	15000	15	0.015	16	0.016	31	0.031

STACK ANALYSIS - FINAL CALCULATIONS

Polycyclic Aromatic Hydrocarbons

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

Date: 1-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 6

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.0523 m^3	Average barometric pressure (P_{BARO})	1005 hPa
Average gas meter temp. ($T_{M,2}$):	22.8 °C		
	296.0 K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.9633 m^3

(B) PAH concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: DAU150616C PAH Weight 0.000015 g

Final PAH Weight (Mp1): 0.00002 g

PAH Concentration (C1): $=M_{p1}/MV_4=$ 0.000016 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.016 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00009 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.09 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 17.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.000058 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.058 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P1

V_v = 10.8 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0144

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

B_{ws} = 1.47 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Polycyclic Aromatic Hydrocarbons

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

(i) Initial gas density for sampling: 1.29 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.30 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.764 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.05 m/s

(ii) Average of post-sampling velocities: 12.74 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.39 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 = 3.27 m^3/s (stack conditions)

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

Qstd = 1.9 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.000031	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.031	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.00017	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.17	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.00011	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	0.11	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Sulfuric Acid Mist (H2SO4 as SO3)

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

Date: 1-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 6

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8524 m^3	Average barometric pressure (P_{BARO})	1005 hPa	
Average gas meter temp. ($T_{M,2}$):	20.9 °C			
	294.1 K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7854 m^3			

(B) H2SO4 as SO3 concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: NA H2SO4 as SO3 Weight <0.002 g

Final H2SO4 as SO3 Weight (Mp1): <0.002 g

H2SO4 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ <0.0025 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <2.5 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.014 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <14 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 17.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.0091 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <9.1 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P8

V_v = 15.8 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0211

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

B_{ws} = 2.62 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfuric Acid Mist (H2SO4 as SO3)

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

(i) Initial gas density for sampling: 1.29 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.30 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.770 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.05 m/s

(ii) Average of post-sampling velocities: 12.74 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.39 m/s (stack conditions, wet)
(**Note**: (Vs) is from all individual data, **not** from (i) and (ii) alone.) N/A m/s (stack conditions, wet)

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

Qstack = Vs x A = 3.27 m^3/s (stack conditions)

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

Qstd = 1.9 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.0048	g/s (0°C, dry gas, 1 atm pressure)		
	=	<4.8	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.027	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<27	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<0.017	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<17	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Sulfur Dioxide (SO2 as SO3)

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

Date: 1-Jul-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 6

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8524 m^3	Average barometric pressure (P_{BARO})	1005 hPa	
Average gas meter temp. ($T_{M,2}$):	20.9 °C			
	294.1 K	Average pressure at meter ($P_{M,2}$)	1005.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7854 m^3			

(B) SO2 as SO3 concentration at standard conditions

Blank thimble No.:	NA	Blank weight:	g
Thimble No. used:	NA	SO2 as SO3 Weight	<0.01 g
Final SO2 as SO3 Weight (Mp1):	<0.01 g		
SO2 as SO3 Concentration (C1):	$=M_{p1}/MV_4=$	<0.013	g/m^3 (0°C, dry gas, 1atm pressure)
	;and C_2 =	<13	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.073 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <73 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 17.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.047 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <47 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P8

V_v = 15.8 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0211

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

B_{ws} = 2.62 %

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfur Dioxide (SO2 as SO3)

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

(i) Initial gas density for sampling: 1.29 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.30 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.770 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.05 m/s

(ii) Average of post-sampling velocities: 12.74 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.39 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 = 3.27 m^3/s (stack conditions)

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

Qstd = 1.9 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.025	g/s (0°C, dry gas, 1 atm pressure)		
	=	<25	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.14	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<140	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<0.09	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<90	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

EMISSION MONITORING RESULTS, STACK 6
WESTON ALUMINIUM
1-Jul-16
POLYCYCLIC AROMATIC HYDROCARBONS
SULFURIC ACID MIST (H2SO4 AS SO3)
SULFUR DIOXIDE (SO2 AS SO3)

Sampling Conditions:			
Stack internal diameter at test location	580 mm		
Stack gas temperature (average)	180.5 °C		453.7 K
Stack pressure (average)	1004 hPa		
Stack gas velocity (average, stack conditions)	12 m/s		
Stack gas flowrate (stack conditions)	3.3 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	1.9 m^3/s		
Polycyclic Aromatic Hydrocarbons Testing			
Test Period	10:24	-	11:28
Polycyclic Aromatic Hydrocarbons Mass	0.015 mg		
Gas Volume Sampled	0.963 m^3		
Polycyclic Aromatic Hydrocarbons Emission*1	0.016 mg/m^3		
Polycyclic Aromatic Hydrocarbons Mass Emission Rate*2	0.031 mg/s		
Regulatory Limit	NA mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing			
Test Period	10:24	-	11:28
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2 mg		
Gas Volume Sampled	0.785 m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<2.5 mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<4.8 mg/s		
Regulatory Limit	NA mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing			
Test Period	10:24	-	11:28
Sulfur Dioxide (SO2 as SO3) Mass	<10 mg		
Gas Volume Sampled	0.785 m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	<13 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	<25 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.5		
Gas Density (dry at 1 atmosphere)	1.30 kg/m^3		
Dry Molecular Weight	29 g/g-mole		

Notes *1 Emission concentration at Standard conditions of 0^0C, 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.

STACK ANALYSIS - SAMPLING OF VOLATILE ORGANIC COMPOUNDS

AECOM

Client:	Weston Aluminium	
Project Number:	60489919	
Stack Description:	Stack 6	
Date:	01-Jul-16	
Rotameter Correction Factor:	1.01	
Time Start:	9:20	
Time Finish:	10:20	
Sample Flow Rate:	0.2	L/min
Sample Time:	60	min
Sampled Volume:	12.12	litres
	0.01212	m^3
Ambient Temperature:	12	°C
Barometric Pressure:	1016	hPa
Stack Gas Moisture:	1.5	%

Corrected Volume: 0.0115 m^3 (0°C, dry gas, 1 atmosphere pressure)

Stack Flow Rate 1.8 m^3/s (0°C, dry gas, 1 atmosphere pressure)

VOC AIR EMISSION TEST RESULTS

Analyte	Sample µg	Blank µg	Sample Blank Corrected µg	(mg/m^3)	mg/s
Acetone	1.1	<1.0	0.6	0.052	0.094
1,1-dichloroethane	<1.0	<1.0	<1.0	<0.087	<0.16
2-Butanone	<1.0	<1.0	<1.0	<0.087	<0.16
Chloroform	<1.0	<1.0	<1.0	<0.087	<0.16
Benzene	<1.0	<1.0	<1.0	<0.087	<0.16
1-heptene	<1.0	<1.0	<1.0	<0.087	<0.16
n-heptane	<1.0	<1.0	<1.0	<0.087	<0.16
Trichloroethene	<1.0	<1.0	<1.0	<0.087	<0.16
MIBK	<1.0	<1.0	<1.0	<0.087	<0.16
Toluene	26.2	<1.0	25.7	2.2	4
2-hexanone	<1.0	<1.0	<1.0	<0.087	<0.16
Chlorobenzene	<1.0	<1.0	<1.0	<0.087	<0.16
Ethyl Benzene	<1.0	<1.0	<1.0	<0.087	<0.16
m- & p-xylene	<2.0	<0.2	<2.0	<0.17	<0.31
o-xylene	<1.0	<1.0	<1.0	<0.087	<0.16
Styrene	<1.0	<1.0	<1.0	<0.087	<0.16
Cyclohexanone	<1.0	<1.0	<1.0	<0.087	<0.16
Isopropylbenzene	<1.0	<1.0	<1.0	<0.087	<0.16
2-chlorotoluene	<1.0	<1.0	<1.0	<0.087	<0.16
4-chlorotoluene	<1.0	<1.0	<1.0	<0.087	<0.16
1,3,5-trimethylbenzene	<1.0	<1.0	<1.0	<0.087	<0.16
n-decane	<1.0	<1.0	<1.0	<0.087	<0.16
1,2,4-trimethylbenzene	<1.0	<1.0	<1.0	<0.087	<0.16
1,3-dichlorobenzene	<1.0	<1.0	<1.0	<0.087	<0.16
1,4-dichlorobenzene	<1.0	<1.0	<1.0	<0.087	<0.16
1,2-dichlorobenzne	<1.0	<1.0	<1.0	<0.087	<0.16
n-butylbenzene	<1.0	<1.0	<1.0	<0.087	<0.16
Hexachlorobutadiene	<1.0	<1.0	<1.0	<0.087	<0.16
Total	27.3		26.3	2.3	4.094

Note: Where the blank has returned a less than value, the analysed value has been corrected for half of that blank value. ie a blank value of <0.5 has had 0.25 subtracted from the analysed value.

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 7

Date Sampled: 3-Aug-16

ANALYTE(S)	METHOD
Fine Particulate (PM10)	NSW EPA OM - 5
Total Particulate	NSW EPA TM - 15
Polycyclic Aromatic Hydrocarbons	NSW EPA OM - 6

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: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Polycyclic Aromatic Hydrocarbons

Measurement/Observations

Stack Internal Dimensions:

Diameter 1500 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 1.77 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 10
No. Diameters = 6.7
Type of Upstream Disturbance: Fan
Downstream (m) = 3.1
No. Diameters = 2.1
Type of Down Stream Disturbance: Stack Exit

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	66	36	66	36
2	219	189	219	189
3	444	414	444	414
4	1056	1026	1056	1026
5	1281	1251	1281	1251
6	1434	1404	1434	1404
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Polycyclic Aromatic Hydrocarbons

Sampling time start: 8:10		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	8:10	0	20.1	0.0
2	8:11	0	20.1	0.0
3	8:12	0	20.1	0.0
4	8:13	0	20.1	0.0
5	8:14	0	20.1	0.0
6	8:15	0	20.1	0.0
7	8:16	0	20.1	0.0
8	8:17	0	20.1	0.0
	Averages:	0.0 ppm	20.1 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.50 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.9 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.1 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	78.7 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	19.8 %,(wet)
H_2O:	1.50 %(=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: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Polycyclic Aromatic Hydrocarbons

Sampling time start: 10:00		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:00	0	20.1	0.0
2	10:01	0	20.1	0.0
3	10:02	0	20.1	0.0
4	10:03	0	20.1	0.0
5	10:04	0	20.1	0.0
6	10:05	0	20.1	0.0
7	10:06	0	20.1	0.0
8	10:07	0	20.1	0.0
	Averages:	0.0 ppm	20.1 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.17 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.9 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.1 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	79.0 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	19.9 %,(wet)
H_2O:	1.17 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0°C, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0°C, dry, 1 atm pressure)	

Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate
Test 3:Polycyclic Aromatic Hydrocarbons

Time :	8:00	Barometric Pressure :		1015	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.28	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	36	0.136	21.0	294.2	12.7
1/2	189	0.105	21.0	294.2	11.2
1/3	414	0.141	21.0	294.2	12.9
1/4	1026	0.176	21.0	294.2	14.4
1/5	1251	0.173	21.0	294.2	14.3
1/6	1404	0.139	22.0	295.2	12.9
2/1	36	0.153	21.0	294.2	13.5
2/2	189	0.153	21.0	294.2	13.5
2/3	414	0.180	22.0	295.2	14.6
2/4	1026	0.155	22.0	295.2	13.6
2/5	1251	0.160	22.0	295.2	13.8
2/6	1404	0.160	22.0	295.2	13.8
Average			21.4	294.6	13.4

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 10.8 mm
Absolute pressure in stack (hPa) : 1016.06 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 7
Sample Nozzle No.: fine3
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 1.47 x $10^{-5}m^2$
Thimble No: T463
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 208.4789 Meter finish: 208.4789
Time start: 8:45 Time finish: 8:46
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 209.3054 Meter finish: 209.3054
Time start: 10:04 Time finish: 10:05
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1015 hPa (start); 1015 hPa (finish)
Meter start: 208.4806 Time start: 8:58
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	0:04:45	66	13.5	22.0	14.0		Yes
1/2	0:04:15	219	13.5	23.0	15.0		Yes
1/3	0:04:45	444	13.5	24.0	15.0		Yes
1/4	0:05:30	1056	13.5	25.0	15.0		Yes
1/5	0:05:15	1281	13.5	26.0	15.0		Yes
1/6	0:04:45	1434	13.5	26.0	15.0		Yes
2/1	0:05:00	66	13.5	26.0	15.0		Yes
2/2	0:05:00	219	13.5	26.0	15.0		Yes
2/3	0:05:30	444	13.5	27.0	15.0		Yes
2/4	0:05:00	1056	13.5	27.0	16.0		Yes
2/5	0:05:15	1281	13.5	28.0	16.0		Yes
2/6	0:05:15	1434	13.5	29.0	16.0		Yes
Averages				25.8	15.2	no result	

Meter Finish: 209.3035 Time Finish: 10:02
Total Condensate collected: 0 ml Silica gel No(s) used: F25

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 7
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.53 x $10^{-5}m^2$
Thimble No: T464
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 471.6355 Meter finish: 471.6355
Time start: 8:46 Time finish: 8:47

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 472.3825 Meter finish: 472.3825
Time start: 10:05 Time finish: 10:06

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1015 hPa (start); 1015 hPa (finish)
Meter start: 471.6386 Time start: 8:58
Meter correction factor (GMf) : 0.9800

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	0:05:00	66	11.5	22.0	15.0		Yes
1/2	0:10:00	219	10.2	22.0	15.0		Yes
1/3	0:15:00	444	11.7	23.0	16.0		Yes
1/4	0:20:00	1056	13.1	24.0	16.0		Yes
1/5	0:25:00	1281	13.0	25.0	16.0		Yes
1/6	0:30:00	1434	11.7	26.0	16.0		Yes
2/1	0:35:00	66	12.2	26.0	16.0		Yes
2/2	0:40:00	219	12.2	26.0	16.0		Yes
2/3	0:45:00	444	13.2	26.0	17.0		Yes
2/4	0:50:00	1056	12.3	27.0	17.0		Yes
2/5	0:55:00	1281	12.5	28.0	17.0		Yes
2/6	1:00:00	1434	12.5	29.0	18.0		Yes
Averages				25.3	16.3	no result	

Meter Finish: 472.3814 Time Finish: 10:02
Total Condensate collected: 0 ml Silica gel No(s) used: F27

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF POLYCYCLIC AROMATIC HYDROCARBONS

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 7
Sample Nozzle No.: g65
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 2.38 x $10^{-5}m^2$
Thimble No: DAU010816K
Blank thimble No: 0

Leak Check (Pre-Sampling)
Meter start: 111.8866 Meter finish: 111.8866
Time start: 8:47 Time finish: 8:48

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 112.9157 Meter finish: 112.9157
Time start: 10:06 Time finish: 10:07

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1015 hPa (start); 1015 hPa (finish)
Meter start: 111.8878 Time start: 8:58
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	0:05:00	66	18.3	24.0	15.0		Yes
1/2	0:10:00	219	16.1	26.0	15.0		Yes
1/3	0:15:00	444	18.6	28.0	16.0		Yes
1/4	0:20:00	1056	20.7	28.0	16.0		Yes
1/5	0:25:00	1281	20.6	28.0	16.0		Yes
1/6	0:30:00	1434	18.5	28.0	17.0		Yes
2/1	0:35:00	66	19.4	26.0	16.0		Yes
2/2	0:40:00	219	19.4	26.0	17.0		Yes
2/3	0:45:00	444	20.9	26.0	17.0		Yes
2/4	0:50:00	1056	19.5	27.0	17.0		Yes
2/5	0:55:00	1281	19.8	28.0	18.0		Yes
2/6	1:00:00	1434	19.8	29.0	18.0		Yes
Averages				27.0	16.5	no result	

Meter Finish: 112.9145 Time Finish: 10:02
Total Condensate collected: 0 ml Silica gel No(s) used: F23

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Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate
Test 3:Polycyclic Aromatic Hydrocarbons

Time :	10:10	Barometric Pressure :		1015	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.28	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	36	0.128	23.0	296.2	12.3
1/2	189	0.107	24.0	297.2	11.3
1/3	414	0.124	24.0	297.2	12.2
1/4	1026	0.113	24.0	297.2	11.6
1/5	1251	0.133	24.0	297.2	12.6
1/6	1404	0.098	24.0	297.2	10.8
2/1	36	0.152	23.0	296.2	13.5
2/2	189	0.144	23.0	296.2	13.1
2/3	414	0.135	24.0	297.2	12.7
2/4	1026	0.122	24.0	297.2	12.1
2/5	1251	0.128	24.0	297.2	12.3
2/6	1404	0.106	24.0	297.2	11.3
Average			23.8	297.0	12.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 9.7 mm
Absolute pressure in stack (hPa) : 1015.95 hPa

STACK ANALYSIS - PM10 CALCULATIONS

Date:	3-Aug-16	Client:	Weston Aluminium
AECOM's Project No:	60489919	Stack/Duct Description:	Stack 7

1. Gas Analysis

	%		
$\%CO_2$	0.0		
$\%O_2$	20.1		
$\%N_2+\%CO$	79.9		
Fraction Moisture Content, Bws	0.01	M_s=	0.99

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	28.80
Mol. Wt. of Stack Gas (wet)	28.64

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	101500	29.96
Stack Static Pressure (Pg)	101595	29.99
Absolute Stack Pressure		29.99

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	23.8	74.8
Average Meter Temperature:	20.5	
Stack Gas Viscosity		181.5

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.45	0.0158	15.82	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	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1	0.135	75.49	24.85	0.755	1.231	56.97	18.69	92.96	30.50
2	0.158	54.91	18.08	0.725	1.250	39.80	13.06	68.64	22.52
3	0.170	47.10	15.50	0.703	1.262	33.12	10.87	59.45	19.50
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
6	0.217	28.98	9.54	0.569	1.324	16.49	5.41	38.37	12.59
7	0.240	23.81	7.84	0.433	1.363	11.90	3.91	32.45	10.65
8	0.269	18.93	6.23	#NUM!	1.422	9.46	3.11	26.92	8.83
9	0.302	14.97	4.93	#NUM!	1.502	7.49	2.46	22.46	7.37
10	0.336	12.11	3.99	#NUM!	1.594	6.05	1.99	18.16	5.96
11	0.393	8.85	2.91	#NUM!	1.776	4.42	1.45	13.27	4.35

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
3	0.170	0.004	0.000015	13.5

STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 3-Aug-16 Client: Weston Aluminium
AECOM's Project No: 60489919 Stack/Duct Description: Stack 7

7.Sampling Time Total Run Time 60 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
127.53	0.51	0.72	5.1
106.93	0.43	0.66	4.7
123.61	0.50	0.70	5.0
112.82	0.45	0.67	4.8
133.42	0.54	0.73	5.2
98.10	0.39	0.63	4.5
152.06	0.61	0.78	5.5
144.21	0.58	0.76	5.4
135.38	0.54	0.74	5.2
121.64	0.49	0.70	5.0
127.53	0.51	0.72	5.1
105.95	0.43	0.65	4.6
	Average	0.70	60.00
	Square	0.50	

Total time min	Full hours	Full minutes	Seconds
4.8	0	4	45
9.0	0	9	0
13.8	0	13	45
19.3	0	19	15
24.5	0	24	30
29.3	0	29	15
34.3	0	34	15
39.3	0	39	15
44.8	0	44	45
49.8	0	49	45
55.0	0	55	0
60.3	1	0	15

Aerodynamic Cut Size (u_{cyc})
182.3

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0131

Actual D_{50}
9.8

Emission Measurement Calculations Spreadsheet

Stack Analysis - Speciated Polycyclic Aromatic Hydrocarbons (PAH) Results

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7

	Sample Result			Emission		Mass Emission Rate	
	(ng)	(µg)	(mg)	(µg/m^3)	(mg/m^3)	(µg/s)	(mg/s)
Naphthalene	100	0.1	0.0001	0.1	0.0001	2.2	0.0022
2 - Methylnapthalene	2000	2	0.002	2.1	0.0021	43	0.043
Acenaphthylene	43	0.043	0.000043	0.045	0.000045	0.93	0.00093
Acenaphthene	490	0.49	0.00049	0.51	0.00051	11	0.011
Fluorene	210	0.21	0.00021	0.22	0.00022	4.5	0.0045
Phenanthrene	290	0.29	0.00029	0.3	0.0003	6.3	0.0063
Anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Fluoranthene	65	0.065	0.000065	0.068	0.000068	1.4	0.0014
Pyrene	33	0.033	0.000033	0.035	0.000035	0.71	0.00071
Benz(a)anthracene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Chrysene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Benzo(b)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Benzo(k)fluoranthene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Benzo(e)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Benzo(a)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Perylene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Indeno(123:cd)pyrene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Dibenzo(ah)anthracene	30	0.03	0.00003	0.031	0.000031	0.65	0.00065
Benzo(ghi)perylene	<20	<0.02	<0.00002	<0.021	<0.000021	<0.43	<0.00043
Sum of reported PAH's	3300	3.3	0.0033	3.4	0.0034	71	0.071

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 3-Aug-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 7

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8311	m^3	Average barometric pressure (P_{BARO})	1015 hPa
Average gas meter temp. ($T_{M,2}$):	20.5	°C		
	293.7	K	Average pressure at meter ($P_{M,2}$)	1015.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7744	m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.:	NA		Blank weight:	g
Thimble No. used:	T463		PM10 Weight	0.0033 g
Final PM10 Weight (Mp1):	0.00330	g		
PM10 Concentration (C1):		$=M_{p1}/MV_4=$	0.0043	g/m^3 (0°C, dry gas, 1atm pressure)
		;and C_2 =	4.3	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0043 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 4.3 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.1 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.067 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 67 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F25

V_v = 6.4 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0085

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

B_{ws} = 1.09 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.185 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.43 m/s

(ii) Average of post-sampling velocities: 12.15 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.79 m/s (stack conditions, wet)
(**Note**: (Vs) is from all individual data, **not** from (i) and (ii) alone.) N/A m/s (stack conditions, wet)

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

Qstack = Vs x A = 22.60 m^3/s (stack conditions)

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

Qstd = 20.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.089	g/s (0°C, dry gas, 1 atm pressure)		
	=	89	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.089	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	89	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	1.4	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	1400	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 3-Aug-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 7

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.7279	m^3	Average barometric pressure (P_{BARO})	1015 hPa
Average gas meter temp. ($T_{M,2}$):	20.8	°C		
	294.0	K	Average pressure at meter ($P_{M,2}$)	1015.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.6776	m^3		

(B) Total Particulate concentration at standard conditions

Blank thimble No.: NA Blank weight: g

Thimble No. used: T464 Total Particulate Weight 0.0086 g

Final Total Particulate Weight (Mp1): 0.00860 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.013 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 13 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.013 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 13 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.1 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.2 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 200 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F27

V_v = 5.9 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0079

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

B_{ws} = 1.15 %

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): 1.28 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 $\frac{(Ps)}{(1013.25)}$

= 1.185 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.43 m/s

(ii) Average of post-sampling velocities: 12.15 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.79 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 = 22.60 m^3/s (stack conditions)

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

Qstd = 20.7 m^3/s (0^oC, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.27	g/s (0^oC, dry gas, 1 atm pressure)		
	=	270	mg/s (0^oC, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.27	g/s (0^oC, dry gas, 1 atm pressure	12%	CO_2)
	=	270	mg/s (0^oC, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	4.2	g/s (0^oC, dry gas, 1 atm pressure	7%	O_2)
	=	4200	mg/s (0^oC, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Polycyclic Aromatic Hydrocarbons

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

Date: 3-Aug-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 7

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.0267	m^3	Average barometric pressure (P_{BARO})	1015 hPa
Average gas meter temp. ($T_{M,2}$):	21.8	°C		
	295.0	K	Average pressure at meter ($P_{M,2}$)	1015.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.9525	m^3		

(B) PAH concentration at standard conditions

Blank thimble No.: 0 Blank weight: g

Thimble No. used: DAU010816K PAH Weight 3.3E-06 g

Final PAH Weight (Mp1): 0.00000 g

PAH Concentration (C1): $=M_{p1}/MV_4=$ 3.5E-06 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.0035 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0000035 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.0035 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.1 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.000054 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.054 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F23

V_v = 10.4 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0139

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

B_{ws} = 1.44 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Polycyclic Aromatic Hydrocarbons

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.185 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.43 m/s

(ii) Average of post-sampling velocities: 12.15 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.79 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 = 22.60 m^3/s (stack conditions)

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

Qstd = 20.6 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.000072	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.072	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.000072	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.072	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.0011	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	1.1	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, STACK 7
WESTON ALUMINIUM
3-Aug-16
FINE PARTICULATE (PM10)
TOTAL PARTICULATE
POLYCYCLIC AROMATIC HYDROCARBONS

Sampling Conditions:			
Stack internal diameter at test location	1500 mm		
Stack gas temperature (average)	22.6 °C		295.8 K
Stack pressure (average)	1016 hPa		
Stack gas velocity (average, stack conditions)	13 m/s		
Stack gas flowrate (stack conditions)	23 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	21 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	8:58	-	10:02
Fine Particulate (PM10) Mass	3.3 mg		
Gas Volume Sampled	0.774 m^3		
Fine Particulate (PM10) Emission*1	4.3 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	89 mg/s		
Regulatory Limit	NA mg/m^3		
Total Particulate Testing			
Test Period	8:58	-	10:02
Total Particulate Mass	8.6 mg		
Gas Volume Sampled	0.678 m^3		
Total Particulate Emission*1	13 mg/m^3		
Total Particulate Mass Emission Rate*2	270 mg/s		
Regulatory Limit	15 mg/m^3		
Polycyclic Aromatic Hydrocarbons Testing			
Test Period	8:58	-	10:02
Polycyclic Aromatic Hydrocarbons Mass	0.0033 mg		
Gas Volume Sampled	0.952 m^3		
Polycyclic Aromatic Hydrocarbons Emission*1	0.0035 mg/m^3		
Polycyclic Aromatic Hydrocarbons Mass Emission Rate*2	0.072 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	1.2		
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 0^0C, 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.

Emission Measurement Calculations Spreadsheet

Weston Aluminium

AECOM's Project Number: 60489919

Emission Source: Stack 7

Date Sampled: 3-Aug-16

ANALYTE(S)	METHOD
Total Fluoride	NSW EPA TM - 9
Sulfuric Acid Mist	NSW EPA TM - 3
Sulfur Dioxide	NSW EPA TM - 4

Observations made during testing period:

Sampling Performed By:

James Lang

Dylan Turnbull

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - PRE-SAMPLING

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1: Total Fluoride
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Measurement/Observations

Stack Internal Dimensions:

Diameter 1500 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area : 1.77 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 10
No. Diameters = 6.7
Type of Upstream Disturbance: Fan
Downstream (m) = 3.1
No. Diameters = 2.1
Type of Down Stream Disturbance: Stack Exit

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

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	66	36		
2	219	189		
3	444	414		
4	1056	1026		
5	1281	1251		
6	1434	1404		
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: .....

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Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1: Total Fluoride
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 10:00		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:00	0	20.1	0.0
2	10:01	0	20.1	0.0
3	10:02	0	20.1	0.0
4	10:03	0	20.1	0.0
5	10:04	0	20.1	0.0
6	10:05	0	20.1	0.0
7	10:06	0	20.1	0.0
8	10:07	0	20.1	0.0
	Averages:	0.0 ppm	20.1 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.50 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.9 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.1 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	78.7 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	19.8 %,(wet)
H_2O:	1.50 %(=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: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1: Total Fluoride
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 11:30		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:30	0	20.2	0.0
2	11:31	0	20.2	0.0
3	11:32	0	20.2	0.0
4	11:33	0	20.2	0.0
5	11:34	0	20.2	0.0
6	11:35	0	20.2	0.0
7	11:36	0	20.2	0.0
8	11:37	0	20.2	0.0
	Averages:	0.0 ppm	20.2 %	0.0 %

Moisture content (M3): 0.97
Moisture percentage (M2): 2.62 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.8 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.2 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	77.7 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	19.7 %,(wet)
H_2O:	2.62 %(=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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Emission Measurement Calculations Spreadsheet

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1:Total Fluoride
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	10:10	Barometric Pressure :		1015	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.28	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	36	0.128	23.0	296.2	12.3
1/2	189	0.107	24.0	297.2	11.3
1/3	414	0.124	24.0	297.2	12.2
1/4	1026	0.113	24.0	297.2	11.6
1/5	1251	0.133	24.0	297.2	12.6
1/6	1404	0.098	24.0	297.2	10.8
2/1	36	0.152	23.0	296.2	13.5
2/2	189	0.144	23.0	296.2	13.1
2/3	414	0.135	24.0	297.2	12.7
2/4	1026	0.122	24.0	297.2	12.1
2/5	1251	0.128	24.0	297.2	12.4
2/6	1404	0.106	24.0	297.2	11.3
Average			23.8	297.0	12.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 9.7 mm
Absolute pressure in stack (hPa) : 1015.95 hPa

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF TOTAL FLUORIDE

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 7
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.53 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 209.3056 Meter finish: 209.3056
Time start: 10:20 Time finish: 10:21

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 209.9912 Meter finish: 209.9912
Time start: 11:26 Time finish: 11:27

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1015 hPa (start); 1015 hPa (finish)
Meter start: 209.3078 Time start: 10:24
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	0:05:00	66	11.4	21.0	17.0		Yes
1/2	0:10:00	219	10.5	23.0	17.0		Yes
1/3	0:15:00	444	11.3	26.0	17.0		Yes
1/4	0:20:00	1056	10.7	27.0	17.0		Yes
1/5	0:25:00	1281	11.7	28.0	17.0		Yes
1/6	0:30:00	1434	10.0	29.0	17.0		Yes
2/1	0:35:00	66	12.5	29.0	17.0		Yes
2/2	0:40:00	219	12.2	29.0	17.0		Yes
2/3	0:45:00	444	11.7	30.0	18.0		Yes
2/4	0:50:00	1056	11.2	30.0	18.0		Yes
2/5	0:55:00	1281	11.5	30.0	18.0		Yes
2/6	1:00:00	1434	10.5	30.0	18.0		Yes
Averages				27.7	17.3	no result	

Meter Finish: 209.9893 Time Finish: 11:25
Total Condensate collected: 0 ml Silica gel No(s) used: L16

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF SULFURIC ACID MIST (H2SO4 AS SO3)

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 7
Sample Nozzle No.: s16
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.6 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 472.3977 Meter finish: 472.3977
Time start: 10:21 Time finish: 10:22

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 473.0505 Meter finish: 473.0505
Time start: 11:27 Time finish: 11:28

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1015 hPa (start); 1015 hPa (finish)
Meter start: 472.3996 Time start: 10:24
Meter correction factor (GMf) : 0.9800

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	0:05:00	66	11.6	22.0	18.0		Yes
1/2	0:10:00	219	10.6	24.0	18.0		Yes
1/3	0:15:00	444	11.4	26.0	18.0		Yes
1/4	0:20:00	1056	10.9	27.0	18.0		Yes
1/5	0:25:00	1281	11.8	28.0	18.0		Yes
1/6	0:30:00	1434	10.1	28.0	18.0		Yes
2/1	0:35:00	66	12.7	28.0	18.0		Yes
2/2	0:40:00	219	12.3	29.0	19.0		Yes
2/3	0:45:00	444	11.9	29.0	19.0		Yes
2/4	0:50:00	1056	11.4	29.0	19.0		Yes
2/5	0:55:00	1281	11.6	29.0	19.0		Yes
2/6	1:00:00	1434	10.6	29.0	19.0		Yes
Averages				27.3	18.4	no result	

Meter Finish: 473.0498 Time Finish: 11:25
Total Condensate collected: 0 ml Silica gel No(s) used: P32

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS

SAMPLING OF SULFUR DIOXIDE (SO2 AS SO3)

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack Description No.: Stack 7
Sample Nozzle No.: s16
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.6 x 10^{-5} m^2
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 472.3977 Meter finish: 472.3977
Time start: 10:21 Time finish: 10:22

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 473.0505 Meter finish: 473.0505
Time start: 11:27 Time finish: 11:28

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1015 hPa (start); 1015 hPa (finish)
Meter start: 472.3996 Time start: 10:24
Meter correction factor (GMf) : 0.9800

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	0:05:00	66	11.6	22.0	18.0		Yes
1/2	0:10:00	219	10.6	24.0	18.0		Yes
1/3	0:15:00	444	11.4	26.0	18.0		Yes
1/4	0:20:00	1056	10.9	27.0	18.0		Yes
1/5	0:25:00	1281	11.8	28.0	18.0		Yes
1/6	0:30:00	1434	10.1	28.0	18.0		Yes
2/1	0:35:00	66	12.7	28.0	18.0		Yes
2/2	0:40:00	219	12.3	29.0	19.0		Yes
2/3	0:45:00	444	11.9	29.0	19.0		Yes
2/4	0:50:00	1056	11.4	29.0	19.0		Yes
2/5	0:55:00	1281	11.6	29.0	19.0		Yes
2/6	1:00:00	1434	10.6	29.0	19.0		Yes
Averages				27.3	18.4	no result	

Meter Finish: 473.0498 Time Finish: 11:25
Total Condensate collected: 0 ml Silica gel No(s) used: P32

Emission Measurement Calculations Spreadsheet

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 3-Aug-16
Client: Weston Aluminium
AECOM's Project No: 60489919
Stack/Duct Description: Stack 7
Test 1:Total Fluoride
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	11:30	Barometric Pressure :		1015	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		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	36	0.123	24.0	297.2	12.1
1/2	189	0.109	24.0	297.2	11.4
1/3	414	0.129	25.0	298.2	12.5
1/4	1026	0.125	25.0	298.2	12.3
1/5	1251	0.134	25.0	298.2	12.7
1/6	1404	0.122	25.0	298.2	12.1
2/1	36	0.147	24.0	297.2	13.3
2/2	189	0.149	24.0	297.2	13.4
2/3	414	0.137	24.0	297.2	12.8
2/4	1026	0.122	25.0	298.2	12.1
2/5	1251	0.123	25.0	298.2	12.2
2/6	1404	0.108	25.0	298.2	11.4
Average			24.6	297.8	12.4

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 9.5 mm
Absolute pressure in stack (hPa) : 1015.93 hPa

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Total Fluoride

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

Date: 3-Aug-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 7

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.6883 m^3

Average gas meter temp. ($T_{M,2}$): 22.5 °C

295.7 K

Average barometric pressure (P_{BARO}) 1015 hPa

Average pressure at meter ($P_{M,2}$) 1015.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.6370 m^3

(B) Total Fluoride concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: NA

Blank weight: g

Total Fluoride Weight 0.00012 g

Final Total Fluoride Weight (Mp1): 0.00012 g

Total Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.00019 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.19 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00019 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.19 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.0031 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 3.1 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: L16

V_v = 9.5 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0127

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

B_{ws} = 1.95 %

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Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Fluoride

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.28 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.179 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.16 m/s

(ii) Average of post-sampling velocities: 12.36 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.26 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 = 21.67 m^3/s (stack conditions)

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

Qstd = 19.6 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0037	g/s (0°C, dry gas, 1 atm pressure)		
	=	3.7	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0037	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	3.7	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.061	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	61	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

Sulfuric Acid Mist (H2SO4 as SO3)

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

Date: 3-Aug-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 7

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.6372	m^3	Average barometric pressure (P_{BARO})	1015 hPa
Average gas meter temp. ($T_{M,2}$):	22.9	°C		
	296.1	K	Average pressure at meter ($P_{M,2}$)	1015.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.5889	m^3		

(B) H2SO4 as So3 concentration at standard conditions

Blank thimble No.:	NA		Blank weight:	g
Thimble No. used:	NA		H2SO4 as So3 Weight	<0.002 g
Final H2SO4 as So3 Weight (Mp1):	<0.002	g		
H2SO4 as So3 Concentration (C1):		$=M_{p1}/MV_4=$	<0.0034	g/m^3 (0°C, dry gas, 1atm pressure)
		;and C_2 =	<3.4	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.0034 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <3.4 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.056 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <56 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P32

V_v = 13.4 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0179

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

B_{ws} = 2.95 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfuric Acid Mist (H2SO4 as SO3)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.188 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.16 m/s

(ii) Average of post-sampling velocities: 12.36 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.26 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 = 21.67 m^3/s (stack conditions)

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

Qstd = 19.4 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.066	g/s (0°C, dry gas, 1 atm pressure)		
	=	<66	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.066	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<66	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<1.1	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<1100	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

ANZ

Emission Measurement Calculations Spreadsheet

STACK ANALYSIS - FINAL CALCULATIONS

Sulfur Dioxide (SO2 as SO3)

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

Date: 3-Aug-16 Client: Weston Aluminium

AECOM's Project No: 60489919 Stack/Duct Description: Stack 7

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.6372 m^3	Average barometric pressure (P_{BARO})	1015 hPa	
Average gas meter temp. ($T_{M,2}$):	22.9 °C			
	296.1 K	Average pressure at meter ($P_{M,2}$)	1015.00 hPa	
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.5889 m^3			

(B) SO2 as SO3 concentration at standard conditions

Blank thimble No.:	NA	Blank weight:	g
Thimble No. used:	NA	SO2 as SO3 Weight	<0.01 g
Final SO2 as SO3 Weight (Mp1):	<0.01 g		
SO2 as SO3 Concentration (C1):	$=M_{p1}/MV_4=$	<0.017	g/m^3 (0°C, dry gas, 1atm pressure)
	;and C_2 =	<17	mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.017 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <17 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.28 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <280 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P32

V_v = 13.4 g (from laboratory report) V_w = 0 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0000

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0179

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

B_{ws} = 2.95 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfur Dioxide (SO2 as SO3)

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

(i) Initial gas density for sampling: 1.28 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.29 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.188 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.16 m/s

(ii) Average of post-sampling velocities: 12.36 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.26 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 = 21.67 m^3/s (stack conditions)

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

Qstd = 19.4 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.33	g/s (0°C, dry gas, 1 atm pressure)		
	=	<330	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.33	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<330	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<5.4	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<5400	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, STACK 7
WESTON ALUMINIUM
3-Aug-16
TOTAL FLUORIDE
SULFURIC ACID MIST (H2SO4 AS SO3)
SULFUR DIOXIDE (SO2 AS SO3)

Sampling Conditions:			
Stack internal diameter at test location	1500 mm		
Stack gas temperature (average)	24.2 °C		297.4 K
Stack pressure (average)	1016 hPa		
Stack gas velocity (average, stack conditions)	12 m/s		
Stack gas flowrate (stack conditions)	22 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	19 m^3/s		
Total Fluoride Testing			
Test Period	10:24	-	11:25
Total Fluoride Mass	0.12 mg		
Gas Volume Sampled	0.637 m^3		
Total Fluoride Emission*1	0.19 mg/m^3		
Total Fluoride Mass Emission Rate*2	3.7 mg/s		
Regulatory Limit	NA mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing			
Test Period	10:24	-	11:25
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2 mg		
Gas Volume Sampled	0.589 m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<3.4 mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<66 mg/s		
Regulatory Limit	NA mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing			
Test Period	10:24	-	11:25
Sulfur Dioxide (SO2 as SO3) Mass	<10 mg		
Gas Volume Sampled	0.589 m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	<17 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	<330 mg/s		
Regulatory Limit	NA mg/m^3		
Moisture Content (%)	2.0		
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 0^0C, 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.

STACK ANALYSIS - SAMPLING OF VOLATILE ORGANIC COMPOUNDS

AECOM

Client:	Weston Aluminium
Project Number:	60489919
Stack Description:	Stack 7
Date:	03-Aug-16
Rotameter Correction Factor:	1.01
Time Start:	10:32
Time Finish:	11:02
Sample Flow Rate:	0.2 L/min
Sample Time:	30 min
Sampled Volume:	6.06 litres
	0.00606 m^3
Ambient Temperature:	15 °C
Barometric Pressure:	1016 hPa
Stack Gas Moisture:	2.0 %
Corrected Volume:	0.00564 m^3 (0°C, dry gas, 1 atmosphere pressure)
Stack Flow Rate	19 m^3/s (0°C, dry gas, 1 atmosphere pressure)

VOC AIR EMISSION TEST RESULTS

Analyte	Sample µg	Blank µg	Sample Blank Corrected µg	(mg/m^3)	mg/s
Acetone	<1.0	<1.0	<1.0	<0.18	<3.4
1,1-dichloroethane	<1.0	<1.0	<1.0	<0.18	<3.4
2-Butanone	<1.0	<1.0	<1.0	<0.18	<3.4
Chloroform	<1.0	<1.0	<1.0	<0.18	<3.4
Benzene	<1.0	<1.0	<1.0	<0.18	<3.4
1-heptene	<1.0	<1.0	<1.0	<0.18	<3.4
n-heptane	<1.0	<1.0	<1.0	<0.18	<3.4
Trichloroethene	<1.0	<1.0	<1.0	<0.18	<3.4
MIBK	<1.0	<1.0	<1.0	<0.18	<3.4
Toluene	<1.0	<1.0	<1.0	<0.18	<3.4
2-hexanone	<1.0	<1.0	<1.0	<0.18	<3.4
Chlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
Ethyl Benzene	<1.0	<1.0	<1.0	<0.18	<3.4
m- & p-xylene	<2.0	<0.2	<2.0	<0.35	<6.7
o-xylene	<1.0	<1.0	<1.0	<0.18	<3.4
Styrene	<1.0	<1.0	<1.0	<0.18	<3.4
Cyclohexanone	<1.0	<1.0	<1.0	<0.18	<3.4
Isopropylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
2-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<3.4
4-chlorotoluene	<1.0	<1.0	<1.0	<0.18	<3.4
1,3,5-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
n-decane	<1.0	<1.0	<1.0	<0.18	<3.4
1,2,4-trimethylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,3-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,4-dichlorobenzene	<1.0	<1.0	<1.0	<0.18	<3.4
1,2-dichlorobenzne	<1.0	<1.0	<1.0	<0.18	<3.4
n-butylbenzene	<1.0	<1.0	<1.0	<0.18	<3.4
Hexachlorobutadiene	<1.0	<1.0	<1.0	<0.18	<3.4
Total	<1		<1	<0.35	<6.7

Note: Where the blank has returned a less than value, the analysed value has been corrected for half of that blank value. ie a blank value of <0.5 has had 0.25 subtracted from the analysed value.

Appendix B

Laboratory Analytical Reports (67 pages)

Steel River Testing

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

STACK EMISSION - MOISTURE REPORT

Origin:	AECOM - Newcastle	**Report :**	11615-0-M	Page 1 of 1
Project:	**60489919 / 1.2**			
Description :	Stack Emission Samples Received: 06-Jul-16	**Date :**	08-Jul-16	
Report To :	James Lang 17 Warabrook Blvd, Warabrook NSW 2304	**Copy to:**	FILE	

Jar ID	Moisture (g)
134	6.8
Z9	5.0

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

ACCREDITED FOR TECHNICAL COMPETENCE

Reported By: M. Campbell

Michael Campbell

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

Steel River Testing

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

STACK EMISSION - PARTICULATES REPORT

Origin:	AECOM - Newcastle	**Report :**	11615-0-P	Page 1 of 1
Project:	**60489919 / 1.2**			
Description :	Stack Emission Samples Received: 06-Jul-16	**Date :**	08-Jul-16	
Report To :	James Lang 17 Warabrook Blvd, Warabrook NSW 2304	**Copy to:**	FILE	

Thimble ID		Volume (mL)	Total Particulate Matter (g)
T411	Filter	-	0.0005
T448	Filter	-	0.0015

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

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	**Report :**	11616-0-M	Page 1 of 3
Project:	**60489919 / 1.2**			
Description :	Stack Emission Samples	**Date :**	15-Jul-16	
	Received: 06-Jul-16			
Report To :	James Lang	**Copy to:**	FILE	
	17 Warabrook Blvd, Warabrook NSW 2304			

Jar ID	Moisture (g)
135	5.4
192	9.5
CC12	5.2
F21	5.1
F23	9.3
F25	9.6
F26	9.6
F28	4.7
F99	4.4
FA8	8.8
FA9	32.3
I34	5.5
iA	11.9
JL308	5.9
L16	5.9
M300	9.2

NATA Accredited Laboratory 18079
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ACCREDITED FOR TECHNICAL COMPETENCE

Reported By: M. Campbell
Michael Campbell

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

Steel River Testing

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

STACK EMISSION - MOISTURE REPORT

Origin: AECOM - Newcastle
Project: **60489919 / 1.2**
Report : 11616-0-M

Description : Stack Emission Samples
Received: 06-Jul-16
Date : 15-Jul-16

Report To : James Lang
17 Warabrook Blvd, Warabrook NSW 2304
Copy to: FILE

Jar ID	Moisture (g)
M301	12.8
M302	8.1
M99	9.5
P1	10.8
P3	6.3
P32	4.0
P33	9.4
P35	2.7
P38	10.6
P5	11.1
P8	15.8
VK1	14.7
VK2	4.3
Z12	6.0
Z18	12.7
Z6	12.6

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

ACCREDITED FOR TECHNICAL COMPETENCE

Reported By: M. Campbell
Michael Campbell

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

Steel River Testing

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

STACK EMISSION - MOISTURE REPORT

Origin:	AECOM - Newcastle	**Report :**	11616-0-M	Page 3 of 3
Project:	**60489919 / 1.2**			
Description :	Stack Emission Samples Received: 06-Jul-16	**Date :**	15-Jul-16	
Report To :	James Lang 17 Warabrook Blvd, Warabrook NSW 2304	**Copy to:**	FILE	

Jar ID	Moisture (g)
Z7	13.2

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

ACCREDITED FOR TECHNICAL COMPETENCE

Reported By: M. Campbell

Michael Campbell

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

Steel River Testing

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

STACK EMISSION - MOISTURE REPORT

Origin:	AECOM - Newcastle	**Report :**	11793-0-M	Page 1 of 1
Project:	**60489919**			
Description :	Stack Emission Samples Received: 03-Aug-16	**Date :**	09-Aug-16	
Report To :	James Lang 17 Warabrook Blvd, Warabrook NSW 2304	**Copy to:**	FILE	

Jar ID	Moisture (g)
F23	10.4
F25	6.4
F27	5.9
L16	9.5
P32	13.4

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

ACCREDITED FOR TECHNICAL COMPETENCE

Reported By: M. Campbell
Michael Campbell

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

Steel River Testing

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

STACK EMISSION - PARTICULATES REPORT

Origin:	AECOM - Newcastle	**Report :**	11793-0-P	Page 1 of 1
Project:	**60489919**			
Description :	Stack Emission Samples Received: 03-Aug-16	**Date :**	09-Aug-16	
Report To :	James Lang 17 Warabrook Blvd, Warabrook NSW 2304	**Copy to:**	FILE	

Thimble ID		Volume (mL)	Total Particulate Matter (g)
T463	Filter	-	0.0033
T464	Filter	-	0.0086

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

Note : Sampled by Client

Reported By: M. Campbell
Michael Campbell

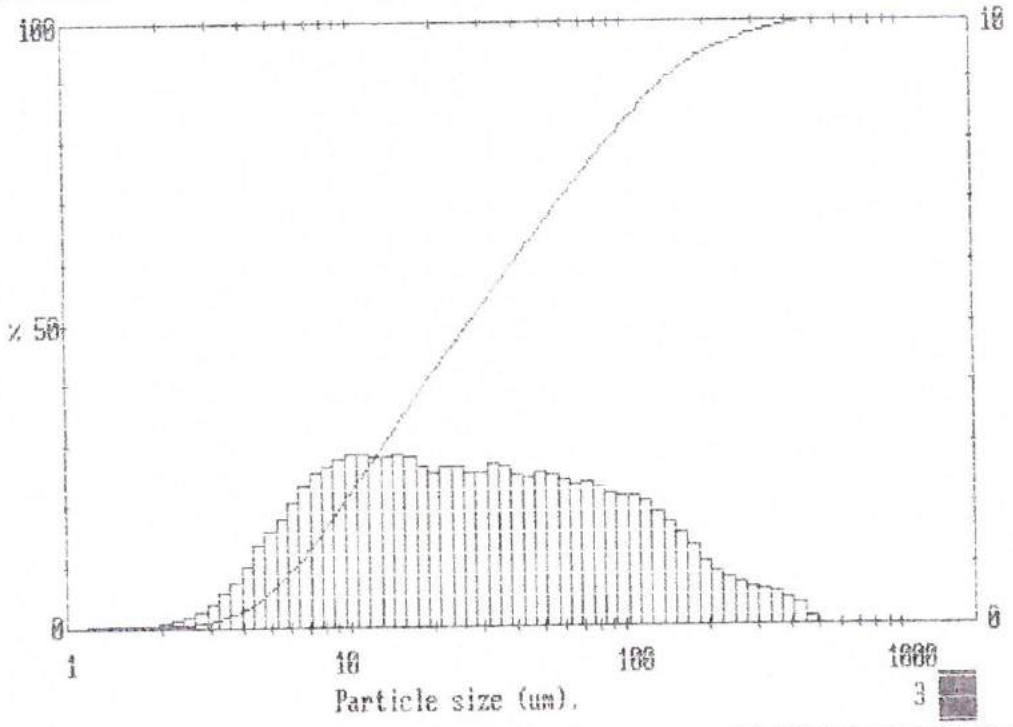
Determined in Accordance With:
Particulate matter - total in stack gases by gravimetric using in-house M300;
Acetone/Water Rinse using AS4323.2

MALVERN Instruments SB.0D 8:03 am

STEEL RIVER TESTING THIMBLE ID : S44 000006802

DATE:14/8/2016

7160 stnd 11w650



Upper	in	Lower	Under
600	0.0	492	100
492	0.5	404	99.5
404	1.0	332	98.5
332	1.6	272	97.5
272	1.5	224	95.9
224	2.0	183	93.8
183	2.9	151	91.0
151	3.6	124	87.3

Upper	in	Lower	Under
124	4.2	101	83.1
101	4.4	83.3	78.8
83.3	4.7	68.3	74.1
68.3	4.9	56.1	69.3
56.1	5.1	46.0	64.2
46.0	5.0	37.8	59.1
37.8	5.4	31.0	54.0
31.0	5.2	25.5	48.6
25.5	5.3	20.9	43.3
20.9	5.2	17.1	38.0
17.1	5.7	14.1	32.3
14.1	5.7	11.6	26.6

Upper	in	Lower	Under
11.6	5.8	9.48	20.8
9.48	5.5	7.78	15.4
7.78	4.9	6.39	10.5
6.39	3.9	5.24	6.6
5.24	2.9	4.30	3.7
4.30	1.8	3.53	1.9
3.53	1.0	2.90	0.9
2.90	0.5	2.38	0.5
2.38	0.2	1.95	0.3
1.95	0.1	1.60	0.2
1.60	0.1	1.32	0.1
1.32	0.1	0.50	0.0

Span 5.07

D[4,3] 55.83µm

D[3,2] 15.18µm

D[v,0.9] 142.27µm

D[v,0.1] 6.25µm

D[v,0.5] 26.85µm

Shape OFF

Source = ;Sample

Focal length = 300 mm

Presentation = stnd

Beam length = 2.4 mm

Residual = 1.407 %

Obscuration = 0.0000

Volume distribution

Model indp

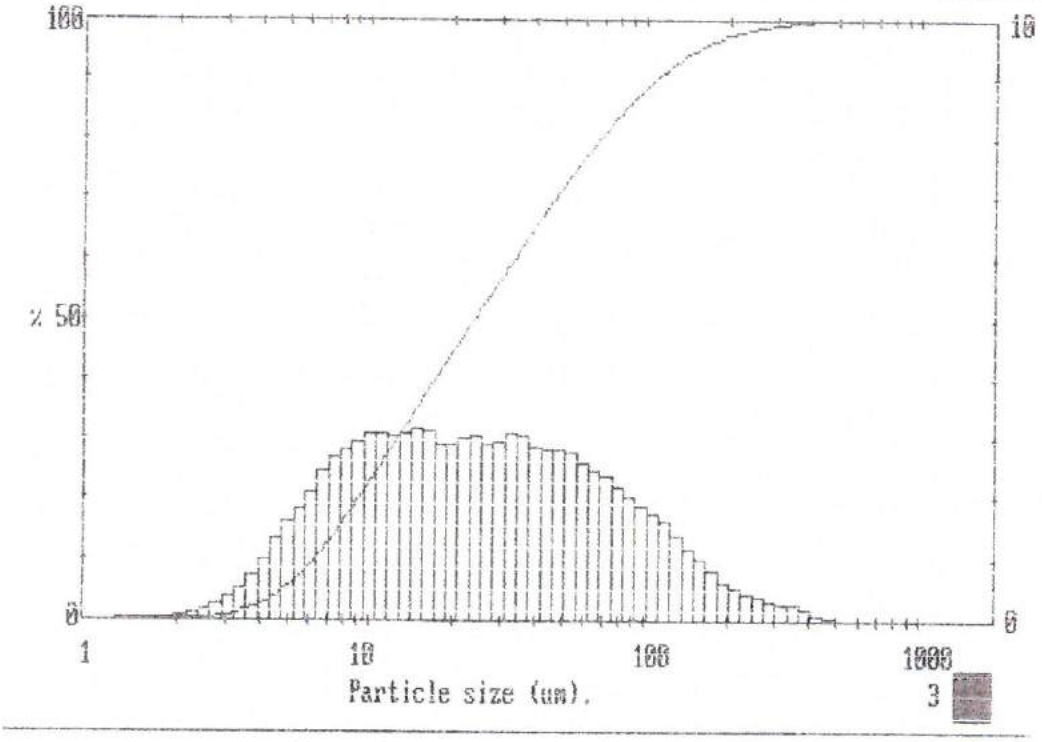
Volume Conc. = 0.0000%

Sp.S.A 0.3952 m²/cc.

MALVERN Instruments SB.00 ... 8:03 am

STEEL RIVER TESTING THIMBLE ID : 544
repeat
DATE:14/8/2018 000006501

7160 stnd 11w652s



Upper	in	Lower	Under
600	0.0	492	100
492	0.1	404	99.9
404	0.4	332	99.4
332	0.6	272	98.8
272	0.8	224	98.0
224	1.2	183	96.8
183	1.9	151	95.0
151	2.6	124	92.3
124	3.4	101	88.9
101	3.9	83.3	85.0
83.3	4.6	68.3	80.4
68.3	5.1	56.1	75.3
56.1	5.6	46.0	69.7
46.0	5.7	37.8	64.0
37.8	6.2	31.0	57.8
31.0	5.9	25.5	51.9
25.5	6.1	20.9	46.0
20.9	5.8	17.1	40.0
17.1	6.3	14.1	33.7
14.1	6.2	11.6	27.5
11.6	6.2	9.48	21.3
9.48	5.8	7.78	15.5
7.78	5.1	6.39	10.4
6.39	4.0	5.24	6.4
5.24	3.0	4.30	3.4
4.30	1.7	3.53	1.7
3.53	0.9	2.90	0.8
2.90	0.4	2.38	0.4
2.38	0.2	1.95	0.2
1.95	0.1	1.60	0.1
1.60	0.1	1.32	0.1
1.32	0.1	0.50	0.0

Span 4.23

D[4,3] 44.39µm

D[3,2] 14.70µm

D[v,0.9] 107.55µm

D[v,0.1] 6.28µm

D[v,0.5] 33.93µm

Shape OFF

Source = :Sample
Focal length = 300 mm
Presentation = stnd

Beam length = 2.4 mm
Residual = 1.492 %
Obscuration = 0.0000
Volume distribution

Model indp
Volume Conc. = 0.0000%
Sp.S.A 0.4080 m²/cc.

Steel River Testing

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

STACK EMISSION - PARTICULATES REPORT

Origin: AECOM - Newcastle
Project: **60489919 / 1.2**

Report : 11616-0-P

Description : Stack Emission Samples
Received: 06-Jul-16

Date : 16-Aug-16

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

Copy to: FILE

Thimble ID		Volume (mL)	Total Particulate Matter (g)
S44	Thimble	-	0.0030
T423	Filter	-	0.0002
T435	Filter	-	0.0008
T441	Filter	-	<0.0002
T444	Filter	-	0.0032
T447	Filter	-	0.0002
T452	Filter	-	<0.0002
T461	Filter	-	0.0003
T462	Filter	-	0.0002

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

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

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1602428**	Page	: 1 of 16
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR JAMES LANG	Contact	: Kim Smith
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Project	: 60489919 Task 1.2	Date Samples Received	: 06-Jul-2016 15:00
Order number	: 60489919 Task 1.2	Date Analysis Commenced	: 07-Jul-2016
C-O-C number	: ----	Issue Date	: 14-Jul-2016 20:28
Sampler	: COLIN CLARKE, D TURNBULL, JAMES LANG, VILAI KELEMETE-MANUA		
Site	: ----		
Quote number	: ----		
No. of samples received	: 27		
No. of samples analysed	: 27		

NATA Accredited Laboratory 825
Accredited for compliance with ISO/IEC 17025.

NATA
WORLD RECOGNISED ACCREDITATION

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dian Dao		Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Justin Houghton	Senior Analyst - Organic	Newcastle - Organics, Mayfield West, NSW
Karinne Gelderman	Analyst	Newcastle - Organics, Mayfield West, NSW
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

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

- Filters were supplied by the client. Filter preparation may not meet ALS method requirements.
- EA144C-F: Gaseous and Particulate Fluoride conducted in accordance with AS3580.13.2 - 2013.
- ED009x: LOR has been raised for various analytes due to sample matrix interference.
- EP091: The LOR values for EP091 have been raised due to increased charcoal sample size (350/350/350 mg) over the standard charcoal sample size (100/50mg) requiring greater extraction volume of solvent.

Analytical Results

Sub-Matrix: **FILTER** (Matrix: **AIR**)			Client sample ID	St1_Particulate Fluoride	Particulate Fluoride_Blank	----	----	----
			Client sampling date / time	[05-Jul-2016]	[05-Jul-2016]	----	----	----
Compound	CAS Number	LOR	Unit	EN1602428-006	EN1602428-020	--------	--------	--------
				Result	Result	----	----	----
EA144C: Gaseous and Particulate Fluorides								
Fluoride (Particulate) as HF	----	1	µg/filter	113	1	----	----	----

Analytical Results

Sub-Matrix: **IMPINGER SOLUTION** (Matrix: **AIR**)

Compound	CAS Number	LOR	Unit	Client sample ID	St1_H2SO4 as SO3	St1_SO2 as SO3	St1_HCl(H2SO4)	St1_Cl2(NaOH)	St1_Gaseous Fluoride
				Client sampling date / time	[05-Jul-2016]	[05-Jul-2016]	[05-Jul-2016]	[05-Jul-2016]	[05-Jul-2016]
					EN1602428-001	EN1602428-002	EN1602428-003	EN1602428-004	EN1602428-005
					Result	Result	Result	Result	Result
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	----	1	mL		220	----	----	----	----
Sulfuric Acid as SO3	----	2	mg/sample		<2	----	----	----	----
Volume - Impinger	----	1	mL		----	250	----	----	----
Sulfur Dioxide as SO3	----	10	mg/sample		----	<10	----	----	----
EA144C: Gaseous and Particulate Fluorides									
Fluoride (as HF)	----	0.01	mg/sample		----	----	----	----	0.04
Volume - Impinger	----	1	mL		----	----	----	----	270
EA147: Acid Gases									
Hydrogen Bromide	----	0.01	mg		----	----	<1.00	----	----
Hydrogen Chloride	7647-01-0	0.1	mg		----	----	<10.0	----	----
Hydrogen Fluoride	73602-61-6	0.01	mg		----	----	<1.00	----	----
EA147: Halogens									
Bromine	7726-95-6	0.01	mg		----	----	----	<0.200	----
Chlorine	7782-50-5	0.1	mg		----	----	----	<2.00	----
Fluorine	7782-41-4	0.01	mg		----	----	----	<0.200	----
Sampling Method									
ø Volume - Impinger	----	0.01	mL		----	----	213	199	----

Analytical Results

Sub-Matrix: **IMPINGER SOLUTION** (Matrix: **AIR**)				Client sample ID	Stack 2_Total Fluordie	Stack 3_Total Fluordie	St5_H2SO4 as SO3	St5_SO2 as SO3	St5_HCl(H2SO4)
				Client sampling date / time	[29-Jun-2016]	[29-Jun-2016]	[24-Jun-2016]	[24-Jun-2016]	[24-Jun-2016]
Compound	CAS Number	LOR	Unit		EN1602428-008	EN1602428-009	EN1602428-010	EN1602428-011	EN1602428-012
					Result	Result	Result	Result	Result
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	----	1	mL		----	----	**206**	----	----
Sulfuric Acid as SO3	----	2	mg/sample		----	----	<2	----	----
Volume - Impinger	----	1	mL		----	----	----	**255**	----
Sulfur Dioxide as SO3	----	10	mg/sample		----	----	----	<10	----
EA144C: Gaseous and Particulate Fluorides									
Fluoride (as HF)	----	0.01	mg/sample		**0.04**	**0.04**	----	----	----
Volume - Impinger	----	1	mL		**310**	**290**	----	----	----
EA147: Acid Gases									
Hydrogen Bromide	----	0.01	mg		----	----	----	----	<1.00
Hydrogen Chloride	7647-01-0	0.1	mg		----	----	----	----	<10.0
Hydrogen Fluoride	73602-61-6	0.01	mg		----	----	----	----	<1.00
EA147: Halogens									
Bromine	7726-95-6	0.01	mg		----	----	----	----	----
Chlorine	7782-50-5	0.1	mg		----	----	----	----	----
Fluorine	7782-41-4	0.01	mg		----	----	----	----	----
Sampling Method									
ø Volume - Impinger	----	0.01	mL		----	----	----	----	**288**

Analytical Results

Sub-Matrix: **IMPINGER SOLUTION** (Matrix: **AIR**)			Client sample ID	St5_Cl2(NaOH)	St5_Total Fluordie	St6_Sox(IPA)	St6_SOX(H2O2)	St6_Total Fluoride
			Client sampling date / time	[24-Jun-2016]	[24-Jun-2016]	[01-Jul-2016]	[01-Jul-2016]	[01-Jul-2016]
Compound	CAS Number	LOR	Unit	EN1602428-013	EN1602428-014	EN1602428-016	EN1602428-017	EN1602428-018
				Result	Result	Result	Result	Result
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)								
Volume - Impinger	----	1	mL	----	----	**208**	----	----
Sulfuric Acid as SO3	----	2	mg/sample	----	----	<2	----	----
Volume - Impinger	----	1	mL	----	----	----	**320**	----
Sulfur Dioxide as SO3	----	10	mg/sample	----	----	----	<10	----
EA144C: Gaseous and Particulate Fluorides								
Fluoride (as HF)	----	0.01	mg/sample	----	**0.03**	----	----	**0.07**
Volume - Impinger	----	1	mL	----	**270**	----	----	**255**
EA147: Acid Gases								
Hydrogen Bromide	----	0.01	mg	----	----	----	----	----
Hydrogen Chloride	7647-01-0	0.1	mg	----	----	----	----	----
Hydrogen Fluoride	73602-61-6	0.01	mg	----	----	----	----	----
EA147: Halogens								
Bromine	7726-95-6	0.01	mg	<0.200	----	----	----	----
Chlorine	7782-50-5	0.1	mg	<2.00	----	----	----	----
Fluorine	7782-41-4	0.01	mg	<0.200	----	----	----	----
Sampling Method								
ø Volume - Impinger	----	0.01	mL	**231**	----	----	----	----

Analytical Results

Sub-Matrix: **IMPINGER SOLUTION** (Matrix: **AIR**)				Client sample ID	Gaseous Fluoride_Blank	Total Fluoride_Blank	Sox_IPA_Blank	SOX_H202_Blank	HCl(H2SO4)Blank
				Client sampling date / time	[05-Jul-2016]	[29-Jun-2016]	[05-Jul-2016]	[05-Jul-2016]	[05-Jul-2016]
Compound	CAS Number	LOR	Unit		EN1602428-021	EN1602428-022	EN1602428-023	EN1602428-024	EN1602428-025
					Result	Result	Result	Result	Result
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	----	1	mL		----	----	230	----	----
Sulfuric Acid as SO3	----	2	mg/sample		----	----	<2	----	----
Volume - Impinger	----	1	mL		----	----	----	236	----
Sulfur Dioxide as SO3	----	10	mg/sample		----	----	----	<10	----
EA144C: Gaseous and Particulate Fluorides									
Fluoride (as HF)	----	0.01	mg/sample		0.01	0.02	----	----	----
Volume - Impinger	----	1	mL		200	200	----	----	----
EA147: Acid Gases									
Hydrogen Bromide	----	0.01	mg		----	----	----	----	<1.00
Hydrogen Chloride	7647-01-0	0.1	mg		----	----	----	----	<10.0
Hydrogen Fluoride	73602-61-6	0.01	mg		----	----	----	----	<1.00
EA147: Halogens									
Bromine	7726-95-6	0.01	mg		----	----	----	----	----
Chlorine	7782-50-5	0.1	mg		----	----	----	----	----
Fluorine	7782-41-4	0.01	mg		----	----	----	----	----
Sampling Method									
ø Volume - Impinger	----	0.01	mL		----	----	----	----	227

Analytical Results

Sub-Matrix: **IMPINGER SOLUTION** (Matrix: **AIR**)				Client sample ID	Cl2(NaOH) Blank	----	----	----	----
				Client sampling date / time	[05-Jul-2016]	----	----	----	----
Compound	CAS Number	LOR	Unit		EN1602428-026	--------	--------	--------	--------
					Result	---	---	---	---
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	----	1	mL		----	----	----	----	----
Sulfuric Acid as SO3	----	2	mg/sample		----	----	----	----	----
Volume - Impinger	----	1	mL		----	----	----	----	----
Sulfur Dioxide as SO3	----	10	mg/sample		----	----	----	----	----
EA144C: Gaseous and Particulate Fluorides									
Fluoride (as HF)	----	0.01	mg/sample		----	----	----	----	----
Volume - Impinger	----	1	mL		----	----	----	----	----
EA147: Acid Gases									
Hydrogen Bromide	----	0.01	mg		----	----	----	----	----
Hydrogen Chloride	7647-01-0	0.1	mg		----	----	----	----	----
Hydrogen Fluoride	73602-61-6	0.01	mg		----	----	----	----	----
EA147: Halogens									
Bromine	7726-95-6	0.01	mg		<0.200	----	----	----	----
Chlorine	7782-50-5	0.1	mg		<2.00	----	----	----	----
Fluorine	7782-41-4	0.01	mg		<0.200	----	----	----	----
Sampling Method									
ø Volume - Impinger	----	0.01	mL		**99.1**	----	----	----	----

Analytical Results

Sub-Matrix: SORBENT TUBE (Matrix: AIR)				Client sample ID	St1_VOC	St5_VOC	St6_VOC	VOC Blank	----
				Client sampling date / time	[05-Jul-2016]	[24-Jun-2016]	[01-Jul-2016]	[05-Jul-2016]	----
Compound	CAS Number	LOR	Unit		EN1602428-007	EN1602428-015	EN1602428-019	EN1602428-027	--------
					Result	Result	Result	Result	----
EP091A: Aliphatic Hydrocarbons - Total									
1-heptene	592-76-7	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
Decane	124-18-5	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
Heptane	142-82-5	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
EP091B: Monocyclic Aromatic Hydrocarbons - Total									
Benzene	71-43-2	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
Toluene	108-88-3	0.5	µg/sample		<1.0	2.2	26.2	<1.0	----
Ethylbenzene	100-41-4	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
meta- & para-Xylene	108-38-3 106-42-3	1	µg/sample		<2	<2	<2	<2	----
Styrene	100-42-5	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
ortho-Xylene	95-47-6	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
1.3.5-Trimethylbenzene	108-67-8	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
1.2.4-Trimethylbenzene	95-63-6	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
n-Butylbenzene	104-51-8	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
Isopropylbenzene	98-82-8	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
EP091C: Oxygenated Compounds - Total									
2-Propanone (Acetone)	67-64-1	0.5	µg/sample		<1.0	<1.0	1.1	<1.0	----
2-Butanone (MEK)	78-93-3	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
4-Methyl-2-pentanone (MIBK)	108-10-1	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
2-Hexanone (MBK)	591-78-6	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
EP091D: Halogenated Compounds - Total									
1.1-Dichloroethane	75-34-3	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
Chloroform	67-66-3	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
Trichloroethene	79-01-6	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
Chlorobenzene	108-90-7	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
2-Chlorotoluene	95-49-8	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
4-Chlorotoluene	106-43-4	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
1.3-Dichlorobenzene	541-73-1	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
1.4-Dichlorobenzene	106-46-7	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
1.2-Dichlorobenzene	95-50-1	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
Hexachlorobutadiene	87-68-3	0.5	µg/sample		<1.0	<1.0	<1.0	<1.0	----
EP091A: Aliphatic Hydrocarbons (Section 1)									
1-heptene	592-76-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Heptane	142-82-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Decane	124-18-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----

Analytical Results

Sub-Matrix: SORBENT TUBE (Matrix: AIR)				Client sample ID	St1_VOC	St5_VOC	St6_VOC	VOC Blank	----
				Client sampling date / time	[05-Jul-2016]	[24-Jun-2016]	[01-Jul-2016]	[05-Jul-2016]	----
Compound	CAS Number	LOR	Unit		EN1602428-007	EN1602428-015	EN1602428-019	EN1602428-027	--------
					Result	Result	Result	Result	---
EP091B: Monocyclic Aromatic Hydrocarbons (Section 1)									
Benzene	71-43-2	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Toluene	108-88-3	0.5	µg		<1.0	2.2	26.2	<1.0	----
Ethylbenzene	100-41-4	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
meta- & para-Xylene	108-38-3 106-42-3	1	µg		<2	<2	<2	<2	----
Styrene	100-42-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
ortho-Xylene	95-47-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.3.5-Trimethylbenzene	108-67-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.2.4-Trimethylbenzene	95-63-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
n-Butylbenzene	104-51-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Isopropylbenzene	98-82-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091C: Oxygenated Compounds (Section 1)									
2-Propanone (Acetone)	67-64-1	0.5	µg		<1.0	<1.0	1.1	<1.0	----
2-Butanone (MEK)	78-93-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
4-Methyl-2-pentanone (MIBK)	108-10-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
2-Hexanone (MBK)	591-78-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091D: Halogenated Compounds (Section 1)									
1.1-Dichloroethane	75-34-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Chloroform	67-66-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Trichloroethene	79-01-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Chlorobenzene	108-90-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
2-Chlorotoluene	95-49-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
4-Chlorotoluene	106-43-4	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.3-Dichlorobenzene	541-73-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.4-Dichlorobenzene	106-46-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.2-Dichlorobenzene	95-50-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Hexachlorobutadiene	87-68-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091A: Aliphatic Hydrocarbons (Section 2)									
1-heptene	592-76-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Heptane	142-82-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Decane	124-18-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091B: Monocyclic Aromatic Hydrocarbons (Section 2)									
Benzene	71-43-2	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Toluene	108-88-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Ethylbenzene	100-41-4	0.5	µg		<1.0	<1.0	<1.0	<1.0	----

Analytical Results

Sub-Matrix: SORBENT TUBE (Matrix: AIR)				Client sample ID	St1_VOC	St5_VOC	St6_VOC	VOC Blank	----
				Client sampling date / time	[05-Jul-2016]	[24-Jun-2016]	[01-Jul-2016]	[05-Jul-2016]	----
Compound	CAS Number	LOR	Unit		EN1602428-007	EN1602428-015	EN1602428-019	EN1602428-027	--------
					Result	Result	Result	Result	----
EP091B: Monocyclic Aromatic Hydrocarbons (Section 2) - Continued									
meta- & para-Xylene	108-38-3 106-42-3	1	µg		<2	<2	<2	<2	----
Styrene	100-42-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
ortho-Xylene	95-47-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.3.5-Trimethylbenzene	108-67-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.2.4-Trimethylbenzene	95-63-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
n-Butylbenzene	104-51-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Isopropylbenzene	98-82-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091C: Oxygenated Compounds (Section 2)									
2-Propanone (Acetone)	67-64-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
2-Butanone (MEK)	78-93-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
4-Methyl-2-pentanone (MIBK)	108-10-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
2-Hexanone (MBK)	591-78-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091D: Halogenated Compounds (Section 2)									
1.1-Dichloroethane	75-34-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Chloroform	67-66-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Trichloroethene	79-01-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Chlorobenzene	108-90-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
2-Chlorotoluene	95-49-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
4-Chlorotoluene	106-43-4	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.3-Dichlorobenzene	541-73-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.4-Dichlorobenzene	106-46-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.2-Dichlorobenzene	95-50-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Hexachlorobutadiene	87-68-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091A: Aliphatic Hydrocarbons (Section 3)									
1-heptene	592-76-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Heptane	142-82-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Decane	124-18-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091B: Monocyclic Aromatic Hydrocarbons (Section 3)									
Benzene	71-43-2	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Toluene	108-88-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Ethylbenzene	100-41-4	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
meta- & para-Xylene	108-38-3 106-42-3	1	µg		<2	<2	<2	<2	----
Styrene	100-42-5	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
ortho-Xylene	95-47-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----

Analytical Results

Sub-Matrix: SORBENT TUBE (Matrix: AIR)				Client sample ID	St1_VOC	St5_VOC	St6_VOC	VOC Blank	----
				Client sampling date / time	[05-Jul-2016]	[24-Jun-2016]	[01-Jul-2016]	[05-Jul-2016]	----
Compound	CAS Number	LOR	Unit		EN1602428-007	EN1602428-015	EN1602428-019	EN1602428-027	-------
					Result	Result	Result	Result	---
EP091B: Monocyclic Aromatic Hydrocarbons (Section 3) - Continued									
1.3.5-Trimethylbenzene	108-67-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.2.4-Trimethylbenzene	95-63-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
n-Butylbenzene	104-51-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Isopropylbenzene	98-82-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091C: Oxygenated Compounds (Section 3)									
2-Propanone (Acetone)	67-64-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
2-Butanone (MEK)	78-93-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
4-Methyl-2-pentanone (MIBK)	108-10-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
2-Hexanone (MBK)	591-78-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091D: Halogenated Compounds (Section 3)									
1.1-Dichloroethane	75-34-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Chloroform	67-66-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Trichloroethene	79-01-6	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Chlorobenzene	108-90-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
2-Chlorotoluene	95-49-8	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
4-Chlorotoluene	106-43-4	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.3-Dichlorobenzene	541-73-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.4-Dichlorobenzene	106-46-7	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
1.2-Dichlorobenzene	95-50-1	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
Hexachlorobutadiene	87-68-3	0.5	µg		<1.0	<1.0	<1.0	<1.0	----
EP091: Chlorinated Organic Surrogates (Section 1)									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		118	122	121	104	----
4-Bromofluorobenzene	460-00-4	0.5	%		83.9	87.6	85.3	75.2	----
EP091: Chlorinated Organic Surrogates (Section 2)									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		123	112	119	108	----
4-Bromofluorobenzene	460-00-4	0.5	%		85.2	73.2	82.6	82.8	----
EP091: Chlorinated Organic Surrogates (Section 3)									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		115	113	108	106	----
4-Bromofluorobenzene	460-00-4	0.5	%		83.9	80.8	78.7	74.4	----
EP091: MAH Surrogates (Section 1)									
Toluene-D8	2037-26-5	0.5	%		102	105	116	96.8	----
EP091: MAH Surrogates (Section 2)									
Toluene-D8	2037-26-5	0.5	%		114	107	114	97.9	----
EP091: MAH Surrogates (Section 3)									

Analytical Results

Sub-Matrix: **SORBENT TUBE** (Matrix: **AIR**)				Client sample ID	St1_VOC	St5_VOC	St6_VOC	VOC Blank	----
				Client sampling date / time	[05-Jul-2016]	[24-Jun-2016]	[01-Jul-2016]	[05-Jul-2016]	----
Compound	CAS Number	LOR	Unit		EN1602428-007	EN1602428-015	EN1602428-019	EN1602428-027	--------
					Result	Result	Result	Result	---
EP091: MAH Surrogates (Section 3) - Continued									
Toluene-D8	2037-26-5	0.5	%		**110**	**108**	**102**	**99.0**	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	St1_HCl(H2SO4)	St1_Cl2(NaOH)	St5_HCl(H2SO4)	St5_Cl2(NaOH)	HCl(H2SO4)Blank
				Client sampling date / time	[05-Jul-2016]	[05-Jul-2016]	[24-Jun-2016]	[24-Jun-2016]	[05-Jul-2016]
Compound	CAS Number	LOR	Unit		EN1602428-003	EN1602428-004	EN1602428-012	EN1602428-013	EN1602428-025
					Result	Result	Result	Result	Result
ED009: Anions									
Bromide	24959-67-9	0.01	mg/L		<1.00	**0.431**	<1.00	<0.200	<1.00
Chloride	16887-00-6	0.1	mg/L		<10.0	<2.00	<10.0	<2.00	<10.0
Fluoride	16984-48-8	0.01	mg/L		<1.00	<0.200	<1.00	<0.200	<1.00

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	Cl2(NaOH) Blank	----	----	----	----
				Client sampling date / time	[05-Jul-2016]	----	----	----	----
Compound	CAS Number	LOR	Unit		EN1602428-026	--------	--------	--------	--------
					Result	----	----	----	----
ED009: Anions									
Bromide	24959-67-9	0.01	mg/L		<0.200	----	----	----	----
Chloride	16887-00-6	0.1	mg/L		<2.00	----	----	----	----
Fluoride	16984-48-8	0.01	mg/L		<0.200	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SORBENT TUBE**		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP091: Chlorinated Organic Surrogates (Section 1)			
1.2-Dichloroethane-D4	17060-07-0	70	130
4-Bromofluorobenzene	460-00-4	60	130
EP091: Chlorinated Organic Surrogates (Section 2)			
1.2-Dichloroethane-D4	17060-07-0	60	140
4-Bromofluorobenzene	460-00-4	60	140
EP091: Chlorinated Organic Surrogates (Section 3)			
1.2-Dichloroethane-D4	17060-07-0	60	140
4-Bromofluorobenzene	460-00-4	60	140
EP091: MAH Surrogates (Section 1)			
Toluene-D8	2037-26-5	70	130
EP091: MAH Surrogates (Section 2)			
Toluene-D8	2037-26-5	60	140
EP091: MAH Surrogates (Section 3)			
Toluene-D8	2037-26-5	60	140

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1602429**	Page	: 1 of 2
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR JAMES LANG	Contact	: Kim Smith
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Project	: 60489919 Task 1.2	Date Samples Received	: 06-Jul-2016 15:00
Order number	: 60489919 Task 1.2	Date Analysis Commenced	: 11-Jul-2016
C-O-C number	: ----	Issue Date	: 11-Jul-2016 15:12
Sampler	: DT and VK		
Site	: ----		
Quote number	: ----		
No. of samples received	: 1		
No. of samples analysed	: 1		

NATA Accredited Laboratory 825
Accredited for compliance with
ISO/IEC 17025.

NATA
WORLD RECOGNISED ACCREDITATION

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

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

- **EA144C-F: Gaseous and Particulate Fluoride conducted in accordance with AS3580.13.2 - 2013.**

Analytical Results

Sub-Matrix: **EMISSION** (Matrix: **AIR**)				Client sample ID	**St4_Total Fluoride**	----	----	----	----
				Client sampling date / time	[29-Jun-2016]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EN1602429-001**	--------	--------	--------	--------
					Result	---	---	---	---
EA144C: Gaseous and Particulate Fluorides									
Fluoride (as HF)	----	0.01	mg/sample		**0.08**	----	----	----	----
Volume - Impinger	----	1	mL		**260**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1602768**	Page	: 1 of 10
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR JAMES LANG	Contact	: Kim Smith
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Project	: 60489919 Task 1.2	Date Samples Received	: 03-Aug-2016 14:11
Order number	: 60489919 Task 1.2	Date Analysis Commenced	: 09-Aug-2016
C-O-C number	: ----	Issue Date	: 11-Aug-2016 12:07
Sampler	: DT SM JL		
Site	: ----		
Quote number	: ----		
No. of samples received	: 8		
No. of samples analysed	: 8		

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NATA
WORLD RECOGNISED ACCREDITATION

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Justin Houghton	Senior Analyst - Organic	Newcastle - Organics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

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

- **EP091: The LOR values for EP091 have been raised due to increased charcoal sample size (350/350/350 mg) over the standard charcoal sample size (100/50mg) requiring greater extraction volume of solvent.**

Analytical Results

Sub-Matrix: **EMISSION** (Matrix: **AIR**)				Client sample ID	St7_Total Fluoride	St7_H2SO4 as SO3	St7_SO2 as SO3	Total Fluoride Blank	Sox_IPA_Blank
				Client sampling date / time	[03-Aug-2016]	[03-Aug-2016]	[03-Aug-2016]	[03-Aug-2016]	[03-Aug-2016]
Compound	CAS Number	LOR	Unit		EN1602768-001	EN1602768-002	EN1602768-003	EN1602768-005	EN1602768-006
					Result	Result	Result	Result	Result
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	----	1	mL		----	**245**	----	----	**162**
Sulfuric Acid as SO3	----	2	mg/sample		----	<2	----	----	<2
Volume - Impinger	----	1	mL		----	----	**265**	----	----
Sulfur Dioxide as SO3	----	10	mg/sample		----	----	<10	----	----
EA144C: Gaseous and Particulate Fluorides									
Fluoride (as HF)	----	0.01	mg/sample		**0.12**	----	----	<0.01	----
Volume - Impinger	----	1	mL		**310**	----	----	**165**	----

Analytical Results

Sub-Matrix: **EMISSION** (Matrix: **AIR**)				Client sample ID	**Sox_H2O2_Blank**	----	----	----	----
				Client sampling date / time	[03-Aug-2016]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EN1602768-007**	--------	--------	--------	--------
					Result	----	----	----	----
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	----	1	mL		----	----	----	----	----
Sulfuric Acid as SO3	----	2	mg/sample		----	----	----	----	----
Volume - Impinger	----	1	mL		**186**	----	----	----	----
Sulfur Dioxide as SO3	----	10	mg/sample		<10	----	----	----	----
EA144C: Gaseous and Particulate Fluorides									
Fluoride (as HF)	----	0.01	mg/sample		----	----	----	----	----
Volume - Impinger	----	1	mL		----	----	----	----	----

Analytical Results

Sub-Matrix: SORBENT TUBE (Matrix: AIR)				Client sample ID	St7_VOC	VOC_Blank	----	----	----
				Client sampling date / time	[03-Aug-2016]	[03-Aug-2016]	----	----	----
Compound	CAS Number	LOR	Unit		EN1602768-004	EN1602768-008	--------	--------	--------
					Result	Result	----	----	----
EP091A: Aliphatic Hydrocarbons - Total									
1-heptene	592-76-7	0.5	µg/sample		<1.0	<1.0	----	----	----
Decane	124-18-5	0.5	µg/sample		<1.0	<1.0	----	----	----
Heptane	142-82-5	0.5	µg/sample		<1.0	<1.0	----	----	----
EP091B: Monocyclic Aromatic Hydrocarbons - Total									
Benzene	71-43-2	0.5	µg/sample		<1.0	<1.0	----	----	----
Toluene	108-88-3	0.5	µg/sample		<1.0	<1.0	----	----	----
Ethylbenzene	100-41-4	0.5	µg/sample		<1.0	<1.0	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	1	µg/sample		<2	<2	----	----	----
Styrene	100-42-5	0.5	µg/sample		<1.0	<1.0	----	----	----
ortho-Xylene	95-47-6	0.5	µg/sample		<1.0	<1.0	----	----	----
1.3.5-Trimethylbenzene	108-67-8	0.5	µg/sample		<1.0	<1.0	----	----	----
1.2.4-Trimethylbenzene	95-63-6	0.5	µg/sample		<1.0	<1.0	----	----	----
n-Butylbenzene	104-51-8	0.5	µg/sample		<1.0	<1.0	----	----	----
Isopropylbenzene	98-82-8	0.5	µg/sample		<1.0	<1.0	----	----	----
EP091C: Oxygenated Compounds - Total									
2-Propanone (Acetone)	67-64-1	0.5	µg/sample		<1.0	<1.0	----	----	----
2-Butanone (MEK)	78-93-3	0.5	µg/sample		<1.0	<1.0	----	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	0.5	µg/sample		<1.0	<1.0	----	----	----
2-Hexanone (MBK)	591-78-6	0.5	µg/sample		<1.0	<1.0	----	----	----
EP091D: Halogenated Compounds - Total									
1.1-Dichloroethane	75-34-3	0.5	µg/sample		<1.0	<1.0	----	----	----
Chloroform	67-66-3	0.5	µg/sample		<1.0	<1.0	----	----	----
Trichloroethene	79-01-6	0.5	µg/sample		<1.0	<1.0	----	----	----
Chlorobenzene	108-90-7	0.5	µg/sample		<1.0	<1.0	----	----	----
2-Chlorotoluene	95-49-8	0.5	µg/sample		<1.0	<1.0	----	----	----
4-Chlorotoluene	106-43-4	0.5	µg/sample		<1.0	<1.0	----	----	----
1.3-Dichlorobenzene	541-73-1	0.5	µg/sample		<1.0	<1.0	----	----	----
1.4-Dichlorobenzene	106-46-7	0.5	µg/sample		<1.0	<1.0	----	----	----
1.2-Dichlorobenzene	95-50-1	0.5	µg/sample		<1.0	<1.0	----	----	----
Hexachlorobutadiene	87-68-3	0.5	µg/sample		<1.0	<1.0	----	----	----
EP091A: Aliphatic Hydrocarbons (Section 1)									
1-heptene	592-76-7	0.5	µg		<1.0	<1.0	----	----	----
Heptane	142-82-5	0.5	µg		<1.0	<1.0	----	----	----
Decane	124-18-5	0.5	µg		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: **SORBENT TUBE** (Matrix: **AIR**)				Client sample ID	St7_VOC	VOC_Blank	----	----	----
				Client sampling date / time	[03-Aug-2016]	[03-Aug-2016]	----	----	----
Compound	CAS Number	LOR	Unit		EN1602768-004	EN1602768-008	--------	--------	--------
					Result	Result	----	----	----
EP091B: Monocyclic Aromatic Hydrocarbons (Section 1)									
Benzene	71-43-2	0.5	µg		<1.0	<1.0	----	----	----
Toluene	108-88-3	0.5	µg		<1.0	<1.0	----	----	----
Ethylbenzene	100-41-4	0.5	µg		<1.0	<1.0	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	1	µg		<2	<2	----	----	----
Styrene	100-42-5	0.5	µg		<1.0	<1.0	----	----	----
ortho-Xylene	95-47-6	0.5	µg		<1.0	<1.0	----	----	----
1.3.5-Trimethylbenzene	108-67-8	0.5	µg		<1.0	<1.0	----	----	----
1.2.4-Trimethylbenzene	95-63-6	0.5	µg		<1.0	<1.0	----	----	----
n-Butylbenzene	104-51-8	0.5	µg		<1.0	<1.0	----	----	----
Isopropylbenzene	98-82-8	0.5	µg		<1.0	<1.0	----	----	----
EP091C: Oxygenated Compounds (Section 1)									
2-Propanone (Acetone)	67-64-1	0.5	µg		<1.0	<1.0	----	----	----
2-Butanone (MEK)	78-93-3	0.5	µg		<1.0	<1.0	----	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	0.5	µg		<1.0	<1.0	----	----	----
2-Hexanone (MBK)	591-78-6	0.5	µg		<1.0	<1.0	----	----	----
EP091D: Halogenated Compounds (Section 1)									
1.1-Dichloroethane	75-34-3	0.5	µg		<1.0	<1.0	----	----	----
Chloroform	67-66-3	0.5	µg		<1.0	<1.0	----	----	----
Trichloroethene	79-01-6	0.5	µg		<1.0	<1.0	----	----	----
Chlorobenzene	108-90-7	0.5	µg		<1.0	<1.0	----	----	----
2-Chlorotoluene	95-49-8	0.5	µg		<1.0	<1.0	----	----	----
4-Chlorotoluene	106-43-4	0.5	µg		<1.0	<1.0	----	----	----
1.3-Dichlorobenzene	541-73-1	0.5	µg		<1.0	<1.0	----	----	----
1.4-Dichlorobenzene	106-46-7	0.5	µg		<1.0	<1.0	----	----	----
1.2-Dichlorobenzene	95-50-1	0.5	µg		<1.0	<1.0	----	----	----
Hexachlorobutadiene	87-68-3	0.5	µg		<1.0	<1.0	----	----	----
EP091A: Aliphatic Hydrocarbons (Section 2)									
1-heptene	592-76-7	0.5	µg		<1.0	<1.0	----	----	----
Heptane	142-82-5	0.5	µg		<1.0	<1.0	----	----	----
Decane	124-18-5	0.5	µg		<1.0	<1.0	----	----	----
EP091B: Monocyclic Aromatic Hydrocarbons (Section 2)									
Benzene	71-43-2	0.5	µg		<1.0	<1.0	----	----	----
Toluene	108-88-3	0.5	µg		<1.0	<1.0	----	----	----
Ethylbenzene	100-41-4	0.5	µg		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: SORBENT TUBE (Matrix: AIR)				Client sample ID	St7_VOC	VOC_Blank	----	----	----
				Client sampling date / time	[03-Aug-2016]	[03-Aug-2016]	----	----	----
Compound	CAS Number	LOR	Unit		EN1602768-004	EN1602768-008	--------	--------	--------
					Result	Result	----	----	----
EP091B: Monocyclic Aromatic Hydrocarbons (Section 2) - Continued									
meta- & para-Xylene	108-38-3 106-42-3	1	µg		<2	<2	----	----	----
Styrene	100-42-5	0.5	µg		<1.0	<1.0	----	----	----
ortho-Xylene	95-47-6	0.5	µg		<1.0	<1.0	----	----	----
1.3.5-Trimethylbenzene	108-67-8	0.5	µg		<1.0	<1.0	----	----	----
1.2.4-Trimethylbenzene	95-63-6	0.5	µg		<1.0	<1.0	----	----	----
n-Butylbenzene	104-51-8	0.5	µg		<1.0	<1.0	----	----	----
Isopropylbenzene	98-82-8	0.5	µg		<1.0	<1.0	----	----	----
EP091C: Oxygenated Compounds (Section 2)									
2-Propanone (Acetone)	67-64-1	0.5	µg		<1.0	<1.0	----	----	----
2-Butanone (MEK)	78-93-3	0.5	µg		<1.0	<1.0	----	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	0.5	µg		<1.0	<1.0	----	----	----
2-Hexanone (MBK)	591-78-6	0.5	µg		<1.0	<1.0	----	----	----
EP091D: Halogenated Compounds (Section 2)									
1.1-Dichloroethane	75-34-3	0.5	µg		<1.0	<1.0	----	----	----
Chloroform	67-66-3	0.5	µg		<1.0	<1.0	----	----	----
Trichloroethene	79-01-6	0.5	µg		<1.0	<1.0	----	----	----
Chlorobenzene	108-90-7	0.5	µg		<1.0	<1.0	----	----	----
2-Chlorotoluene	95-49-8	0.5	µg		<1.0	<1.0	----	----	----
4-Chlorotoluene	106-43-4	0.5	µg		<1.0	<1.0	----	----	----
1.3-Dichlorobenzene	541-73-1	0.5	µg		<1.0	<1.0	----	----	----
1.4-Dichlorobenzene	106-46-7	0.5	µg		<1.0	<1.0	----	----	----
1.2-Dichlorobenzene	95-50-1	0.5	µg		<1.0	<1.0	----	----	----
Hexachlorobutadiene	87-68-3	0.5	µg		<1.0	<1.0	----	----	----
EP091A: Aliphatic Hydrocarbons (Section 3)									
1-heptene	592-76-7	0.5	µg		<1.0	<1.0	----	----	----
Heptane	142-82-5	0.5	µg		<1.0	<1.0	----	----	----
Decane	124-18-5	0.5	µg		<1.0	<1.0	----	----	----
EP091B: Monocyclic Aromatic Hydrocarbons (Section 3)									
Benzene	71-43-2	0.5	µg		<1.0	<1.0	----	----	----
Toluene	108-88-3	0.5	µg		<1.0	<1.0	----	----	----
Ethylbenzene	100-41-4	0.5	µg		<1.0	<1.0	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	1	µg		<2	<2	----	----	----
Styrene	100-42-5	0.5	µg		<1.0	<1.0	----	----	----
ortho-Xylene	95-47-6	0.5	µg		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: SORBENT TUBE (Matrix: AIR)				Client sample ID	St7_VOC	VOC_Blank	----	----	----
				Client sampling date / time	[03-Aug-2016]	[03-Aug-2016]	----	----	----
Compound	CAS Number	LOR	Unit		EN1602768-004	EN1602768-008	--------	--------	--------
					Result	Result	----	----	----
EP091B: Monocyclic Aromatic Hydrocarbons (Section 3) - Continued									
1.3.5-Trimethylbenzene	108-67-8	0.5	µg		<1.0	<1.0	----	----	----
1.2.4-Trimethylbenzene	95-63-6	0.5	µg		<1.0	<1.0	----	----	----
n-Butylbenzene	104-51-8	0.5	µg		<1.0	<1.0	----	----	----
Isopropylbenzene	98-82-8	0.5	µg		<1.0	<1.0	----	----	----
EP091C: Oxygenated Compounds (Section 3)									
2-Propanone (Acetone)	67-64-1	0.5	µg		<1.0	<1.0	----	----	----
2-Butanone (MEK)	78-93-3	0.5	µg		<1.0	<1.0	----	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	0.5	µg		<1.0	<1.0	----	----	----
2-Hexanone (MBK)	591-78-6	0.5	µg		<1.0	<1.0	----	----	----
EP091D: Halogenated Compounds (Section 3)									
1.1-Dichloroethane	75-34-3	0.5	µg		<1.0	<1.0	----	----	----
Chloroform	67-66-3	0.5	µg		<1.0	<1.0	----	----	----
Trichloroethene	79-01-6	0.5	µg		<1.0	<1.0	----	----	----
Chlorobenzene	108-90-7	0.5	µg		<1.0	<1.0	----	----	----
2-Chlorotoluene	95-49-8	0.5	µg		<1.0	<1.0	----	----	----
4-Chlorotoluene	106-43-4	0.5	µg		<1.0	<1.0	----	----	----
1.3-Dichlorobenzene	541-73-1	0.5	µg		<1.0	<1.0	----	----	----
1.4-Dichlorobenzene	106-46-7	0.5	µg		<1.0	<1.0	----	----	----
1.2-Dichlorobenzene	95-50-1	0.5	µg		<1.0	<1.0	----	----	----
Hexachlorobutadiene	87-68-3	0.5	µg		<1.0	<1.0	----	----	----
EP091: Chlorinated Organic Surrogates (Section 1)									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		93.4	97.7	----	----	----
4-Bromofluorobenzene	460-00-4	0.5	%		74.6	74.3	----	----	----
EP091: Chlorinated Organic Surrogates (Section 2)									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		94.5	99.7	----	----	----
4-Bromofluorobenzene	460-00-4	0.5	%		75.6	72.6	----	----	----
EP091: Chlorinated Organic Surrogates (Section 3)									
1.2-Dichloroethane-D4	17060-07-0	0.5	%		94.5	99.4	----	----	----
4-Bromofluorobenzene	460-00-4	0.5	%		69.5	74.6	----	----	----
EP091: MAH Surrogates (Section 1)									
Toluene-D8	2037-26-5	0.5	%		93.1	97.7	----	----	----
EP091: MAH Surrogates (Section 2)									
Toluene-D8	2037-26-5	0.5	%		92.9	98.3	----	----	----
EP091: MAH Surrogates (Section 3)									

Analytical Results

Sub-Matrix: **SORBENT TUBE** (Matrix: **AIR**)				Client sample ID	St7_VOC	VOC_Blank	----	----	----
				Client sampling date / time	[03-Aug-2016]	[03-Aug-2016]	----	----	----
Compound	CAS Number	LOR	Unit		EN1602768-004	EN1602768-008	--------	--------	--------
					Result	Result	----	----	----
EP091: MAH Surrogates (Section 3) - Continued									
Toluene-D8	2037-26-5	0.5	%		**94.0**	**100**	----	----	----

Surrogate Control Limits

Sub-Matrix: **SORBENT TUBE**		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP091: Chlorinated Organic Surrogates (Section 1)			
1.2-Dichloroethane-D4	17060-07-0	70	130
4-Bromofluorobenzene	460-00-4	60	130
EP091: Chlorinated Organic Surrogates (Section 2)			
1.2-Dichloroethane-D4	17060-07-0	60	140
4-Bromofluorobenzene	460-00-4	60	140
EP091: Chlorinated Organic Surrogates (Section 3)			
1.2-Dichloroethane-D4	17060-07-0	60	140
4-Bromofluorobenzene	460-00-4	60	140
EP091: MAH Surrogates (Section 1)			
Toluene-D8	2037-26-5	70	130
EP091: MAH Surrogates (Section 2)			
Toluene-D8	2037-26-5	60	140
EP091: MAH Surrogates (Section 3)			
Toluene-D8	2037-26-5	60	140

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1602848**	Page	: 1 of 4
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR JAMES LANG	Contact	: Kim Smith
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Project	: 60489919 Task 1.2	Date Samples Received	: 08-Aug-2016 09:40
Order number	: 60489919 Task 1.2	Date Analysis Commenced	: 11-Aug-2016
C-O-C number	: ----	Issue Date	: 16-Aug-2016 19:59
Sampler	: JAMES LANG		
Site	: ----		
Quote number	: ----		
No. of samples received	: 3		
No. of samples analysed	: 3		

NATA Accredited Laboratory 825
Accredited for compliance with
ISO/IEC 17025.

NATA
WORLD RECOGNISED ACCREDITATION

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

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

- **EK026-I: Cyanide was analysed as a preserved water sample by ALS Environmental, Sydney under NATA accreditation no. 825, site no 10911**

Analytical Results

Sub-Matrix: **EMISSION** (Matrix: **AIR**)			Client sample ID	**Stack 1_CN A**	**Stack 1_CN B**	**CN Blank**	----	----
			Client sampling date / time	[05-Jul-2016]	[05-Jul-2016]	[06-Jul-2016]	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN1602848-001**	**EN1602848-002**	**EN1602848-003**	--------	--------
				Result	Result	Result	---	---
EK026-I: Cyanide in Air Impinger Solutions								
ø Cyanide	57-12-5	0.01	mg	**0.16**	<0.01	<0.01	----	----
ø Volume - Impinger	----	1	mL	**202**	**54**	**200**	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**Stack 1_CN A**	**Stack 1_CN B**	**CN Blank**	----	----
				Client sampling date / time	[05-Jul-2016]	[05-Jul-2016]	[06-Jul-2016]	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EN1602848-001**	**EN1602848-002**	**EN1602848-003**	--------	--------
					Result	Result	Result	---	---
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		**0.798**	<0.004	<0.004	----	----

Australian Government
National Measurement Institute

ANALYSIS REPORT # ORG16_045A

Client	AECOM AUSTRALIA 17 WARABROOK BOULEVARDE WARABROOK NSW 2304	**Job No.**	AECO01/160707
		Sampled by	Client
		Date Sampled	Not specified
Contact	James Lang	**Date Received**	7-Jul-2016

The results relate only to the sample(s) tested.

Method NGCMS 11.27

Details The samples are spiked with a range of isotopically labelled PAHs then extracted with organic solvent. The extracts were purified by chemical treatment and column chromatography. Analysis was performed using high resolution gas chromatography with low resolution mass spectrometry. Results have been corrected for recoveries of the internal standard.

Instrument: Agilent 5975 GCMS run in SIM mode. Column is a DB5-ms (30m×0.25mm×0.25µm). Method based on CARB429, July 1997 Revision.

Authorisation

Danny Slee
Senior Chemist- Environment
July 29, 2016

Accreditation NATA Accreditation Number : 198

Accredited for compliance with ISO/IEC 17025.

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Sample Details : Job No. AECO01/160707

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N16/018794	DAU150616A	Emission	Cartridge, Rinses, Filter

Project Details

Project Name	*Not specified*
Project Number	*60489919/1.2*

Key

Analytes	Labelled internal std.	Analytes	Labelled internal std.
Naphthalene	d8-Naphthalene	Chrysene	d12-Chrysene
2-Methylnaphthalene		Benzo(b)fluoranthene	d12-Benzo(b)fluoranthene
Acenaphthylene	d8-Acenaphthylene	Benzo(k)fluoranthene	d12-Benzo(k)fluoranthene
Acenaphthene	d10-Acenaphthene	Benzo(e)pyrene	
Fluorene	d10-Fluorene	Benzo(a)pyrene	d12-Benzo(a)pyrene
Phenanthrene	d10-Phenanthrene	Perylene	
Anthracene		Indeno(1,2,3-cd)pyrene	d12-Indeno(1,2,3-c,d)pyrene
Fluoranthene	d10-Fluoranthene	Dibenz(ah)anthracene	d14-Dibenz(ah)anthracene
Pyrene		Benzo(ghi)perylene	d12-Benzo(ghi)perylene
Benz(a)anthracene	d12-Benz(a)anthracene		

Abbreviations & Definitions

ng	nanograms per sample train
<	level less than limit of reporting (LOR)
BaP-PEF†	Benzo(a)pyrene Potency Equivalent Factor
BaP-TEQ$_{PAH}$	Benzo(a)pyrene Toxic Equivalents

† as defined in "Benzo(a)pyrene as a Toxic Air Contaminant", CARB/OEHHA Executive Summary, July 1994

TEQs are calculated by multiplying the quantified level for each toxic PAH by corresponding PEF and summing the result:

$$BaP\text{-}TEQ_{PAH} = \sum_{i=1}^{n} [PAH_i \times BaP - PEF_i]$$ i = toxic PAH analyte index (1 to n=7)

CARB	California Air Resources Board
OEHHA	Office of Environmental Health Hazard Assessment (US)
Surrogate Standard	Known amount of deuterated standard added to the XAD resin prior to sampling. Surrogates are 'field spikes'. The surrogate recovery indicates how effectively the sample train retains PAHs collected on the resin. It is also a guide to matrix effects caused by time of storage and transportation.
Internal Standard	Known amount of deuterated PAHs added to field samples, blanks and QC samples prior to laboratory analysis. The internal standard is used to measure the concentration of native PAHs and surrogates. The internal standard recovery will determine the performance of the laboratory method. Usual recoveries are 50 to 150%. Lower recoveries can be accepted as long as the signal/noise ratio of the internal standard is >10.

Results : Job No. AECO01/160707

Laboratory Reg. No.	N16/018794	**Date Reported**	29-Jul-2016
Client Sample Ref.	DAU150616A	**Date Extracted**	14-Jul-2016
Matrix	Emission		
Description	Cartridge, Rinses, Filter		

PAH	Conc. ng	Reporting Level (LOR, ng)	BaP-PEF Value	BaP-TEQ Contribution	Labelled Internal recovery (%)	Flags
Naphthalene	140000	75	-	-	91	
2-Methylnaphthalene	18000	20	-	-		
Acenaphthylene	32000	20	-	-	93	
Acenaphthene	730	20	-	-	95	
Fluorene	13000	20	-	-	94	
Phenanthrene	14000	20	-	-	91	
Anthracene	1400	20	-	-		
Fluoranthene	770	20	-	-	83	
Pyrene	520	69	-	-		
Benz(a)anthracene	42	20	0.1	4.2	109	
Chrysene	22	20	0.01	0.2	114	
Benzo(b)fluoranthene	49	20	0.1	4.9	105	
Benzo(k)fluoranthene	<20	20	0.1	1.0	121	
Benzo(e)pyrene	34	20	-	-		
Benzo(a)pyrene	<20	20	1.0	10	113	
Perylene	<20	20	-	-		
Indeno(1,2,3-cd)pyrene	<85	85	0.1	4.3	114	
Dibenz(ah)anthracene	<89	89	0.4	18.0	114	
Benzo(ghi)perylene	<90	90	-	-	101	

Flags
" * " : indicates the recovery is outside range but signal to noise is >10.
Acceptable recovery range set at 50 to 150%.

Surrogate Recovery	%
d14-Terphenyl	73

Summary Results		
BaP -TEQ$_{PAH}$		
Lower Bound [excluding LOD values]	**9.3**	ng
Middle Bound [including half LOD values]	**43**	ng
Upper Bound [including LOD values]	**76**	ng

Australian Government
National Measurement Institute

ANALYSIS REPORT # ORG16_045B

Client	AECOM AUSTRALIA 17 WARABROOK BOULEVARDE WARABROOK NSW 2304	**Job No.**	AECO01/160707
		Sampled by	Client
		Date Sampled	Not specified
Contact	James Lang	**Date Received**	7-Jul-2016

The results relate only to the sample(s) tested.

Method NGCMS 11.27

Details The samples are spiked with a range of isotopically labelled PAHs then extracted with organic solvent. The extracts were purified by chemical treatment and column chromatography. Analysis was performed using high resolution gas chromatography with low resolution mass spectrometry. Results have been corrected for recoveries of the internal standard.

Instrument: Agilent 5975 GCMS run in SIM mode. Column is a DB5-ms (30m×0.25mm×0.25µm). Method based on CARB429, July 1997 Revision.

Authorisation

Danny Slee
Senior Chemist- Environment
July 29, 2016

Accreditation NATA Accreditation Number : 198

Accredited for compliance with ISO/IEC 17025.

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Sample Details : Job No. AECO01/160707

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N16/018795	DAU290616N	Emission	Cartridge, Rinses, Filter
N16/018796	DAU150616C	Emission	Cartridge, Rinses, Filter

Project Details

Project Name	*Not specified*
Project Number	*60489919/1.2*

Key

Analytes	Labelled internal std.	Analytes	Labelled internal std.
Naphthalene	d8-Naphthalene	Chrysene	d12-Chrysene
2-Methylnaphthalene		Benzo(b)fluoranthene	d12-Benzo(b)fluoranthene
Acenaphthylene	d8-Acenaphthylene	Benzo(k)fluoranthene	d12-Benzo(k)fluoranthene
Acenaphthene	d10-Acenaphthene	Benzo(e)pyrene	
Fluorene	d10-Fluorene	Benzo(a)pyrene	d12-Benzo(a)pyrene
Phenanthrene	d10-Phenanthrene	Perylene	
Anthracene		Indeno(1,2,3-cd)pyrene	d12-Indeno(1,2,3-c,d)pyrene
Fluoranthene	d10-Fluoranthene	Dibenz(ah)anthracene	d14-Dibenz(ah)anthracene
Pyrene		Benzo(ghi)perylene	d12-Benzo(ghi)perylene
Benz(a)anthracene	d12-Benz(a)anthracene		

Abbreviations & Definitions

ng	nanograms per sample train
<	level less than limit of reporting (LOR)
BaP-PEF†	Benzo(a)pyrene Potency Equivalent Factor
$BaP\text{-}TEQ_{PAH}$	Benzo(a)pyrene Toxic Equivalents

† as defined in "Benzo(a)pyrene as a Toxic Air Contaminant", CARB/OEHHA Executive Summary, July 1994

TEQs are calculated by multiplying the quantified level for each toxic PAH by corresponding PEF and summing the result:

$$BaP\text{-}TEQ_{PAH} = \sum_{i=1}^{n}[PAH_i \times BaP - PEF_i]$$ i = toxic PAH analyte index (1 to n=7)

CARB	California Air Resources Board
OEHHA	Office of Environmental Health Hazard Assessment (US)
Surrogate Standard	Known amount of deuterated standard added to the XAD resin prior to sampling. Surrogates are 'field spikes'. The surrogate recovery indicates how effectively the sample train retains PAHs collected on the resin. It is also a guide to matrix effects caused by time of storage and transportation.
Internal Standard	Known amount of deuterated PAHs added to field samples, blanks and QC samples prior to laboratory analysis. The internal standard is used to measure the concentration of native PAHs and surrogates. The internal standard recovery will determine the performance of the laboratory method. Usual recoveries are 50 to 150%. Lower recoveries can be accepted as long as the signal/noise ratio of the internal standard is >10.

Results : Job No. AECO01/160707

Laboratory Reg. No.	N16/018795	**Date Reported**	29-Jul-2016
Client Sample Ref.	DAU290616N	**Date Extracted**	18-Jul-2016
Matrix	Emission		
Description	Cartridge, Rinses, Filter		

PAH	Conc. ng	Reporting Level (LOR, ng)	BaP-PEF Value	BaP-TEQ Contribution	Labelled Internal recovery (%)	Flags
Naphthalene	11000	100	-	-	91	
2-Methylnaphthalene	12000	25	-	-		
Acenaphthylene	180	20	-	-	80	
Acenaphthene	700	20	-	-	97	
Fluorene	280	20	-	-	95	
Phenanthrene	290	20	-	-	115	
Anthracene	<20	20	-	-		
Fluoranthene	190	20	-	-	85	
Pyrene	210	20	-	-		
Benz(a)anthracene	<20	20	0.1	1.0	100	
Chrysene	<20	20	0.01	0.1	103	
Benzo(b)fluoranthene	27	20	0.1	2.7	94	
Benzo(k)fluoranthene	<20	20	0.1	1.0	99	
Benzo(e)pyrene	<20	20	-	-		
Benzo(a)pyrene	<20	20	1.0	10	103	
Perylene	420	20	-	-		
Indeno(1,2,3-cd)pyrene	<150	150	0.1	7.5	95	
Dibenz(ah)anthracene	<140	140	0.4	28	99	
Benzo(ghi)perylene	<210	210	-	-	98	

Flags
" * " : indicates the recovery is outside range but signal to noise is >10.
Acceptable recovery range set at 50 to 150%.

Surrogate Recovery	%
d14-Terphenyl	59

Summary Results		
BaP-TEQ$_{PAH}$		
Lower Bound [excluding LOD values]	**2.7**	ng
Middle Bound [including half LOD values]	**50**	ng
Upper Bound [including LOD values]	**98**	ng

Results : Job No. AECO01/160707

Laboratory Reg. No.	N16/018796	**Date Reported**	29-Jul-2016
Client Sample Ref.	DAU150616C	**Date Extracted**	18-Jul-2016
Matrix	Emission		
Description	Cartridge, Rinses, Filter		

PAH	Conc. ng	Reporting Level (LOR, ng)	BaP-PEF Value	BaP-TEQ Contribution	Labelled Internal recovery (%)	Flags
Naphthalene	5800	100	-	-	68	
2-Methylnaphthalene	7800	25	-	-		
Acenaphthylene	<20	20	-	-	56	
Acenaphthene	460	20	-	-	63	
Fluorene	250	20	-	-	87	
Phenanthrene	330	20	-	-	109	
Anthracene	<20	20	-	-		
Fluoranthene	100	20	-	-	82	
Pyrene	140	20	-	-		
Benz(a)anthracene	<20	20	0.1	1.0	116	
Chrysene	<20	20	0.01	0.1	131	
Benzo(b)fluoranthene	<20	20	0.1	1.0	90	
Benzo(k)fluoranthene	<20	20	0.1	1.0	99	
Benzo(e)pyrene	<20	20	-	-		
Benzo(a)pyrene	<20	20	1.0	10	103	
Perylene	310	20	-	-		
Indeno(1,2,3-cd)pyrene	<150	150	0.1	7.5	96	
Dibenz(ah)anthracene	<140	140	0.4	28	101	
Benzo(ghi)perylene	<210	210	-	-	96	

Flags
" * " : indicates the recovery is outside range but signal to noise is >10.
Acceptable recovery range set at 50 to 150%.

Surrogate Recovery	%
d14-Terphenyl	57

Summary Results		
BaP-TEQ$_{PAH}$		
Lower Bound [excluding LOD values]	**0**	ng
Middle Bound [including half LOD values]	**49**	ng
Upper Bound [including LOD values]	**97**	ng

Australian Government
National Measurement Institute

ANALYSIS REPORT # ORG16_052

Client	AECOM Australia P/L 17 Warabrook Boulevarde Warabrook NSW 2304	**Job No.**	AECO01/160804
		Sampled by	Client
		Date Sampled	3-Aug-2016
Contact	James Lang	**Date Received**	4-Aug-2016

The results relate only to the sample(s) tested.

Method NGCMS 11.27

Details The samples are spiked with a range of isotopically labelled PAHs then extracted with organic solvent. The extracts were purified by chemical treatment and column chromatography. Analysis was performed using high resolution gas chromatography with low resolution mass spectrometry. Results have been corrected for recoveries of the internal standard.

Instrument: Agilent 5975 GCMS run in SIM mode. Column is a DB5-ms (30m×0.25mm×0.25µm). Method based on CARB429, July 1997 Revision.

Authorisation

Danny Slee
Senior Chemist- Environment
August 25, 2016

Accreditation NATA Accreditation Number : 198

Accredited for compliance with ISO/IEC 17025.

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NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Sample Details : Job No. AECO01/160804

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N16/021768	DAU010816K	Emission	Cartridge+Filter+Solvent Rinses

Project Details

Project Name	*Stack 7*
Project Number	*60489919*

Key

Analytes	**Labelled internal std.**	**Analytes**	**Labelled internal std.**
Naphthalene	d8-Naphthalene	Chrysene	d12-Chrysene
2-Methylnaphthalene		Benzo(b)fluoranthene	d12-Benzo(b)fluoranthene
Acenaphthylene	d8-Acenaphthylene	Benzo(k)fluoranthene	d12-Benzo(k)fluoranthene
Acenaphthene	d10-Acenaphthene	Benzo(e)pyrene	
Fluorene	d10-Fluorene	Benzo(a)pyrene	d12-Benzo(a)pyrene
Phenanthrene	d10-Phenanthrene	Perylene	
Anthracene		Indeno(1,2,3-cd)pyrene	d12-Indeno(1,2,3-c,d)pyrene
Fluoranthene	d10-Fluoranthene	Dibenz(ah)anthracene	d14-Dibenz(ah)anthracene
Pyrene		Benzo(ghi)perylene	d12-Benzo(ghi)perylene
Benz(a)anthracene	d12-Benz(a)anthracene		

Abbreviations & Definitions

ng	nanograms per sample train
<	level less than limit of reporting (LOR)
BaP-PEF†	Benzo(a)pyrene Potency Equivalent Factor
BaP-TEQ$_{PAH}$	Benzo(a)pyrene Toxic Equivalents

† as defined in "Benzo(a)pyrene as a Toxic Air Contaminant", CARB/OEHHA Executive Summary, July 1994

TEQs are calculated by multiplying the quantified level for each toxic PAH by corresponding PEF and summing the result:

$$BaP\text{-}TEQ_{PAH} = \sum_{i=1}^{n}[PAH_i \times BaP - PEF_i]$$ i = toxic PAH analyte index (1 to n=7)

CARB	California Air Resources Board
OEHHA	Office of Environmental Health Hazard Assessment (US)
Surrogate Standard	Known amount of deuterated standard added to the XAD resin prior to sampling. Surrogates are 'field spikes'. The surrogate recovery indicates how effectively the sample train retains PAHs collected on the resin. It is also a guide to matrix effects caused by time of storage and transportation.
Internal Standard	Known amount of deuterated PAHs added to field samples, blanks and QC samples prior to laboratory analysis. The internal standard is used to measure the concentration of native PAHs and surrogates. The internal standard recovery will determine the performance of the laboratory method. Usual recoveries are 50 to 150%. Lower recoveries can be accepted as long as the signal/noise ratio of the internal standard is >10.

Results : Job No. AECO01/160804

Laboratory Reg. No.	N16/021768	**Date Reported**	25-Aug-2016
Client Sample Ref.	DAU010816K	**Date Extracted**	11-Aug-2016
Matrix	Emission		
Description	Cartridge+Filter+Solvent Rinses		

PAH	Conc. ng	Reporting Level (LOR, ng)	BaP-PEF Value	BaP-TEQ Contribution	Labelled Internal recovery (%)	Flags
Naphthalene	100	39	-	-	73	
2-Methylnaphthalene	2000	20	-	-		
Acenaphthylene	43	20	-	-	69	
Acenaphthene	490	20	-	-	64	
Fluorene	210	20	-	-	74	
Phenanthrene	290	20	-	-	99	
Anthracene	<20	20	-	-		
Fluoranthene	65	20	-	-	89	
Pyrene	33	20	-	-		
Benz(a)anthracene	<20	20	0.1	1.0	120	
Chrysene	<20	20	0.01	0.1	134	
Benzo(b)fluoranthene	<20	20	0.1	1.0	124	
Benzo(k)fluoranthene	<20	20	0.1	1.0	129	
Benzo(e)pyrene	<20	20	-	-		
Benzo(a)pyrene	<20	20	1.0	10	105	
Perylene	<20	20	-	-		
Indeno(1,2,3-cd)pyrene	<20	20	0.1	1.0	117	
Dibenz(ah)anthracene	30	20	0.4	12	116	
Benzo(ghi)perylene	<20	20	-	-	104	

Flags
" * " : indicates the recovery is outside range but signal to noise is >10.
Acceptable recovery range set at 50 to 150%.

Surrogate Recovery	%
d14-Terphenyl	82

Summary Results		
BaP -TEQ$_{PAH}$		
Lower Bound [excluding LOD values]	**12**	ng
Middle Bound [including half LOD values]	**26**	ng
Upper Bound [including LOD values]	**40**	ng

Australian Government
National Measurement Institute

CERTIFICATE OF ANALYSIS # DAU16_161

Client	AECOM 17 Warabrook Boulevarde Warabrook NSW 2304	**Job No.**	AECO01/160707
		Sampled by	Client
		Date Sampled	24-Jun-16
Contact	James Lang	**Date Received**	7-Jul-16

The results relate only to the sample(s) tested.

Method AUTL_02 **Date Reported** 2-Aug-16

Details

The method is for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) in emission samples by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS). This method provides data on all toxic 2,3,7,8-PCDD (seven) and PCDF (ten) isomers. PCDD and PCDF totals for each homologue group (tetra to octa) are also reported. The dioxin toxicity equivalent (I-TEQ) in each sample is calculated using International toxic equivalency factors (I-TEFs).
All results are corrected for labelled surrogate recoveries.

After sampling the filter & resin are spiked with a range of isotopically labelled surrogate standards and exhaustively extracted. Clean up is effected by partitioning with sulphuric acid then distilled water. Further purification is performed using column chromatography on acid and base modified silica gels, basic alumina and carbon dispersed on celite.

Immediately prior to injection, internal standards are added to each extract, and an aliquot of the extract is injected into the GC. The analytes are separated by the GC and detected by a high-resolution (>10,000) mass spectrometer.

Authorisation

Nino Piro
Senior Chemist
Dioxin Analysis Unit

Dr Alan Yates
Senior Analyst
Dioxin Analysis Unit

Accreditation

NATA Accredited Laboratory Number : 198

Accredited for compliance with ISO/IEC 17025.

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NATA ACCREDITED FOR TECHNICAL COMPETENCE

Sample Details : Job No. AECO01/160707

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N16/018794X	60489919 - ST5	Emission	Resin DAU150616A, Filter, Solvent Rinse

Project Details

Project Name	*Not Specified*
Project Number	*PO No. 60489919 / 1.2*

Key

Analytes

TCDD	Tetrachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	HxCDF	Hexachlorodibenzofuran
HpCDD	Heptachlorodibenzo-p-dioxin	HpCDF	Heptachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin	OCDF	Octachlorodibenzofuran

Units & Abbreviations

pg	picograms
<	level less than limit of detection (LOD)
I-TEF‡	International toxic equivalency factor
I-TEQ‡	International toxic equivalents - dioxins & furans

TEQs are calculated by multiplying the quantified level for each individual dioxin and furan congener reported by the corresponding TEF value and summing the result:

$$\text{I–TEQ} = \sum_{i=1}^{7}[\text{PCDD}_i \times \text{TEF}_i] + \sum_{j=1}^{10}[\text{PCDF}_j \times \text{TEF}_j]$$

i = PCDD congener index (1 - 7)
j = PCDF congener index (1 - 10)

Lower Bound TEQ	defines all congener values reported below the LOD as equal to zero.
Middle Bound TEQ	defines all congener values reported below the LOD as equal to half the LOD.
Upper Bound TEQ	defines all congener values reported below the LOD as equal to the LOD.

Surrogate Recovery	percentage recovery for $^{13}C_{12}$ labelled surrogate standard
P□	Laboratory surrogate recovery outside normal acceptance criteria: **40-130%** for Tetra/Penta/Hexa congeners - **25-130%** for Hepta/Octa congeners
P▷	Field surrogate recovery outside normal acceptance criteria (**70-130%**)

‡ as defined in USEPA publication **EPA/625/3-89/016** (1989)

USEPA US Environmental Protection Agency

Results : Job No. AECO01/160707

Laboratory Reg. No. N16/018794X **Date Extracted** 15-Jul-16

Client Sample Ref. 60489919 - ST5 **DB5 Analysis** 01-Aug-16
Matrix Emission **DB-Dioxin Analysis** 28-Jul-16
Description Resin DAU150616A, Filter, Solvent Rinse

PCDD/F Congeners	Level pg	I-TEF	I-TEQ middle bound contribution	Labelled Surrogate recovery
2,3,7,8-TCDF	<2	0.1	0.1	62
2,3,7,8-TCDD	<2	1	1	61
1,2,3,7,8-PeCDF	<2	0.05	0.05	72
2,3,4,7,8-PeCDF	<2	0.5	0.5	**113**
1,2,3,7,8-PeCDD	<2	0.5	0.5	82
1,2,3,4,7,8-HxCDF	<1	0.1	0.05	**90**
1,2,3,6,7,8-HxCDF	<1	0.1	0.05	79
2,3,4,6,7,8-HxCDF	<1	0.1	0.05	
1,2,3,7,8,9-HxCDF	<1	0.1	0.05	
1,2,3,4,7,8-HxCDD	<2	0.1	0.1	**76**
1,2,3,6,7,8-HxCDD	<2	0.1	0.1	88
1,2,3,7,8,9-HxCDD	<2	0.1	0.1	
1,2,3,4,6,7,8-HpCDF	<2	0.01	0.01	78
1,2,3,4,7,8,9-HpCDF	<2	0.01	0.01	**92**
1,2,3,4,6,7,8-HpCDD	<3	0.01	0.015	83
OCDF	<7	0.001	0.0035	
OCDD	17	0.001	0.017	77

PCDD/F Homologue Groups	Level pg
Total TCDF isomers	37
Total TCDD isomers	<10
Total PeCDF isomers	<10
Total PeCDD isomers	<10
Total HxCDF isomers	<10
Total HxCDD isomers	<10
Total HpCDF isomers	<8
Total HpCDD isomers	<10

Summary Results		
Sum of PCDD and PCDF congeners		
Excluding LOD values	54	pg
I-TEQ		
Lower Bound [excluding LOD values]	**0.017**	pg
Middle Bound [including half LOD values]	**2.7**	pg
Upper Bound [including LOD values]	**5.4**	pg

A.B.N. 44 000 964 278
10 / 585 Blackburn Road
Notting Hill, Vic, 3168
Telephone: (03) 9574 3200

Chartered Chemists

11-Jul-2016

REPORT NUMBER: M161449
Site/Client Ref: 60489919/1.2
Order No: 60489919/1.2

AECOM
17 Warabrook Bvde
Warabrook

NSW 2304
Attention: James Lang

CERTIFICATE OF ANALYSIS

SAMPLES:	Eighteen samples were received for analysis
DATE RECEIVED:	**7-Jul-2016**
DATE COMMENCED:	**7-Jul-2016**
METHODS:	See Attached Results
RESULTS:	Please refer to attached pages for results.

Note: Results are based on samples as received at SGS Leeder Consulting's laboratories

REPORTED BY:

Ming

Ming Dai
Senior Chemist

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory Number: 14429

Accredited for compliance with ISO/IEC 17025.

ANALYTICAL RESULTS

Matrix: Filter
Method: USEPA M29 (Analysis only) - MA-1400.FL.M29.02
Sample units are expressed in µg total

Test Started: 7/07/2016

	Leeder ID	2016018618	2016018619	2016018620	2016018621
	Client ID	ST1_Metals 1	Metals 12_BLANK	ST5_Metals 1	Method
Analyte Name	Sampled Date	5/07/2016	5/07/2016	24/06/2016	
	PQL				Blank
Sb	0.2	nd	nd	nd	nd
As	0.2	nd	nd	nd	nd
Be	0.2	nd	nd	nd	nd
Cd	0.2	nd	nd	nd	nd
Cr	0.2	0.5	0.3	0.5	nd
Co	0.2	nd	nd	nd	nd
Cu	0.2	nd	nd	nd	nd
Pb	0.2	0.4	0.2	0.2	nd
Mg	2	36	24	26	nd
Mn	0.2	nd	nd	nd	nd
Hg	0.2	nd	nd	nd	nd
Ni	0.2	0.3	nd	nd	nd
Se	0.2	nd	nd	nd	nd
Tl	0.2	nd	nd	nd	nd
Sn	0.2	nd	nd	nd	nd
V	0.2	nd	nd	nd	nd
Zn	0.2	450	240	280	nd

ANALYTICAL RESULTS

Matrix: Impinger Solution
Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.06 Metals in Impingers (ug total)
Sample units are expressed in µg total

Test Started: 7/07/2016

	Leeder ID	2016018622	2016018623
	Client ID	ST1_Metals 3	ST1_Metals 4
Analyte Name	**Sampled Date**	5/07/2016	5/07/2016
	PQL		
Sb	0.1	nd	nd
As	0.1	nd	nd
Be	0.1	nd	nd
Cd	0.1	nd	nd
Cr	0.1	nd	3.9
Co	0.1	nd	nd
Cu	0.1	nd	2.8
Pb	0.1	nd	0.6
Mg	0.1	9.5	26
Mn	0.1	nd	nd
Hg	0.1	nd	nd
Ni	0.1	nd	nd
Se	0.1	nd	nd
Tl	0.1	nd	nd
Sn	0.1	nd	nd
V	0.1	nd	nd
Zn	0.1	nd	1.1
Sample Volume		100	300

ANALYTICAL RESULTS

Matrix: Impinger Solution
Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.06 Metals in Impingers (ug total)
Sample units are expressed in µg total

Test Started: 7/07/2016

	Leeder ID	2016018624	2016018625	2016018626	2016018627	2016018628	2016018629
	Client ID	Metals 8A_BLANK	Metals 9_BLANK	ST5_Metals 3	ST5_Metals 4	ST1_Metals 5A	ST1_Metals 5C
Analyte Name	**Sampled Date**	5/07/2016	5/07/2016	24/06/2016	24/06/2016	5/07/2016	5/07/2016
	PQL						
Sb	0.1	nd	nd	nd	nd		
As	0.1	nd	nd	nd	0.4		
Be	0.1	nd	nd	nd	nd		
Cd	0.1	nd	nd	nd	nd		
Cr	0.1	nd	nd	nd	79		
Co	0.1	nd	nd	nd	nd		
Cu	0.1	0.8	1.5	0.6	31		
Pb	0.1	nd	nd	0.2	26		
Mg	0.1	26	17	11	29		
Mn	0.1	nd	nd	nd	nd		
Hg	0.1	nd	nd	nd	nd	nd	nd
Ni	0.1	nd	nd	nd	3.3		
Se	0.1	nd	nd	nd	nd		
Tl	0.1	nd	nd	nd	nd		
Sn	0.1	nd	nd	nd	nd		
V	0.1	nd	nd	nd	nd		
Zn	0.1	nd	nd	14	7.7		
Sample Volume		300	200	100	300	100	260

ANALYTICAL RESULTS

Matrix: Impinger Solution
Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.06 Metals in Impingers (ug total)
Sample units are expressed in µg total — Test Started: 7/07/2016

	Leeder ID	2016018630	2016018631	2016018632	2016018633	2016018634
	Client ID	Metals 8B_BLANK	Metals 11_BLANK	ST5_Metals 5A	ST5_Metals 5C	Method
Analyte Name	**Sampled Date**	5/07/2016	5/07/2016	24/06/2016	24/06/2016	
	PQL					Blank
Sb	0.1					nd
As	0.1					nd
Be	0.1					nd
Cd	0.1					nd
Cr	0.1					nd
Co	0.1					nd
Cu	0.1					nd
Pb	0.1					nd
Mg	0.1					nd
Mn	0.1					nd
Hg	0.1	nd	nd	nd	nd	nd
Ni	0.1					nd
Se	0.1					nd
Tl	0.1					nd
Sn	0.1					nd
V	0.1					nd
Zn	0.1					nd
Sample Volume		100	260	100	250	

Matrix: KMnO4
Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)
Sample units are expressed in µg total — Test Started: 7/07/2016

	Leeder ID	2016018635
	Client ID	ST1_Metals 5B
Analyte Name	**Sampled Date**	5/07/2016
	PQL	
Hg	0.5	nd
Sample Volume		390

ANALYTICAL RESULTS

Matrix: KMnO4
Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)
Sample units are expressed in µg total

Test Started: 7/07/2016

	Leeder ID	2016018636	2016018637	2016018638
	Client ID	Metals 10_BLANK	ST5_Metals 5B	Method
Analyte Name	**Sampled Date**	5/07/2016	24/06/2016	
	PQL			Blank
Hg	0.5	nd	nd	nd
Sample Volume		95	390	

QA/QC RESULTS

Matrix: Filter
Method: USEPA M29 (Analysis only) - MA-1400.FL.M29.02
Quality Control Results are expressed in Percent Recovery of expected result

Test Started: 7/07/2016

	Leeder ID	2016018639	2016018640
	Client ID	Matrix	Matrix
Analyte Name	**Sampled Date**		
	PQL	Spike	Spike Dup
Sb		97	100
As		97	99
Be		108	105
Cd		96	99
Cr		101	103
Co		101	102
Cu		99	101
Pb		110	112
Mg		91	91
Mn		99	100
Hg		98	98
Ni		99	101
Se		91	96
Tl		116	118
Sn		103	106
V		109	110
Zn		105	105

QA/QC RESULTS

Matrix: Impinger Solution
Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.06 Metals in Impingers (ug total)
Quality Control Results are expressed in Percent Recovery of expected result

Test Started: 7/07/2016

	Leeder ID	2016018641	2016018642
	Client ID	Matrix	Matrix
Analyte Name	**Sampled Date**		
	PQL	Spike	Spike Dup
Sb		101	98
As		101	99
Be		112	99
Cd		102	98
Cr		105	101
Co		108	105
Cu		105	103
Pb		121	123
Mg		99	97
Mn		121	124
Hg		98	98
Ni		103	99
Se		96	97
Tl		119	117
Sn		101	97
V		111	107
Zn		109	113

Matrix: KMnO4
Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)
Quality Control Results are expressed in Percent Recovery of expected result

Test Started: 7/07/2016

	Leeder ID	2016018643	2016018644
	Client ID	Matrix	Matrix
Analyte Name	**Sampled Date**		
	PQL	Spike	Spike Dup
Hg		98	99

QUALIFIERS / NOTES FOR REPORTED RESULTS

PQL	Practical Quantitation Limit
nd	Not Detected – The analyte was not detected above the reported PQL.
is	Insufficient Sample to perform this analysis.
T	Tentative identification based on computer library search of mass spectra.
NC	Not calculated and/or Results below PQL
NV	No Vacuum, Canister received above standard atmospheric pressure
nr	Not Requested for analysis.
R	Rejected Result – results for this analysis failed QC checks.
SQ	Semi-Quantitative result – quantitation based on a generic response factor for this class of analyte.
IM	Inappropriate method of analysis for this compound
U	Unable to provide Quality Control data – high levels of compounds in sample interfered with analysis of QC results.
UF	Unable to provide Quality Control data- Surrogates failed QC checks due to sample matrix effects
L	Analyte detected at a level above the linear response of calibration curve.
E	Estimated result. NATA accreditation does not cover estimated results.
C1	These compounds co-elute.
--	Parameter Not Determined
CT	Elevated concentration. Results reported from carbon tube analysis
**	Sample shows non-petroleum hydrocarbon profile

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APPENDIX ONE.

CHAIN OF CUSTODY DOCUMENT

Chain of Custody Record - SGS Leeder Consulting

Dispatch samples to: Unit 5/18 Redland Drive, Mitcham, VIC, 3132

Attn: Lyndall Stevens - Contact Ph: (03) 9874 1988 Fax: (03) 9874 1933 Email: au.samplereceipt.mitcham@sgs.com

CLIENT NAME: AECOM

CLIENT ADDRESS: 17 Warabrook I

Warabrook NSW 2304

CONTACT: James Lang

SAMPLED BY:

PROJECT REF. / ORDER No: 60489919/1.2

CONTACT PHONE No: 02 4911 4900

CONTACT FAX No: 02 4911 4999

RESULTS REQUIRED BY: James.Lang@aecom.com

EMAIL REPORT TO: ntlair@aecom.com

LAB QUOTE NUMBER:

Sample Disposal (Please X) After: 4 Weeks ( ) 6 Weeks ( )

Client Sample ID	Date Sampled	Matrix: Filter	Matrix: Impinger	Matrix: KMnO4	Containers/Preservation (please tick) (G=glass, P= plastic): 0.1-1L Jar(G) n.a.	0.1-1.0 litre(G) Nat.	0.1-1.0 litre(P) Nat.	40ml Vial(G) Nat.	40ml Vial(G) H2SO4	0.1-1L (P) H2SO4	125mL (P) HCl acid washed	125mL (P) Zn Acc. NaOH	125mL (P) Filtered Yes/No HNO3	125mL (P) NaOH	Analyses Required (Analyte + Method Code): Metals -USEPA Method 29*	Mercury
ST1_Metals 1	5/7/16	x			x										x	
ST1_Metals 3			x				x								x	
ST1_Metals 4			x				x								x	
ST1_Metals 5A			x				x									x
ST1_Metals 5B				x		x										x
ST1_Metals 5C			x				x									x
Metals 8A_BLANK			x				x								x	
Metals 8B_BLANK			x				x									x
Metals 9_BLANK			x				x								x	
Metals 10_BLANK				x		x										x
Metals 11_BLANK			x				x									x
Metals 12_BLANK		x			x										x	
----------	Totals:	2	8	2	2	2	8								6	6

CHAIN OF CUSTODY RECORD

RELEASED BY: (Name) VILAI KELEMETE (Signature) (Date / Time) 6/07/26

RECEIVED BY: (Name) (Signature) (Date / Time) 7/7/16 10:

Custody Seals Intact? Yes / No

Samples Received Chilled? Yes / No 13.9°C

Please Note: Dissolved metals require filtering in the field.

Please indicate whether the HNO3 acidified sample has been filtered.

Comments: (eg. Highly contaminated samples, reporting requirements etc)

*Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mg, Mn, Hg, Ni, Se, Tl, Sn, V, Zn

Chain of Custody Record - SGS Leeder Consulting

Dispatch samples to: Unit 5/18 Redland Drive, Mitcham, VIC, 3132

Attn: Lyndall Stevens - Contact Ph: (03) 9874 1988 Fax: (03) 9874 1933 Email: au.samplereceipt.mitcham@sgs.com

Sheet 2 of 2

CLIENT NAME: AECOM
CLIENT ADDRESS: 17 Warabrook I
Warabrook NSW 2304
CONTACT: James Lang
SAMPLED BY:
PROJECT REF. / ORDER No: 60489919/1.2

CONTACT PHONE No: 02 4911 4900
CONTACT FAX No: 02 4911 4999
RESULTS REQUIRED BY: James.Lang@aecom.com
EMAIL REPORT TO: ntlair@aecom.com
LAB QUOTE NUMBER:

Sample Disposal (Please X) After: 4 Weeks ( ) 6 Weeks ( )

Client Sample ID	Date Sampled	Matrix: Filter	Matrix: Impinger	Matrix: KMnO4	Containers/Preservation (please tick) (G=glass, P=plastic): 0.1-1L Jar(G) n.a.	0.1-1.0 litre(G) Nat.	0.1-1.0 litre(P) Nat.	40ml Vial(G) Nat.	40ml Vial(G) H2SO4	0.1-1L (P) H2SO4	125mL (P) HCl acid washed	125mL (P) Zn Ace. NaOH	125mL (P) Filtered Yes/No HNO3	125mL (P) NaOH	Analyses Required (Analyte + Method Code): Metals -USEPA Method 29*	Mercury
ST5_Metals 1	24/6/16	x			x										x	
ST5_Metals 3			x				x								x	
ST5_Metals 4			x				x								x	
ST5_Metals 5A			x				x									x
ST5_Metals 5B				x		x										x
ST5_Metals 5C			x				x									x
----------	Totals:	1	4	1	1	1	4								3	3

CHAIN OF CUSTODY RECORD

RELEASED BY: (Name) VILAI KELEMETE (Signature) (Date / Time) 6/07/26

RECEIVED BY: (Name) Kenedict Robinson (Signature) (Date / Time) 7/7/16 10:30am

Custody Seals Intact? Yes / No

Samples Received Chilled? Yes / No 13.1°C

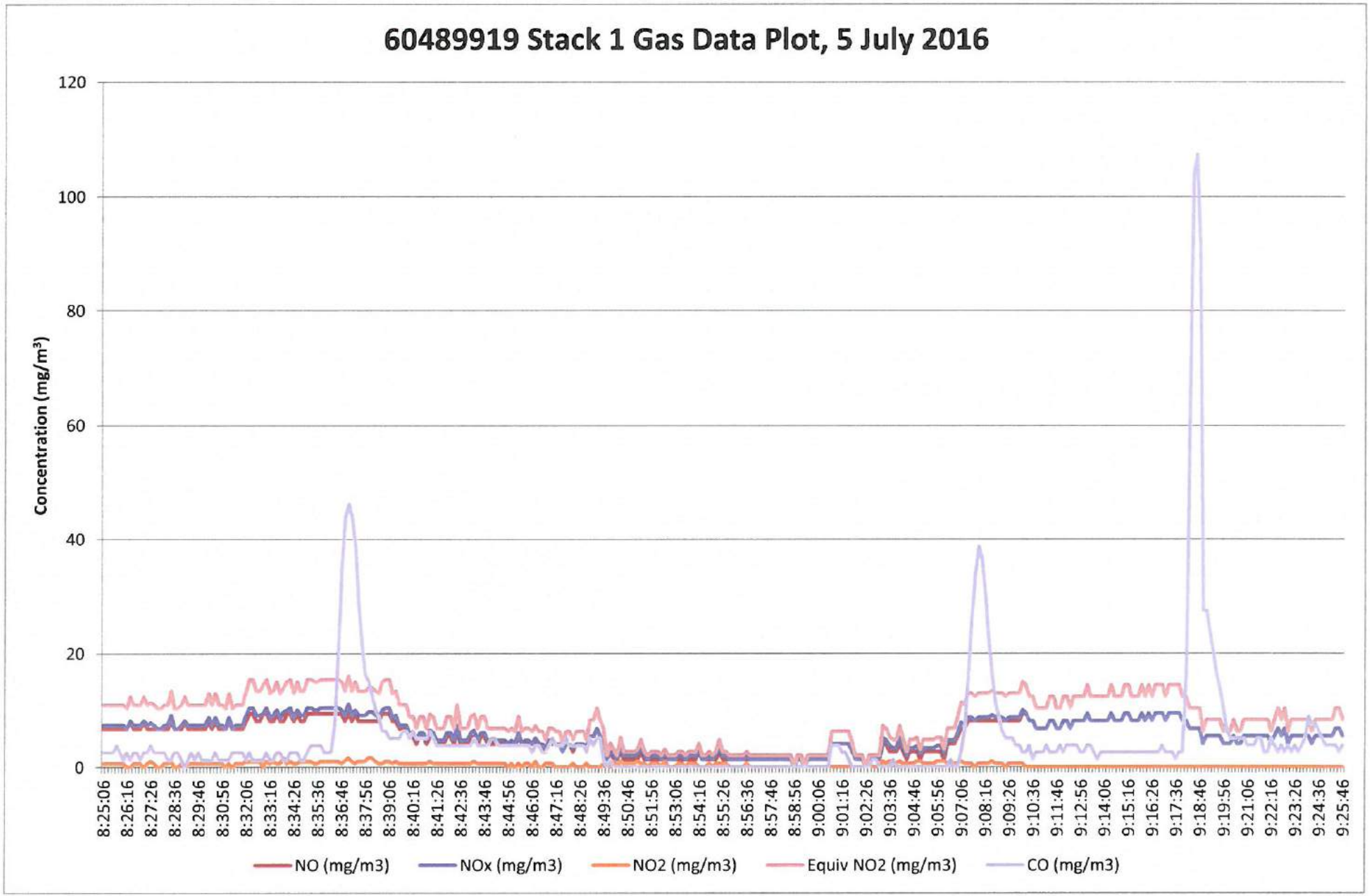
Please Note: Dissolved metals require filtering in the field.
Please indicate whether the HNO3 acidified sample has been filtered.

Comments: (eg. Highly contaminated samples, reporting requirements etc)

*Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mg, Mn, Hg, Ni, Se, Tl, Sn, V, Zn

Appendix C

Raw & Calculated Gas Data (21 pages)


60489919 Stack 1 Gas Data Plot, 5 July 2016
Concentration (mg/m³)
120
100
80
60
40
20
0
8:25:06
8:26:16
8:27:26
8:28:36
8:29:46
8:30:56
8:32:06
8:33:16
8:34:26
8:35:36
8:36:46
8:37:56
8:39:06
8:40:16
8:41:26
8:42:36
8:43:46
8:44:56
8:46:06
8:47:16
8:48:26
8:49:36
8:50:46
8:51:56
8:53:06
8:54:16
8:55:26
8:56:36
8:57:46
8:58:56
9:00:06
9:01:16
9:02:26
9:03:36
9:04:46
9:05:56
9:07:06
9:08:16
9:09:26
9:10:36
9:11:46
9:12:56
9:14:06
9:15:16
9:16:26
9:17:36
9:18:46
9:19:56
9:21:06
9:22:16
9:23:26
9:24:36
9:25:46
NO (mg/m3)
NOx (mg/m3)
NO2 (mg/m3)
Equiv NO2 (mg/m3)
CO (mg/m3)

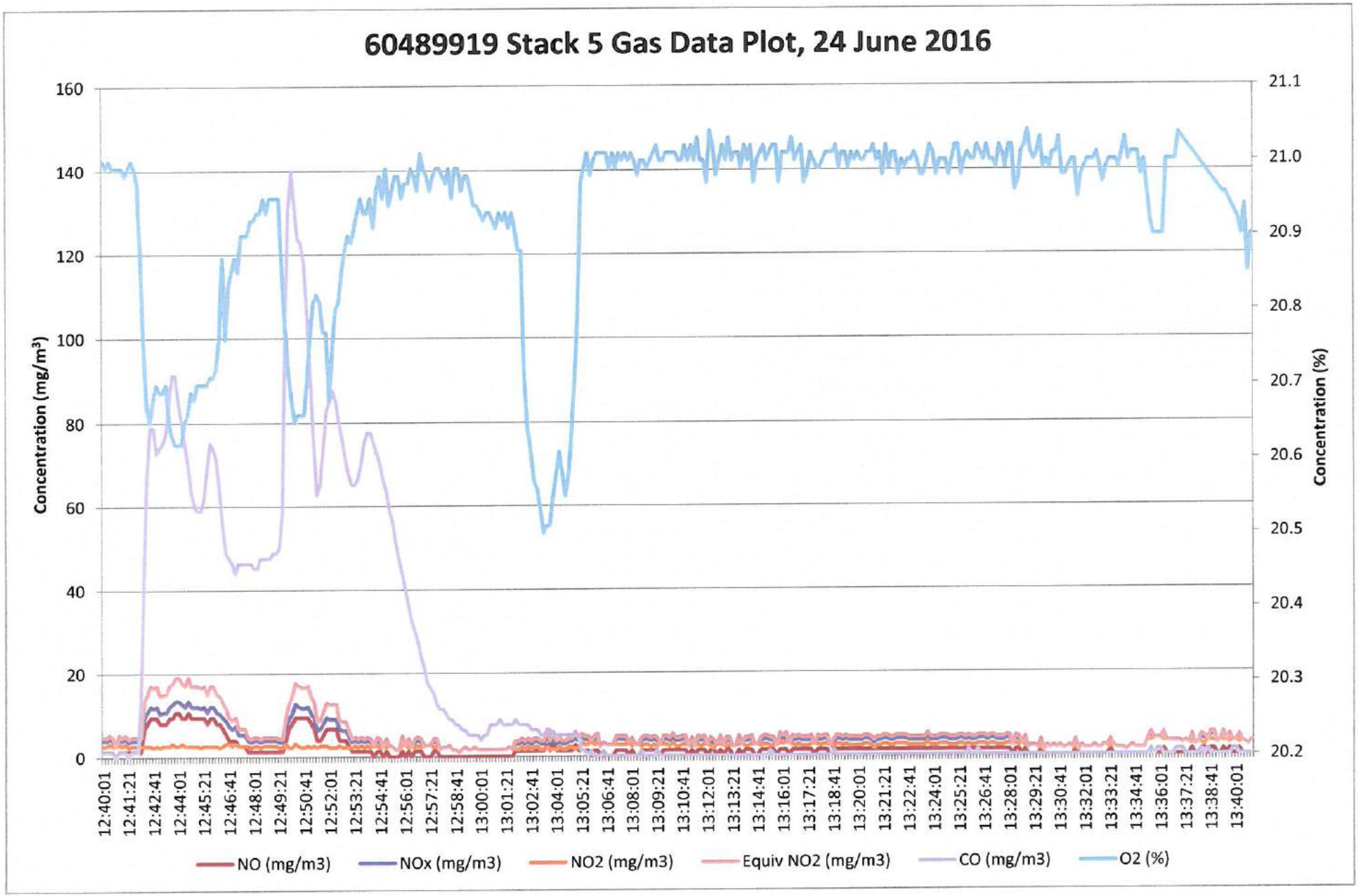
Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
05-Jul-16	8:25:06	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:25:16	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:25:26	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:25:36	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:25:46	5	7	5	7	0.3	0.6	8	11	3	4
05-Jul-16	8:25:56	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:26:06	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:26:16	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	8:26:26	6	8	6	8	0.0	0.0	9	12	1	1
05-Jul-16	8:26:36	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:26:46	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:26:56	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:27:06	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	8:27:16	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:27:26	5	7	6	8	0.5	1.0	8	11	3	4
05-Jul-16	8:27:36	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:27:46	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	8:27:56	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	8:28:06	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:28:16	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:28:26	6	8	6	9	0.5	1.0	10	13	1	1
05-Jul-16	8:28:36	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	8:28:46	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	8:28:56	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:29:06	6	8	6	8	0.0	0.0	9	12	0	0
05-Jul-16	8:29:16	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:29:26	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:29:36	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:29:46	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:29:56	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:30:06	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:30:16	6	8	6	9	0.3	0.6	10	13	1	1
05-Jul-16	8:30:26	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:30:36	6	8	6	9	0.3	0.6	10	13	2	3
05-Jul-16	8:30:46	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:30:56	5	7	6	7	0.3	0.6	8	11	1	1
05-Jul-16	8:31:06	5	7	5	7	0.0	0.0	8	10	1	1
05-Jul-16	8:31:16	6	8	6	9	0.3	0.6	10	13	1	1
05-Jul-16	8:31:26	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	8:31:36	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:31:46	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:31:56	5	7	6	7	0.3	0.6	8	11	2	3
05-Jul-16	8:32:06	6	8	6	9	0.5	1.0	10	13	1	1
05-Jul-16	8:32:16	7	9	7	10	0.5	1.0	11	15	2	3
05-Jul-16	8:32:26	7	9	7	10	0.5	1.0	11	15	1	1
05-Jul-16	8:32:36	6	8	6	9	0.5	1.0	10	13	1	1
05-Jul-16	8:32:46	6	8	6	9	0.5	1.0	10	13	1	1
05-Jul-16	8:32:56	7	9	7	9	0.0	0.0	11	14	1	1
05-Jul-16	8:33:06	7	9	7	10	0.5	1.0	11	15	2	3
05-Jul-16	8:33:16	6	8	6	9	0.3	0.6	10	13	1	1
05-Jul-16	8:33:26	6	8	6	9	0.5	1.0	10	13	1	1
05-Jul-16	8:33:36	7	9	7	10	0.3	0.6	11	15	2	3
05-Jul-16	8:33:46	6	8	6	9	0.3	0.6	10	13	2	3
05-Jul-16	8:33:56	6	8	7	10	0.8	1.6	10	14	1	1
05-Jul-16	8:34:06	7	9	7	10	0.3	0.6	11	15	1	1
05-Jul-16	8:34:16	7	9	7	10	0.5	1.0	11	15	2	3
05-Jul-16	8:34:26	6	8	6	9	0.3	0.6	10	13	2	3
05-Jul-16	8:34:36	7	9	7	10	0.3	0.6	11	15	2	3
05-Jul-16	8:34:46	6	8	6	9	0.5	1.0	10	13	1	1
05-Jul-16	8:34:56	6	8	6	9	0.5	1.0	10	13	1	1
05-Jul-16	8:35:06	7	9	7	10	0.5	1.0	11	15	2	3
05-Jul-16	8:35:16	7	9	7	10	0.5	1.0	11	15	3	4
05-Jul-16	8:35:26	7	9	7	10	0.3	0.6	11	15	3	4
05-Jul-16	8:35:36	7	9	7	10	0.3	0.6	11	15	3	4
05-Jul-16	8:35:46	7	9	8	10	0.5	1.0	11	15	3	4
05-Jul-16	8:35:56	7	9	7	10	0.5	1.0	11	15	2	3
05-Jul-16	8:36:06	7	9	7	10	0.5	1.0	11	15	2	3
05-Jul-16	8:36:16	7	9	8	10	0.5	1.0	11	15	2	3
05-Jul-16	8:36:26	7	9	8	10	0.5	1.0	11	15	6	8
05-Jul-16	8:36:36	7	9	8	10	0.5	1.0	11	15	16	20
05-Jul-16	8:36:46	7	9	7	10	0.3	0.6	11	15	28	35
05-Jul-16	8:36:56	6	8	6	9	0.5	1.0	10	13	35	44
05-Jul-16	8:37:06	7	9	7	11	0.8	1.6	12	16	37	46
05-Jul-16	8:37:16	6	8	6	9	0.5	1.0	10	13	35	44
05-Jul-16	8:37:26	7	9	7	10	0.3	0.6	11	15	31	39
05-Jul-16	8:37:36	6	8	6	9	0.5	1.0	10	13	23	29
05-Jul-16	8:37:46	6	8	6	9	0.5	1.0	10	13	17	21
05-Jul-16	8:37:56	6	8	6	9	0.5	1.0	10	13	13	16
05-Jul-16	8:38:06	6	8	7	10	0.8	1.6	10	14	12	15
05-Jul-16	8:38:16	6	8	7	10	0.8	1.6	10	14	10	13
05-Jul-16	8:38:26	6	8	6	9	0.5	1.0	10	13	8	10
05-Jul-16	8:38:36	6	8	6	9	0.3	0.6	10	13	7	9
05-Jul-16	8:38:46	7	9	7	10	0.3	0.6	11	15	5	6
05-Jul-16	8:38:56	7	9	7	10	0.5	1.0	11	15	5	6
05-Jul-16	8:39:06	7	9	7	10	0.5	1.0	11	15	4	5
05-Jul-16	8:39:16	6	8	6	9	0.3	0.6	10	13	4	5
05-Jul-16	8:39:26	6	8	6	9	0.5	1.0	10	13	4	5
05-Jul-16	8:39:36	5	7	5	7	0.3	0.6	8	11	4	5
05-Jul-16	8:39:46	5	7	5	7	0.3	0.6	8	11	5	6
05-Jul-16	8:39:56	5	7	5	7	0.3	0.6	8	11	5	6
05-Jul-16	8:40:06	4	5	4	6	0.3	0.6	6	9	4	5

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
05-Jul-16	8:40:16	4	5	4	6	0.3	0.6	6	9	5	6
05-Jul-16	8:40:26	3	4	4	5	0.3	0.6	5	7	4	5
05-Jul-16	8:40:36	4	5	4	6	0.3	0.6	6	9	4	5
05-Jul-16	8:40:46	4	5	4	6	0.3	0.6	6	9	4	5
05-Jul-16	8:40:56	3	4	4	5	0.3	0.6	5	7	4	5
05-Jul-16	8:41:06	4	5	4	6	0.5	1.0	7	9	5	6
05-Jul-16	8:41:16	4	5	4	6	0.3	0.6	6	9	4	5
05-Jul-16	8:41:26	3	4	4	5	0.3	0.6	5	7	3	4
05-Jul-16	8:41:36	3	4	4	5	0.3	0.6	5	7	3	4
05-Jul-16	8:41:46	3	4	4	5	0.3	0.6	5	7	3	4
05-Jul-16	8:41:56	4	5	4	6	0.3	0.6	6	9	3	4
05-Jul-16	8:42:06	4	5	4	6	0.3	0.6	6	9	3	4
05-Jul-16	8:42:16	3	4	4	5	0.3	0.6	5	7	3	4
05-Jul-16	8:42:26	5	7	5	7	0.3	0.6	8	11	3	4
05-Jul-16	8:42:36	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:42:46	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:42:56	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:43:06	4	5	4	6	0.3	0.6	6	9	3	4
05-Jul-16	8:43:16	4	5	4	6	0.5	1.0	7	9	4	5
05-Jul-16	8:43:26	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:43:36	4	5	4	6	0.3	0.6	6	9	3	4
05-Jul-16	8:43:46	4	5	4	6	0.3	0.6	6	9	3	4
05-Jul-16	8:43:56	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:44:06	3	4	3	5	0.3	0.6	5	7	4	5
05-Jul-16	8:44:16	3	4	3	5	0.3	0.6	5	7	4	5
05-Jul-16	8:44:26	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:44:36	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:44:46	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:44:56	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:45:06	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:45:16	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:45:26	4	5	4	6	0.3	0.6	6	9	3	4
05-Jul-16	8:45:36	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:45:46	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:45:56	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:46:06	3	4	3	4	0.0	0.0	5	6	2	3
05-Jul-16	8:46:16	3	4	4	5	0.5	1.0	5	7	3	4
05-Jul-16	8:46:26	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:46:36	3	4	3	4	0.0	0.0	5	6	2	3
05-Jul-16	8:46:46	2	3	2	3	0.3	0.6	3	5	2	3
05-Jul-16	8:46:56	3	4	3	5	0.3	0.6	5	7	3	4
05-Jul-16	8:47:06	3	4	3	5	0.3	0.6	5	7	4	5
05-Jul-16	8:47:16	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:47:26	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:47:36	2	3	2	3	0.0	0.0	3	4	3	4
05-Jul-16	8:47:46	3	4	3	4	0.0	0.0	5	6	4	5
05-Jul-16	8:47:56	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:48:06	2	3	2	3	0.3	0.6	3	5	3	4
05-Jul-16	8:48:16	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:48:26	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:48:36	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	8:48:46	2	3	2	3	0.3	0.6	3	5	2	3
05-Jul-16	8:48:56	4	5	4	5	0.0	0.0	6	8	4	5
05-Jul-16	8:49:06	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	8:49:16	5	7	5	7	0.0	0.0	8	10	4	5
05-Jul-16	8:49:26	4	5	4	5	0.0	0.0	6	8	4	5
05-Jul-16	8:49:36	3	4	3	5	0.3	0.6	5	7	1	1
05-Jul-16	8:49:46	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:49:56	2	3	2	3	0.0	0.0	3	4	1	1
05-Jul-16	8:50:06	1	1	2	2	0.5	1.0	2	3	0	0
05-Jul-16	8:50:16	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:50:26	2	3	2	4	0.5	1.0	4	5	0	0
05-Jul-16	8:50:36	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:50:46	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:50:56	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:51:06	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:51:16	1	1	2	2	0.5	1.0	2	3	0	0
05-Jul-16	8:51:26	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	8:51:36	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:51:46	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:51:56	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:52:06	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:52:16	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:52:26	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:52:36	1	1	2	2	0.5	1.0	2	3	0	0
05-Jul-16	8:52:46	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:52:56	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:53:06	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:53:16	1	1	1	2	0.3	0.6	2	3	0	0
05-Jul-16	8:53:26	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:53:36	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:53:46	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:53:56	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:54:06	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:54:16	2	3	2	3	0.0	0.0	3	4	0	0
05-Jul-16	8:54:26	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:54:36	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:54:46	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:54:56	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:55:06	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:55:16	2	3	2	3	0.3	0.6	3	5	0	0

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
05-Jul-16	8:55:26	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	8:55:36	1	1	1	2	0.3	0.6	2	3	0	0
05-Jul-16	8:55:46	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:55:56	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:56:06	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:56:16	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:56:26	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:56:36	1	1	1	2	0.3	0.6	2	3	0	0
05-Jul-16	8:56:46	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:56:56	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:57:06	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:57:16	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:57:26	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:57:36	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:57:46	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:57:56	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:58:06	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:58:16	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:58:26	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:58:36	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:58:46	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:58:56	0	0	0	0	0.0	0.0	0	0	0	0
05-Jul-16	8:59:06	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:59:16	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:59:26	0	0	0	0	0.0	0.0	0	0	0	0
05-Jul-16	8:59:36	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:59:46	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	8:59:56	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:00:06	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:00:16	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:00:26	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:00:36	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:00:46	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	9:00:56	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	9:01:06	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	9:01:16	3	4	3	4	0.0	0.0	5	6	2	3
05-Jul-16	9:01:26	3	4	3	4	0.0	0.0	5	6	2	3
05-Jul-16	9:01:36	3	4	3	4	0.0	0.0	5	6	1	1
05-Jul-16	9:01:46	2	3	2	3	0.0	0.0	3	4	0	0
05-Jul-16	9:01:56	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:02:06	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:02:16	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:02:26	0	0	0	0	0.0	0.0	0	0	0	0
05-Jul-16	9:02:36	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:02:46	1	1	1	1	0.0	0.0	2	2	1	1
05-Jul-16	9:02:56	1	1	1	1	0.0	0.0	2	2	1	1
05-Jul-16	9:03:06	1	1	1	1	0.0	0.0	2	2	0	0
05-Jul-16	9:03:16	3	4	3	5	0.5	1.0	5	7	0	0
05-Jul-16	9:03:26	3	4	3	5	0.3	0.6	5	7	0	0
05-Jul-16	9:03:36	2	3	2	4	0.5	1.0	4	5	0	0
05-Jul-16	9:03:46	2	3	2	3	0.3	0.6	3	5	1	1
05-Jul-16	9:03:56	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	9:04:06	3	4	3	5	0.5	1.0	5	7	0	0
05-Jul-16	9:04:16	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	9:04:26	1	1	2	2	0.3	0.6	2	3	0	0
05-Jul-16	9:04:36	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	9:04:46	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	9:04:56	2	3	2	4	0.5	1.0	4	5	0	0
05-Jul-16	9:05:06	1	1	2	2	0.5	1.0	2	3	0	0
05-Jul-16	9:05:16	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	9:05:26	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	9:05:36	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	9:05:46	2	3	2	3	0.3	0.6	3	5	0	0
05-Jul-16	9:05:56	2	3	2	4	0.5	1.0	4	5	0	0
05-Jul-16	9:06:06	2	3	2	4	0.5	1.0	4	5	0	0
05-Jul-16	9:06:16	1	1	2	2	0.5	1.0	2	3	0	0
05-Jul-16	9:06:26	3	4	3	5	0.3	0.6	5	7	0	0
05-Jul-16	9:06:36	3	4	3	5	0.3	0.6	5	7	1	1
05-Jul-16	9:06:46	3	4	3	5	0.3	0.6	5	7	0	0
05-Jul-16	9:06:56	4	5	4	6	0.3	0.6	6	9	0	0
05-Jul-16	9:07:06	5	7	5	8	0.5	1.0	8	11	2	3
05-Jul-16	9:07:16	5	7	5	7	0.3	0.6	8	11	5	6
05-Jul-16	9:07:26	6	8	6	9	0.3	0.6	10	13	13	16
05-Jul-16	9:07:36	6	8	6	9	0.3	0.6	10	13	21	26
05-Jul-16	9:07:46	6	8	6	8	0.0	0.0	9	12	27	34
05-Jul-16	9:07:56	6	8	6	9	0.3	0.6	10	13	31	39
05-Jul-16	9:08:06	6	8	7	9	0.3	0.6	10	13	29	36
05-Jul-16	9:08:16	6	8	6	9	0.3	0.6	10	13	24	30
05-Jul-16	9:08:26	6	8	6	9	0.3	0.6	10	13	18	23
05-Jul-16	9:08:36	6	8	6	9	0.5	1.0	10	13	13	16
05-Jul-16	9:08:46	6	8	7	9	0.3	0.6	10	13	9	11
05-Jul-16	9:08:56	6	8	6	9	0.3	0.6	10	13	7	9
05-Jul-16	9:09:06	6	8	6	9	0.3	0.6	10	13	5	6
05-Jul-16	9:09:16	6	8	6	8	0.0	0.0	9	12	4	5
05-Jul-16	9:09:26	6	8	6	9	0.3	0.6	10	13	4	5
05-Jul-16	9:09:36	6	8	6	9	0.3	0.6	10	13	4	5
05-Jul-16	9:09:46	6	8	7	9	0.3	0.6	10	13	3	4
05-Jul-16	9:09:56	6	8	7	9	0.3	0.6	10	13	3	4
05-Jul-16	9:10:06	7	9	7	10	0.3	0.6	11	15	2	3
05-Jul-16	9:10:16	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:10:26	6	8	6	8	0.0	0.0	9	12	3	4

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
05-Jul-16	9:10:36	6	8	6	8	0.0	0.0	9	12	1	1
05-Jul-16	9:10:46	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	9:10:56	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	9:11:06	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	9:11:16	5	7	5	7	0.0	0.0	8	10	3	4
05-Jul-16	9:11:26	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:11:36	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:11:46	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	9:11:56	5	7	5	7	0.0	0.0	8	10	3	4
05-Jul-16	9:12:06	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:12:16	6	8	6	8	0.0	0.0	9	12	3	4
05-Jul-16	9:12:26	5	7	5	7	0.0	0.0	8	10	3	4
05-Jul-16	9:12:36	6	8	6	8	0.0	0.0	9	12	3	4
05-Jul-16	9:12:46	6	8	6	8	0.0	0.0	9	12	3	4
05-Jul-16	9:12:56	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:13:06	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:13:16	7	9	7	9	0.0	0.0	11	14	3	4
05-Jul-16	9:13:26	6	8	6	8	0.0	0.0	9	12	3	4
05-Jul-16	9:13:36	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:13:46	6	8	6	8	0.0	0.0	9	12	1	1
05-Jul-16	9:13:56	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:14:06	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:14:16	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:14:26	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:14:36	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:14:46	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:14:56	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:15:06	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:15:16	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:15:26	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:15:36	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:15:46	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:15:56	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:16:06	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:16:16	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:16:26	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:16:36	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:16:46	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:16:56	7	9	7	9	0.0	0.0	11	14	3	4
05-Jul-16	9:17:06	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:17:16	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:17:26	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:17:36	7	9	7	9	0.0	0.0	11	14	1	1
05-Jul-16	9:17:46	7	9	7	9	0.0	0.0	11	14	2	3
05-Jul-16	9:17:56	6	8	6	8	0.0	0.0	9	12	2	3
05-Jul-16	9:18:06	6	8	6	8	0.0	0.0	9	12	13	16
05-Jul-16	9:18:16	5	7	5	7	0.0	0.0	8	10	50	63
05-Jul-16	9:18:26	5	7	5	7	0.0	0.0	8	10	83	104
05-Jul-16	9:18:36	5	7	5	7	0.0	0.0	8	10	86	108
05-Jul-16	9:18:46	5	7	5	7	0.0	0.0	8	10	73	91
05-Jul-16	9:18:56	3	4	3	4	0.0	0.0	5	6	22	28
05-Jul-16	9:19:06	4	5	4	5	0.0	0.0	6	8	22	28
05-Jul-16	9:19:16	4	5	4	5	0.0	0.0	6	8	19	24
05-Jul-16	9:19:26	4	5	4	5	0.0	0.0	6	8	16	20
05-Jul-16	9:19:36	4	5	4	5	0.0	0.0	6	8	13	16
05-Jul-16	9:19:46	4	5	4	5	0.0	0.0	6	8	11	14
05-Jul-16	9:19:56	3	4	3	4	0.0	0.0	5	6	8	10
05-Jul-16	9:20:06	3	4	3	4	0.0	0.0	5	6	5	6
05-Jul-16	9:20:16	3	4	3	4	0.0	0.0	5	6	4	5
05-Jul-16	9:20:26	4	5	4	5	0.0	0.0	6	8	4	5
05-Jul-16	9:20:36	3	4	3	4	0.0	0.0	5	6	4	5
05-Jul-16	9:20:46	3	4	3	4	0.0	0.0	5	6	4	5
05-Jul-16	9:20:56	4	5	4	5	0.0	0.0	6	8	4	5
05-Jul-16	9:21:06	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:21:16	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:21:26	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:21:36	4	5	4	5	0.0	0.0	6	8	4	5
05-Jul-16	9:21:46	4	5	4	5	0.0	0.0	6	8	4	5
05-Jul-16	9:21:56	4	5	4	5	0.0	0.0	6	8	2	3
05-Jul-16	9:22:06	4	5	4	5	0.0	0.0	6	8	2	3
05-Jul-16	9:22:16	3	4	3	4	0.0	0.0	5	6	4	5
05-Jul-16	9:22:26	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:22:36	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	9:22:46	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:22:56	5	7	5	7	0.0	0.0	8	10	2	3
05-Jul-16	9:23:06	3	4	3	4	0.0	0.0	5	6	3	4
05-Jul-16	9:23:16	4	5	4	5	0.0	0.0	6	8	2	3
05-Jul-16	9:23:26	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:23:36	4	5	4	5	0.0	0.0	6	8	2	3
05-Jul-16	9:23:46	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:23:56	4	5	4	5	0.0	0.0	6	8	4	5
05-Jul-16	9:24:06	4	5	4	5	0.0	0.0	6	8	7	9
05-Jul-16	9:24:16	3	4	3	4	0.0	0.0	5	6	6	8
05-Jul-16	9:24:26	4	5	4	5	0.0	0.0	6	8	6	8
05-Jul-16	9:24:36	4	5	4	5	0.0	0.0	6	8	5	6
05-Jul-16	9:24:46	4	5	4	5	0.0	0.0	6	8	4	5
05-Jul-16	9:24:56	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:25:06	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:25:16	4	5	4	5	0.0	0.0	6	8	3	4
05-Jul-16	9:25:26	5	7	5	7	0.0	0.0	8	10	3	4
05-Jul-16	9:25:36	5	7	5	7	0.0	0.0	8	10	2	3

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
05-Jul-16	9:25:46	4	5	4	5	0.0	0.0	6	8	3	4
	Average	**4**	**5**	**4**	**6**	**0.2**	**0.4**	**6**	**9**	**4**	**5**
	Maximum	**7**	**9**	**8**	**11**	**0.8**	**1.6**	**12**	**16**	**86**	**108**
	Minimum	**0**	**0**	**0**	**0**	**0.0**	**0.0**	**0**	**0**	**0**	**0**

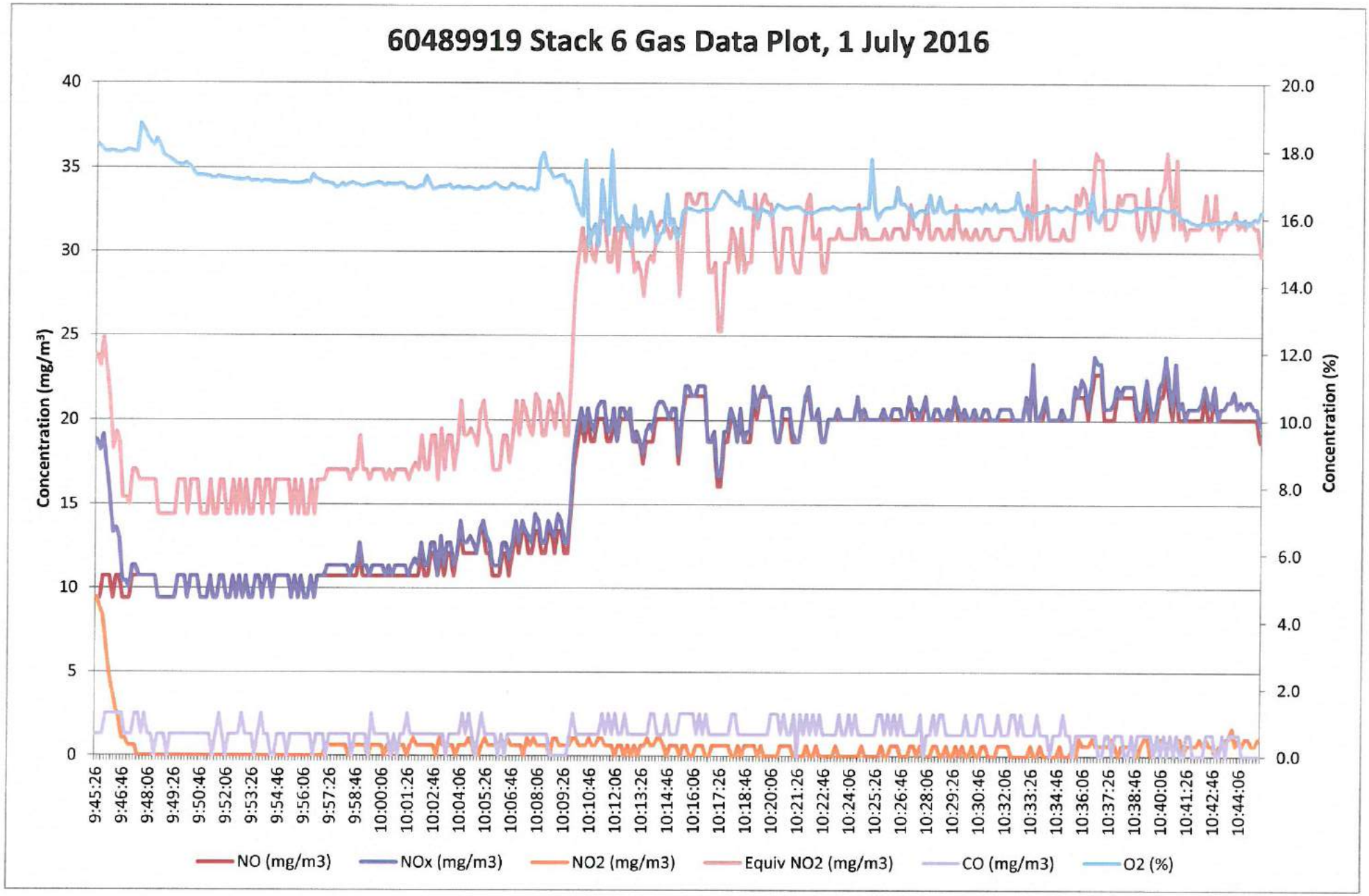

60489919 Stack 5 Gas Data Plot, 24 June 2016
Concentration (mg/m³)
Concentration (%)
160
140
120
100
80
60
40
20
0
21.1
21.0
20.9
20.8
20.7
20.6
20.5
20.4
20.3
20.2
12:40:01
12:41:21
12:42:41
12:44:01
12:45:21
12:46:41
12:48:01
12:49:21
12:50:41
12:52:01
12:53:21
12:54:41
12:56:01
12:57:21
12:58:41
13:00:01
13:01:21
13:02:41
13:04:01
13:05:21
13:06:41
13:08:01
13:09:21
13:10:41
13:12:01
13:13:21
13:14:41
13:16:01
13:17:21
13:18:41
13:20:01
13:21:21
13:22:41
13:24:01
13:25:21
13:26:41
13:28:01
13:29:21
13:30:41
13:32:01
13:33:21
13:34:41
13:36:01
13:37:21
13:38:41
13:40:01
NO (mg/m3)
NOx (mg/m3)
NO2 (mg/m3)
Equiv NO2 (mg/m3)
CO (mg/m3)
O2 (%)

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)	O2 (%)
24-Jun-16	12:40:01	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	12:40:11	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	12:40:21	1	1	2	5	1.6	3.3	3	5	1	1	21.0
24-Jun-16	12:40:31	1	1	3	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	12:40:41	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	12:40:51	1	1	2	5	1.6	3.3	3	5	1	1	21.0
24-Jun-16	12:41:01	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	12:41:11	1	1	2	5	1.6	3.3	3	5	1	1	21.0
24-Jun-16	12:41:21	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	12:41:31	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	12:41:41	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	12:41:51	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	12:42:01	1	1	3	4	1.3	2.7	3	5	11	14	20.9
24-Jun-16	12:42:11	5	7	6	9	1.3	2.7	9	13	35	44	20.8
24-Jun-16	12:42:21	6	8	7	11	1.3	2.7	11	15	54	68	20.7
24-Jun-16	12:42:31	7	9	8	12	1.3	2.7	12	17	63	79	20.7
24-Jun-16	12:42:41	7	9	8	12	1.1	2.3	12	17	63	79	20.7
24-Jun-16	12:42:51	7	9	8	12	1.3	2.7	12	17	58	73	20.7
24-Jun-16	12:43:01	6	8	7	10	1.1	2.3	10	15	59	74	20.7
24-Jun-16	12:43:11	6	8	7	11	1.3	2.7	11	15	60	75	20.7
24-Jun-16	12:43:21	6	8	7	11	1.3	2.7	11	15	62	78	20.7
24-Jun-16	12:43:31	7	9	9	12	1.3	2.7	12	17	68	85	20.7
24-Jun-16	12:43:41	7	9	9	13	1.6	3.3	12	18	73	91	20.6
24-Jun-16	12:43:51	8	11	9	13	1.3	2.7	14	19	73	91	20.6
24-Jun-16	12:44:01	8	11	9	13	1.3	2.7	14	19	68	85	20.6
24-Jun-16	12:44:11	7	9	9	13	1.6	3.3	12	18	64	80	20.6
24-Jun-16	12:44:21	7	9	9	12	1.3	2.7	12	17	60	75	20.7
24-Jun-16	12:44:31	8	11	9	13	1.3	2.7	14	19	56	70	20.7
24-Jun-16	12:44:41	7	9	9	12	1.3	2.7	12	17	51	64	20.7
24-Jun-16	12:44:51	7	9	8	12	1.3	2.7	12	17	48	60	20.7
24-Jun-16	12:45:01	7	9	9	12	1.3	2.7	12	17	47	59	20.7
24-Jun-16	12:45:11	7	9	8	12	1.1	2.3	12	17	47	59	20.7
24-Jun-16	12:45:21	7	9	9	12	1.3	2.7	12	17	49	61	20.7
24-Jun-16	12:45:31	6	8	7	11	1.3	2.7	11	15	55	69	20.7
24-Jun-16	12:45:41	7	9	8	12	1.3	2.7	12	17	60	75	20.7
24-Jun-16	12:45:51	7	9	8	12	1.3	2.7	12	17	59	74	20.7
24-Jun-16	12:46:01	6	8	7	11	1.3	2.7	11	15	57	71	20.7
24-Jun-16	12:46:11	6	8	7	10	1.1	2.3	10	15	51	64	20.8
24-Jun-16	12:46:21	5	7	7	9	1.3	2.7	9	13	44	55	20.9
24-Jun-16	12:46:31	4	5	6	9	1.6	3.3	8	12	39	49	20.8
24-Jun-16	12:46:41	3	4	5	7	1.6	3.3	6	9	38	48	20.8
24-Jun-16	12:46:51	3	4	5	7	1.3	2.7	6	9	37	46	20.9
24-Jun-16	12:47:01	3	4	4	7	1.6	3.3	6	9	35	44	20.9
24-Jun-16	12:47:11	2	3	3	5	1.3	2.7	4	7	37	46	20.9
24-Jun-16	12:47:21	2	3	3	5	1.3	2.7	4	7	37	46	20.9
24-Jun-16	12:47:31	2	3	3	5	1.3	2.7	4	7	37	46	20.9
24-Jun-16	12:47:41	1	1	3	4	1.3	2.7	3	5	37	46	20.9
24-Jun-16	12:47:51	1	1	2	4	1.1	2.3	3	4	37	46	20.9
24-Jun-16	12:48:01	1	1	3	4	1.3	2.7	3	5	36	45	20.9
24-Jun-16	12:48:11	1	1	3	4	1.3	2.7	3	5	36	45	20.9
24-Jun-16	12:48:21	1	1	2	4	1.1	2.3	3	4	38	48	20.9
24-Jun-16	12:48:31	1	1	2	4	1.3	2.7	3	5	38	48	21.0
24-Jun-16	12:48:41	1	1	2	4	1.3	2.7	3	5	38	48	20.9
24-Jun-16	12:48:51	1	1	2	4	1.3	2.7	3	5	38	48	21.0
24-Jun-16	12:49:01	1	1	2	4	1.3	2.7	3	5	39	49	21.0
24-Jun-16	12:49:11	1	1	3	4	1.3	2.7	3	5	39	49	21.0
24-Jun-16	12:49:21	1	1	2	4	1.1	2.3	3	4	40	50	21.0
24-Jun-16	12:49:31	1	1	2	4	1.1	2.3	3	4	47	59	20.9
24-Jun-16	12:49:41	3	4	4	7	1.6	3.3	6	9	82	103	20.8
24-Jun-16	12:49:51	5	7	6	9	1.1	2.3	9	13	104	130	20.7
24-Jun-16	12:50:01	6	8	7	10	1.1	2.3	10	15	112	140	20.7
24-Jun-16	12:50:11	7	9	8	13	1.6	3.3	12	18	105	131	20.7
24-Jun-16	12:50:21	7	9	9	12	1.3	2.7	12	17	99	124	20.7
24-Jun-16	12:50:31	7	9	8	12	1.1	2.3	12	17	98	123	20.7
24-Jun-16	12:50:41	7	9	8	12	1.1	2.3	12	17	94	118	20.7
24-Jun-16	12:50:51	7	9	8	12	1.3	2.7	12	17	84	105	20.7
24-Jun-16	12:51:01	6	8	7	10	1.1	2.3	10	15	72	90	20.8
24-Jun-16	12:51:11	5	7	6	9	1.3	2.7	9	13	60	75	20.8
24-Jun-16	12:51:21	3	4	4	6	1.1	2.3	6	8	50	63	20.8
24-Jun-16	12:51:31	3	4	5	7	1.3	2.7	6	9	52	65	20.8
24-Jun-16	12:51:41	4	5	5	8	1.3	2.7	7	11	59	74	20.8
24-Jun-16	12:51:51	5	7	6	9	1.3	2.7	9	13	66	83	20.8
24-Jun-16	12:52:01	5	7	6	9	1.1	2.3	9	13	68	85	20.7
24-Jun-16	12:52:11	5	7	6	9	1.1	2.3	9	13	70	88	20.8
24-Jun-16	12:52:21	5	7	6	9	1.1	2.3	9	13	68	85	20.8
24-Jun-16	12:52:31	3	4	5	7	1.3	2.7	6	9	64	80	20.8
24-Jun-16	12:52:41	3	4	4	6	1.1	2.3	6	8	61	76	20.9
24-Jun-16	12:52:51	3	4	4	6	1.1	2.3	6	8	57	71	20.9
24-Jun-16	12:53:01	2	3	3	5	1.1	2.3	4	6	54	68	20.9
24-Jun-16	12:53:11	1	1	2	4	1.1	2.3	3	4	52	65	20.9
24-Jun-16	12:53:21	1	1	2	4	1.3	2.7	3	5	52	65	20.9
24-Jun-16	12:53:31	1	1	2	4	1.1	2.3	3	4	53	66	20.9
24-Jun-16	12:53:41	1	1	2	4	1.3	2.7	3	5	56	70	21.0
24-Jun-16	12:53:51	1	1	2	4	1.1	2.3	3	4	60	75	20.9
24-Jun-16	12:54:01	1	1	2	4	1.3	2.7	3	5	62	78	20.9
24-Jun-16	12:54:11	1	1	2	4	1.1	2.3	3	4	62	78	21.0
24-Jun-16	12:54:21	0	0	1	3	1.3	2.7	1	3	60	75	20.9
24-Jun-16	12:54:31	1	1	2	4	1.3	2.7	3	5	58	73	21.0
24-Jun-16	12:54:41	1	1	2	4	1.1	2.3	3	4	56	70	21.0
24-Jun-16	12:54:51	0	0	1	2	1.1	2.3	1	2	53	66	21.0
24-Jun-16	12:55:01	1	1	2	4	1.1	2.3	3	4	51	64	21.0
24-Jun-16	12:55:11	0	0	1	3	1.4	2.9	1	3	47	59	20.9
24-Jun-16	12:55:21	0	0	1	2	1.1	2.3	1	2	45	56	21.0
24-Jun-16	12:55:31	0	0	1	2	0.8	1.6	1	2	41	51	21.0
24-Jun-16	12:55:41	0	0	1	2	0.8	1.6	1	2	38	48	21.0

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)	O2 (%)
24-Jun-16	12:55:51	1	1	2	4	1.4	2.9	3	5	35	44	21.0
24-Jun-16	12:56:01	0	0	1	3	1.4	2.9	1	3	32	40	21.0
24-Jun-16	12:56:11	1	1	2	4	1.1	2.3	3	4	29	36	21.0
24-Jun-16	12:56:21	0	0	1	2	1.1	2.3	1	2	26	33	21.0
24-Jun-16	12:56:31	1	1	2	4	1.1	2.3	3	4	24	30	21.0
24-Jun-16	12:56:41	1	1	2	4	1.3	2.7	3	5	22	28	21.0
24-Jun-16	12:56:51	1	1	2	4	1.1	2.3	3	4	19	24	21.0
24-Jun-16	12:57:01	0	0	1	3	1.3	2.7	1	3	17	21	21.0
24-Jun-16	12:57:11	0	0	1	3	1.3	2.7	1	3	14	18	21.0
24-Jun-16	12:57:21	0	0	1	3	1.4	2.9	1	3	13	16	21.0
24-Jun-16	12:57:31	1	1	2	4	1.1	2.3	3	4	12	15	21.0
24-Jun-16	12:57:41	1	1	2	4	1.1	2.3	3	4	10	13	21.0
24-Jun-16	12:57:51	0	0	1	2	0.8	1.6	1	2	9	11	21.0
24-Jun-16	12:58:01	0	0	1	2	1.1	2.3	1	2	9	11	21.0
24-Jun-16	12:58:11	0	0	1	2	1.1	2.3	1	2	8	10	21.0
24-Jun-16	12:58:21	0	0	1	3	1.3	2.7	1	3	7	9	21.0
24-Jun-16	12:58:31	0	0	1	2	0.8	1.6	1	2	7	9	21.0
24-Jun-16	12:58:41	0	0	1	2	0.8	1.6	1	2	6	8	21.0
24-Jun-16	12:58:51	0	0	1	1	0.5	1.0	1	1	6	8	21.0
24-Jun-16	12:59:01	0	0	1	2	0.8	1.6	1	2	5	6	21.0
24-Jun-16	12:59:11	0	0	1	2	1.1	2.3	1	2	5	6	21.0
24-Jun-16	12:59:21	0	0	1	2	0.8	1.6	1	2	4	5	21.0
24-Jun-16	12:59:31	0	0	1	2	0.8	1.6	1	2	4	5	21.0
24-Jun-16	12:59:41	0	0	1	2	1.1	2.3	1	2	4	5	20.9
24-Jun-16	12:59:51	0	0	1	2	0.8	1.6	1	2	4	5	20.9
24-Jun-16	13:00:01	0	0	1	2	0.8	1.6	1	2	3	4	20.9
24-Jun-16	13:00:11	0	0	1	2	0.8	1.6	1	2	4	5	20.9
24-Jun-16	13:00:21	0	0	1	2	0.8	1.6	1	2	4	5	20.9
24-Jun-16	13:00:31	0	0	1	2	0.8	1.6	1	2	6	8	20.9
24-Jun-16	13:00:41	0	0	1	2	0.8	1.6	1	2	6	8	20.9
24-Jun-16	13:00:51	0	0	1	2	0.8	1.6	1	2	6	8	20.9
24-Jun-16	13:01:01	0	0	1	2	0.8	1.6	1	2	7	9	20.9
24-Jun-16	13:01:11	0	0	1	2	0.8	1.6	1	2	6	8	20.9
24-Jun-16	13:01:21	0	0	1	2	0.8	1.6	1	2	6	8	20.9
24-Jun-16	13:01:31	0	0	1	2	1.1	2.3	1	2	6	8	20.9
24-Jun-16	13:01:41	0	0	1	2	0.8	1.6	1	2	6	8	20.9
24-Jun-16	13:01:51	1	1	1	3	0.8	1.6	2	4	7	9	20.9
24-Jun-16	13:02:01	1	1	1	3	0.8	1.6	2	4	6	8	20.9
24-Jun-16	13:02:11	1	1	2	4	1.1	2.3	3	4	6	8	20.9
24-Jun-16	13:02:21	1	1	1	3	0.8	1.6	2	4	6	8	20.7
24-Jun-16	13:02:31	1	1	2	4	1.1	2.3	3	4	6	8	20.6
24-Jun-16	13:02:41	1	1	2	3	0.8	1.6	2	4	5	6	20.6
24-Jun-16	13:02:51	1	1	2	4	1.1	2.3	3	4	5	6	20.6
24-Jun-16	13:03:01	1	1	2	4	1.1	2.3	3	4	5	6	20.6
24-Jun-16	13:03:11	1	1	2	3	0.8	1.6	2	4	4	5	20.5
24-Jun-16	13:03:21	1	1	2	3	0.8	1.6	2	4	4	5	20.5
24-Jun-16	13:03:31	2	3	3	5	1.1	2.3	4	6	5	6	20.5
24-Jun-16	13:03:41	1	1	2	3	0.8	1.6	2	4	5	6	20.5
24-Jun-16	13:03:51	2	3	3	4	0.8	1.6	4	6	4	5	20.6
24-Jun-16	13:04:01	1	1	2	3	0.8	1.6	2	4	4	5	20.6
24-Jun-16	13:04:11	1	1	2	4	1.1	2.3	3	4	4	5	20.6
24-Jun-16	13:04:21	1	1	2	3	0.8	1.6	2	4	4	5	20.6
24-Jun-16	13:04:31	1	1	2	3	0.8	1.6	2	4	4	5	20.6
24-Jun-16	13:04:41	1	1	2	4	1.1	2.3	3	4	4	5	20.6
24-Jun-16	13:04:51	1	1	2	4	1.1	2.3	3	4	4	5	20.6
24-Jun-16	13:05:01	2	3	3	4	0.8	1.6	4	6	4	5	20.7
24-Jun-16	13:05:11	1	1	2	4	1.1	2.3	3	4	4	5	20.8
24-Jun-16	13:05:21	1	1	2	5	1.6	3.3	3	5	1	1	21.0
24-Jun-16	13:05:31	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	13:05:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:05:51	0	0	2	4	1.9	3.9	2	4	1	1	21.0
24-Jun-16	13:06:01	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:06:11	1	1	2	5	1.6	3.3	3	5	0	0	21.0
24-Jun-16	13:06:21	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:06:31	0	0	2	3	1.6	3.3	2	3	1	1	21.0
24-Jun-16	13:06:41	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:06:51	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:07:01	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:07:11	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:07:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:07:31	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:07:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:07:51	0	0	2	3	1.6	3.3	2	3	0	0	21.0
24-Jun-16	13:08:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:08:11	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:08:21	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:08:31	1	1	2	4	1.1	2.3	3	4	1	1	21.0
24-Jun-16	13:08:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:08:51	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:09:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:09:11	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:09:21	1	1	2	4	1.1	2.3	3	4	1	1	21.0
24-Jun-16	13:09:31	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:09:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:09:51	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:10:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:10:11	1	1	2	5	1.6	3.3	3	5	0	0	21.0
24-Jun-16	13:10:21	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:10:31	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:10:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:10:51	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:11:01	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:11:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:11:21	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:11:31	1	1	2	4	1.3	2.7	3	5	0	0	21.0

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)	O2 (%)
24-Jun-16	13:11:41	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:11:51	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:12:01	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:12:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:12:21	1	1	1	3	0.8	1.6	2	4	0	0	21.0
24-Jun-16	13:12:31	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:12:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:12:51	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:13:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:13:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:13:21	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:13:31	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:13:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:13:51	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:14:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:14:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:14:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:14:31	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:14:41	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:14:51	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:15:01	1	1	3	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:15:11	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:15:21	1	1	2	4	1.1	2.3	3	4	1	1	21.0
24-Jun-16	13:15:31	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:15:41	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:15:51	1	1	2	5	1.6	3.3	3	5	0	0	21.0
24-Jun-16	13:16:01	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:16:11	1	1	3	5	1.6	3.3	3	5	0	0	21.0
24-Jun-16	13:16:21	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:16:31	1	1	3	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:16:41	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:16:51	1	1	3	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:17:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:17:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:17:21	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:17:31	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:17:41	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:17:51	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:18:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:18:11	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:18:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:18:31	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:18:41	1	1	1	3	0.8	1.6	2	4	1	1	21.0
24-Jun-16	13:18:51	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:19:01	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:19:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:19:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:19:31	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:19:41	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:19:51	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:20:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:20:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:20:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:20:31	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:20:41	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:20:51	1	1	1	3	0.8	1.6	2	4	0	0	21.0
24-Jun-16	13:21:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:21:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:21:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:21:31	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:21:41	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:21:51	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:22:01	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:22:11	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:22:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:22:31	1	1	3	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:22:41	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:22:51	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:23:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:23:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:23:21	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:23:31	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:23:41	1	1	2	5	1.6	3.3	3	5	0	0	21.0
24-Jun-16	13:23:51	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:24:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:24:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:24:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:24:31	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:24:41	1	1	3	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:24:51	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:25:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:25:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:25:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:25:31	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:25:41	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:25:51	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	13:26:01	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:26:11	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:26:21	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	13:26:31	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:26:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:26:51	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:27:01	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:27:11	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:27:21	1	1	2	4	1.1	2.3	3	4	0	0	21.0

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)	O2 (%)
24-Jun-16	13:27:31	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:27:41	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:27:51	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:28:01	1	1	3	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:28:11	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:28:21	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:28:31	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:28:41	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:28:51	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:29:01	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:29:11	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:29:21	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:29:31	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:29:41	1	1	1	3	0.8	1.6	2	4	0	0	21.0
24-Jun-16	13:29:51	0	0	1	1	0.5	1.0	1	1	0	0	21.0
24-Jun-16	13:30:01	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:30:11	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:30:21	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:30:31	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:30:41	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:30:51	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:31:01	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:31:11	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:31:21	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:31:31	1	1	1	3	0.8	1.6	2	4	0	0	21.0
24-Jun-16	13:31:41	0	0	1	1	0.5	1.0	1	1	0	0	21.0
24-Jun-16	13:31:51	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:32:01	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:32:11	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:32:21	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:32:31	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:32:41	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:32:51	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:33:01	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:33:11	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:33:21	1	1	1	3	0.8	1.6	2	4	0	0	21.0
24-Jun-16	13:33:31	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:33:41	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:33:51	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:34:01	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:34:11	0	0	1	1	0.5	1.0	1	1	0	0	21.0
24-Jun-16	13:34:21	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:34:31	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:34:41	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:34:51	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:35:01	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:35:11	0	0	1	2	0.8	1.6	1	2	0	0	21.0
24-Jun-16	13:35:21	0	0	2	4	1.9	3.9	2	4	0	0	21.0
24-Jun-16	13:35:31	1	1	2	5	1.6	3.3	3	5	1	1	20.9
24-Jun-16	13:35:41	0	0	2	4	1.9	3.9	2	4	0	0	20.9
24-Jun-16	13:35:51	0	0	2	4	1.9	3.9	2	4	1	1	20.9
24-Jun-16	13:36:01	0	0	2	4	1.9	3.9	2	4	1	1	20.9
24-Jun-16	13:36:11	1	1	2	5	1.6	3.3	3	5	0	0	20.9
24-Jun-16	13:36:21	0	0	2	3	1.6	3.3	2	3	0	0	21.0
24-Jun-16	13:36:31	0	0	2	3	1.6	3.3	2	3	0	0	21.0
24-Jun-16	13:36:41	0	0	2	3	1.6	3.3	2	3	0	0	21.0
24-Jun-16	13:36:51	0	0	2	3	1.6	3.3	2	3	1	1	21.0
24-Jun-16	13:37:01	0	0	2	3	1.6	3.3	2	3	1	1	21.0
24-Jun-16	13:37:11	0	0	1	3	1.3	2.7	1	3	1	1	21.0
24-Jun-16	13:37:21	0	0	2	3	1.6	3.3	2	3	0	0	21.0
24-Jun-16	13:37:31	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:37:41	1	1	2	4	1.3	2.7	3	5	0	0	21.0
24-Jun-16	13:37:51	0	0	1	2	1.1	2.3	1	2	0	0	21.0
24-Jun-16	13:38:01	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:38:11	1	1	2	4	1.3	2.7	3	5	1	1	21.0
24-Jun-16	13:38:21	1	1	2	4	1.1	2.3	3	4	0	0	21.0
24-Jun-16	13:38:31	0	0	2	3	1.6	3.3	2	3	1	1	21.0
24-Jun-16	13:38:41	1	1	2	5	1.6	3.3	3	5	0	0	21.0
24-Jun-16	13:38:51	1	1	2	5	1.6	3.3	3	5	0	0	21.0
24-Jun-16	13:39:01	0	0	1	3	1.3	2.7	1	3	0	0	21.0
24-Jun-16	13:39:11	0	0	2	3	1.6	3.3	2	3	0	0	21.0
24-Jun-16	13:39:21	1	1	2	5	1.6	3.3	3	5	0	0	21.0
24-Jun-16	13:39:31	0	0	2	3	1.6	3.3	2	3	0	0	21.0
24-Jun-16	13:39:41	1	1	2	4	1.3	2.7	3	5	0	0	20.9
24-Jun-16	13:39:51	0	0	2	3	1.6	3.3	2	3	1	1	20.9
24-Jun-16	13:40:01	0	0	2	3	1.6	3.3	2	3	1	1	20.9
24-Jun-16	13:40:11	1	1	2	4	1.3	2.7	3	5	0	0	20.9
24-Jun-16	13:40:21	0	0	2	3	1.6	3.3	2	3	0	0	20.9
24-Jun-16	13:40:31	0	0	1	3	1.3	2.7	1	3	0	0	20.9
24-Jun-16	13:40:41	0	0	1	2	1.1	2.3	1	2	0	0	20.9
24-Jun-16	13:40:51	0	0	2	3	1.6	3.3	2	3	0	0	20.9
	Average	**1**	**2**	**2**	**4**	**1.2**	**2.4**	**3**	**5**	**14**	**18**	**20.9**
	Maximum	**8**	**11**	**9**	**13**	**1.9**	**3.9**	**14**	**19**	**112**	**140**	**21.0**
	Minimum	**0**	**0**	**1**	**1**	**0.5**	**1.0**	**1**	**1**	**0**	**0**	**20.5**

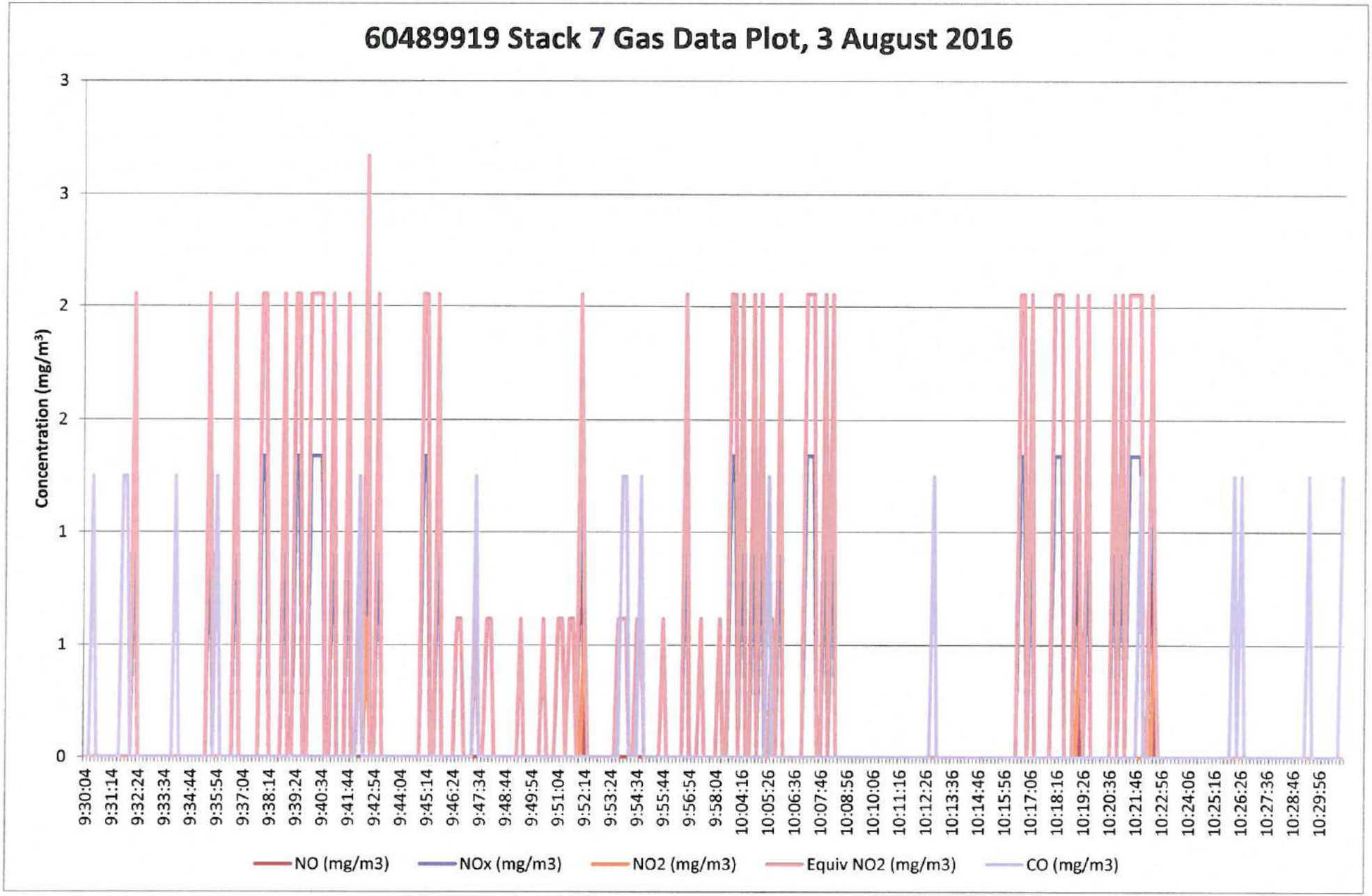

60489919 Stack 6 Gas Data Plot, 1 July 2016
Concentration (mg/m³)
Concentration (%)
40
35
30
25
20
15
10
5
0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
9:45:26
9:46:46
9:48:06
9:49:26
9:50:46
9:52:06
9:53:26
9:54:46
9:56:06
9:57:26
9:58:46
10:00:06
10:01:26
10:02:46
10:04:06
10:05:26
10:06:46
10:08:06
10:09:26
10:10:46
10:12:06
10:13:26
10:14:46
10:16:06
10:17:26
10:18:46
10:20:06
10:21:26
10:22:46
10:24:06
10:25:26
10:26:46
10:28:06
10:29:26
10:30:46
10:32:06
10:33:26
10:34:46
10:36:06
10:37:26
10:38:46
10:40:06
10:41:26
10:42:46
10:44:06
NO (mg/m3)
NOx (mg/m3)
NO2 (mg/m3)
Equiv NO2 (mg/m3)
CO (mg/m3)
O2 (%)

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)	O2 (%)
01-Jul-16	9:45:26	7	9	12	19	4.6	9.4	15	24	1	1	18.2
01-Jul-16	9:45:36	7	9	11	18	4.3	8.8	15	23	1	1	18.1
01-Jul-16	9:45:46	8	11	12	19	4.1	8.4	16	25	1	1	18.0
01-Jul-16	9:45:56	8	11	11	17	3.2	6.6	15	23	2	3	18.0
01-Jul-16	9:46:06	8	11	10	16	2.4	4.9	15	21	2	3	18.0
01-Jul-16	9:46:16	7	9	9	13	1.9	3.9	13	18	2	3	18.0
01-Jul-16	9:46:26	8	11	9	14	1.4	2.9	14	19	2	3	17.9
01-Jul-16	9:46:36	8	11	9	13	1.1	2.3	13	19	2	3	17.9
01-Jul-16	9:46:46	7	9	8	10	0.5	1.0	11	15	2	3	18.0
01-Jul-16	9:46:56	7	9	8	10	0.5	1.0	11	15	1	1	18.0
01-Jul-16	9:47:06	7	9	7	10	0.3	0.6	11	15	1	1	18.0
01-Jul-16	9:47:16	8	11	8	11	0.3	0.6	13	17	1	1	18.0
01-Jul-16	9:47:26	8	11	8	11	0.3	0.6	13	17	2	3	18.0
01-Jul-16	9:47:36	8	11	8	11	0.0	0.0	12	16	2	3	18.8
01-Jul-16	9:47:46	8	11	8	11	0.0	0.0	12	16	1	1	18.6
01-Jul-16	9:47:56	8	11	8	11	0.0	0.0	12	16	2	3	18.4
01-Jul-16	9:48:06	8	11	8	11	0.0	0.0	12	16	1	1	18.3
01-Jul-16	9:48:16	8	11	8	11	0.0	0.0	12	16	1	1	18.2
01-Jul-16	9:48:26	8	11	8	11	0.0	0.0	12	16	0	0	18.3
01-Jul-16	9:48:36	7	9	7	9	0.0	0.0	11	14	1	1	18.2
01-Jul-16	9:48:46	7	9	7	9	0.0	0.0	11	14	1	1	17.9
01-Jul-16	9:48:56	7	9	7	9	0.0	0.0	11	14	1	1	17.8
01-Jul-16	9:49:06	7	9	7	9	0.0	0.0	11	14	0	0	17.7
01-Jul-16	9:49:16	7	9	7	9	0.0	0.0	11	14	1	1	17.7
01-Jul-16	9:49:26	7	9	7	9	0.0	0.0	11	14	1	1	17.6
01-Jul-16	9:49:36	8	11	8	11	0.0	0.0	12	16	1	1	17.6
01-Jul-16	9:49:46	8	11	8	11	0.0	0.0	12	16	1	1	17.6
01-Jul-16	9:49:56	8	11	8	11	0.0	0.0	12	16	1	1	17.6
01-Jul-16	9:50:06	7	9	7	9	0.0	0.0	11	14	1	1	17.6
01-Jul-16	9:50:16	8	11	8	11	0.0	0.0	12	16	1	1	17.4
01-Jul-16	9:50:26	8	11	8	11	0.0	0.0	12	16	1	1	17.3
01-Jul-16	9:50:36	8	11	8	11	0.0	0.0	12	16	1	1	17.3
01-Jul-16	9:50:46	7	9	7	9	0.0	0.0	11	14	1	1	17.3
01-Jul-16	9:50:56	7	9	7	9	0.0	0.0	11	14	1	1	17.3
01-Jul-16	9:51:06	7	9	7	9	0.0	0.0	11	14	1	1	17.2
01-Jul-16	9:51:16	8	11	8	11	0.0	0.0	12	16	1	1	17.2
01-Jul-16	9:51:26	7	9	7	9	0.0	0.0	11	14	0	0	17.2
01-Jul-16	9:51:36	7	9	7	9	0.0	0.0	11	14	1	1	17.2
01-Jul-16	9:51:46	8	11	8	11	0.0	0.0	12	16	2	3	17.2
01-Jul-16	9:51:56	8	11	8	11	0.0	0.0	12	16	1	1	17.2
01-Jul-16	9:52:06	7	9	7	9	0.0	0.0	11	14	0	0	17.2
01-Jul-16	9:52:16	7	9	7	9	0.0	0.0	11	14	1	1	17.2
01-Jul-16	9:52:26	8	11	8	11	0.0	0.0	12	16	1	1	17.2
01-Jul-16	9:52:36	7	9	7	9	0.0	0.0	11	14	1	1	17.2
01-Jul-16	9:52:46	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:52:56	7	9	7	9	0.0	0.0	11	14	2	3	17.1
01-Jul-16	9:53:06	8	11	8	11	0.0	0.0	12	16	1	1	17.2
01-Jul-16	9:53:16	7	9	7	9	0.0	0.0	11	14	1	1	17.1
01-Jul-16	9:53:26	7	9	7	9	0.0	0.0	11	14	1	1	17.1
01-Jul-16	9:53:36	8	11	8	11	0.0	0.0	12	16	0	0	17.1
01-Jul-16	9:53:46	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:53:56	7	9	7	9	0.0	0.0	11	14	2	3	17.1
01-Jul-16	9:54:06	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:54:16	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:54:26	7	9	7	9	0.0	0.0	11	14	0	0	17.1
01-Jul-16	9:54:36	8	11	8	11	0.0	0.0	12	16	0	0	17.1
01-Jul-16	9:54:46	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:54:56	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:55:06	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:55:16	8	11	8	11	0.0	0.0	12	16	0	0	17.0
01-Jul-16	9:55:26	7	9	7	9	0.0	0.0	11	14	1	1	17.0
01-Jul-16	9:55:36	8	11	8	11	0.0	0.0	12	16	1	1	17.0
01-Jul-16	9:55:46	7	9	7	9	0.0	0.0	11	14	1	1	17.0
01-Jul-16	9:55:56	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:56:06	7	9	7	9	0.0	0.0	11	14	1	1	17.1
01-Jul-16	9:56:16	7	9	7	9	0.0	0.0	11	14	1	1	17.1
01-Jul-16	9:56:26	8	11	8	11	0.0	0.0	12	16	1	1	17.3
01-Jul-16	9:56:36	7	9	7	9	0.0	0.0	11	14	0	0	17.2
01-Jul-16	9:56:46	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:56:56	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:57:06	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:57:16	8	11	9	11	0.3	0.6	13	17	0	0	17.0
01-Jul-16	9:57:26	8	11	8	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	9:57:36	8	11	9	11	0.3	0.6	13	17	1	1	16.9
01-Jul-16	9:57:46	8	11	8	11	0.3	0.6	13	17	1	1	16.9
01-Jul-16	9:57:56	8	11	8	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	9:58:06	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	9:58:16	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	9:58:26	8	11	8	11	0.0	0.0	12	16	1	1	17.1
01-Jul-16	9:58:36	8	11	8	11	0.3	0.6	13	17	0	0	17.0
01-Jul-16	9:58:46	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	9:58:56	9	12	9	13	0.3	0.6	14	19	1	1	17.0
01-Jul-16	9:59:06	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	9:59:16	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	9:59:26	8	11	8	11	0.0	0.0	12	16	0	0	17.0
01-Jul-16	9:59:36	8	11	9	11	0.3	0.6	13	17	2	3	17.0
01-Jul-16	9:59:46	8	11	9	11	0.3	0.6	13	17	1	1	17.1
01-Jul-16	9:59:56	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	10:00:06	8	11	8	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	10:00:16	8	11	8	11	0.0	0.0	12	16	1	1	17.0
01-Jul-16	10:00:26	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	10:00:36	8	11	8	11	0.0	0.0	12	16	0	0	17.0
01-Jul-16	10:00:46	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	10:00:56	8	11	9	11	0.3	0.6	13	17	0	0	17.1
01-Jul-16	10:01:06	8	11	9	11	0.3	0.6	13	17	1	1	17.0

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)	O2 (%)
01-Jul-16	10:01:16	8	11	9	11	0.3	0.6	13	17	1	1	16.9
01-Jul-16	10:01:26	8	11	8	11	0.0	0.0	12	16	2	3	16.9
01-Jul-16	10:01:36	8	11	9	11	0.3	0.6	13	17	1	1	16.9
01-Jul-16	10:01:46	8	11	9	12	0.5	1.0	13	17	1	1	16.9
01-Jul-16	10:01:56	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	10:02:06	9	12	9	13	0.3	0.6	14	19	1	1	17.0
01-Jul-16	10:02:16	8	11	9	11	0.3	0.6	13	17	1	1	17.3
01-Jul-16	10:02:26	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	10:02:36	9	12	9	13	0.3	0.6	14	19	1	1	16.9
01-Jul-16	10:02:46	9	12	9	13	0.3	0.6	14	19	1	1	16.9
01-Jul-16	10:02:56	8	11	8	11	0.0	0.0	12	16	1	1	16.9
01-Jul-16	10:03:06	9	12	9	13	0.5	1.0	14	20	1	1	16.9
01-Jul-16	10:03:16	8	11	9	11	0.3	0.6	13	17	1	1	16.9
01-Jul-16	10:03:26	9	12	9	13	0.3	0.6	14	19	0	0	17.0
01-Jul-16	10:03:36	9	12	9	13	0.3	0.6	14	19	1	1	16.9
01-Jul-16	10:03:46	8	11	9	11	0.3	0.6	13	17	1	1	16.9
01-Jul-16	10:03:56	9	12	9	12	0.0	0.0	14	18	1	1	16.9
01-Jul-16	10:04:06	10	13	10	14	0.3	0.6	16	21	1	1	16.9
01-Jul-16	10:04:16	9	12	9	13	0.3	0.6	14	19	2	3	16.9
01-Jul-16	10:04:26	9	12	9	13	0.3	0.6	14	19	1	1	16.9
01-Jul-16	10:04:36	9	12	9	13	0.5	1.0	14	20	2	3	16.9
01-Jul-16	10:04:46	9	12	9	13	0.3	0.6	14	19	1	1	16.9
01-Jul-16	10:04:56	9	12	9	12	0.0	0.0	14	18	0	0	16.9
01-Jul-16	10:05:06	10	13	10	13	0.0	0.0	15	21	1	1	16.9
01-Jul-16	10:05:16	10	13	10	14	0.3	0.6	16	21	2	3	16.9
01-Jul-16	10:05:26	9	12	9	13	0.5	1.0	14	20	1	1	16.9
01-Jul-16	10:05:36	9	12	9	13	0.3	0.6	14	19	1	1	17.0
01-Jul-16	10:05:46	8	11	9	11	0.3	0.6	13	17	1	1	17.1
01-Jul-16	10:05:56	8	11	9	11	0.3	0.6	13	17	1	1	17.0
01-Jul-16	10:06:06	8	11	9	11	0.3	0.6	13	17	0	0	16.9
01-Jul-16	10:06:16	9	12	9	13	0.3	0.6	14	19	1	1	16.9
01-Jul-16	10:06:26	9	12	9	13	0.3	0.6	14	19	0	0	16.9
01-Jul-16	10:06:36	8	11	9	12	0.5	1.0	13	17	1	1	17.0
01-Jul-16	10:06:46	9	12	9	13	0.3	0.6	14	19	1	1	17.0
01-Jul-16	10:06:56	10	13	10	14	0.3	0.6	16	21	1	1	16.9
01-Jul-16	10:07:06	9	12	9	13	0.3	0.6	14	19	1	1	16.9
01-Jul-16	10:07:16	10	13	10	14	0.3	0.6	16	21	1	1	16.9
01-Jul-16	10:07:26	10	13	10	13	0.0	0.0	15	21	1	1	16.8
01-Jul-16	10:07:36	9	12	9	13	0.5	1.0	14	20	1	1	16.9
01-Jul-16	10:07:46	9	12	9	13	0.3	0.6	14	19	1	1	16.8
01-Jul-16	10:07:56	10	13	10	14	0.5	1.0	16	22	1	1	16.9
01-Jul-16	10:08:06	10	13	10	14	0.3	0.6	16	21	1	1	17.8
01-Jul-16	10:08:16	9	12	9	13	0.3	0.6	14	19	1	1	17.9
01-Jul-16	10:08:26	9	12	9	13	0.3	0.6	14	19	1	1	17.5
01-Jul-16	10:08:36	10	13	10	14	0.3	0.6	16	21	1	1	17.4
01-Jul-16	10:08:46	10	13	10	13	0.0	0.0	15	21	0	0	17.2
01-Jul-16	10:08:56	9	12	9	13	0.5	1.0	14	20	0	0	17.2
01-Jul-16	10:09:06	10	13	10	14	0.5	1.0	16	22	0	0	17.3
01-Jul-16	10:09:16	10	13	10	14	0.3	0.6	16	21	0	0	17.3
01-Jul-16	10:09:26	9	12	9	13	0.3	0.6	14	19	0	0	17.1
01-Jul-16	10:09:36	9	12	9	13	0.3	0.6	14	19	0	0	17.1
01-Jul-16	10:09:46	11	15	11	15	0.3	0.6	17	23	1	1	16.9
01-Jul-16	10:09:56	13	17	13	18	0.5	1.0	20	28	2	3	16.5
01-Jul-16	10:10:06	14	19	15	20	0.5	1.0	22	30	1	1	16.2
01-Jul-16	10:10:16	15	20	15	21	0.3	0.6	23	31	1	1	16.1
01-Jul-16	10:10:26	14	19	14	19	0.3	0.6	22	29	1	1	17.7
01-Jul-16	10:10:36	15	20	15	21	0.3	0.6	23	31	1	1	15.2
01-Jul-16	10:10:46	14	19	15	20	0.5	1.0	22	30	1	1	15.6
01-Jul-16	10:10:56	14	19	14	19	0.3	0.6	22	29	1	1	15.8
01-Jul-16	10:11:06	15	20	15	21	0.3	0.6	23	31	1	1	15.2
01-Jul-16	10:11:16	15	20	15	21	0.5	1.0	24	32	1	1	17.1
01-Jul-16	10:11:26	15	20	16	21	0.5	1.0	24	32	2	3	16.2
01-Jul-16	10:11:36	14	19	14	19	0.3	0.6	22	29	1	1	15.5
01-Jul-16	10:11:46	14	19	14	19	0.3	0.6	22	29	2	3	18.0
01-Jul-16	10:11:56	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:12:06	14	19	14	19	0.0	0.0	21	29	2	3	15.6
01-Jul-16	10:12:16	15	20	15	21	0.3	0.6	23	31	1	1	16.1
01-Jul-16	10:12:26	15	20	15	21	0.3	0.6	23	31	1	1	15.8
01-Jul-16	10:12:36	15	20	15	20	0.0	0.0	23	31	2	3	15.8
01-Jul-16	10:12:46	15	20	15	21	0.3	0.6	23	31	1	1	15.2
01-Jul-16	10:12:56	14	19	14	19	0.0	0.0	21	29	1	1	16.4
01-Jul-16	10:13:06	14	19	14	19	0.3	0.6	22	29	1	1	15.7
01-Jul-16	10:13:16	14	19	14	19	0.0	0.0	21	29	1	1	16.0
01-Jul-16	10:13:26	13	17	14	18	0.3	0.6	20	27	1	1	15.5
01-Jul-16	10:13:36	14	19	14	19	0.3	0.6	22	29	1	1	15.7
01-Jul-16	10:13:46	14	19	15	20	0.5	1.0	22	30	1	1	16.2
01-Jul-16	10:13:56	14	19	14	19	0.3	0.6	22	29	2	3	15.8
01-Jul-16	10:14:06	15	20	15	21	0.3	0.6	23	31	2	3	15.3
01-Jul-16	10:14:16	15	20	15	21	0.5	1.0	24	32	1	1	15.5
01-Jul-16	10:14:26	15	20	15	21	0.5	1.0	24	32	1	1	15.6
01-Jul-16	10:14:36	15	20	15	21	0.3	0.6	23	31	1	1	16.7
01-Jul-16	10:14:46	15	20	15	20	0.0	0.0	23	31	2	3	15.8
01-Jul-16	10:14:56	15	20	15	21	0.3	0.6	23	31	1	1	16.0
01-Jul-16	10:15:06	15	20	15	21	0.3	0.6	23	31	1	1	15.4
01-Jul-16	10:15:16	13	17	14	18	0.3	0.6	20	27	1	1	15.5
01-Jul-16	10:15:26	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:15:36	16	21	16	22	0.3	0.6	25	33	2	3	16.3
01-Jul-16	10:15:46	16	21	16	22	0.3	0.6	25	33	2	3	16.3
01-Jul-16	10:15:56	16	21	16	21	0.0	0.0	25	33	2	3	16.3
01-Jul-16	10:16:06	16	21	16	21	0.0	0.0	25	33	2	3	16.2
01-Jul-16	10:16:16	16	21	16	22	0.3	0.6	25	33	1	1	16.2
01-Jul-16	10:16:26	16	21	16	22	0.3	0.6	25	33	2	3	16.3
01-Jul-16	10:16:36	16	21	16	22	0.3	0.6	25	33	1	1	16.3
01-Jul-16	10:16:46	14	19	14	19	0.0	0.0	21	29	2	3	16.3
01-Jul-16	10:16:56	14	19	14	19	0.0	0.0	21	29	1	1	16.3

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)	O2 (%)
01-Jul-16	10:17:06	14	19	15	19	0.3	0.6	22	29	1	1	16.5
01-Jul-16	10:17:16	12	16	13	17	0.3	0.6	19	25	1	1	16.7
01-Jul-16	10:17:26	12	16	13	17	0.3	0.6	19	25	1	1	16.8
01-Jul-16	10:17:36	14	19	14	19	0.3	0.6	22	29	1	1	16.8
01-Jul-16	10:17:46	14	19	15	19	0.3	0.6	22	29	1	1	16.7
01-Jul-16	10:17:56	15	20	15	21	0.3	0.6	23	31	1	1	16.6
01-Jul-16	10:18:06	15	20	15	20	0.0	0.0	23	31	2	3	16.5
01-Jul-16	10:18:16	14	19	14	19	0.0	0.0	21	29	2	3	16.4
01-Jul-16	10:18:26	15	20	15	21	0.3	0.6	23	31	1	1	16.8
01-Jul-16	10:18:36	14	19	14	19	0.0	0.0	21	29	1	1	16.3
01-Jul-16	10:18:46	14	19	15	19	0.3	0.6	22	29	1	1	16.3
01-Jul-16	10:18:56	14	19	15	19	0.3	0.6	22	29	1	1	16.3
01-Jul-16	10:19:06	16	21	16	22	0.3	0.6	25	33	1	1	16.2
01-Jul-16	10:19:16	15	20	15	21	0.3	0.6	23	31	1	1	16.0
01-Jul-16	10:19:26	16	21	16	21	0.0	0.0	25	33	1	1	16.3
01-Jul-16	10:19:36	16	21	16	22	0.3	0.6	25	33	1	1	16.2
01-Jul-16	10:19:46	16	21	16	21	0.0	0.0	25	33	1	1	16.2
01-Jul-16	10:19:56	16	21	16	21	0.0	0.0	25	33	1	1	16.1
01-Jul-16	10:20:06	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:20:16	14	19	14	19	0.0	0.0	21	29	2	3	16.4
01-Jul-16	10:20:26	14	19	14	19	0.0	0.0	21	29	2	3	16.4
01-Jul-16	10:20:36	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:20:46	15	20	15	21	0.3	0.6	23	31	2	3	16.3
01-Jul-16	10:20:56	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:21:06	14	19	15	19	0.3	0.6	22	29	1	1	16.3
01-Jul-16	10:21:16	14	19	14	19	0.0	0.0	21	29	2	3	16.4
01-Jul-16	10:21:26	14	19	14	19	0.0	0.0	21	29	0	0	16.3
01-Jul-16	10:21:36	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:21:46	16	21	16	21	0.0	0.0	25	33	1	1	16.2
01-Jul-16	10:21:56	16	21	16	22	0.3	0.6	25	33	2	3	16.2
01-Jul-16	10:22:06	15	20	15	20	0.0	0.0	23	31	1	1	16.2
01-Jul-16	10:22:16	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:22:26	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:22:36	14	19	14	19	0.0	0.0	21	29	2	3	16.3
01-Jul-16	10:22:46	14	19	14	19	0.0	0.0	21	29	1	1	16.3
01-Jul-16	10:22:56	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:23:06	15	20	15	20	0.0	0.0	23	31	1	1	16.4
01-Jul-16	10:23:16	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:23:26	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:23:36	15	20	15	20	0.0	0.0	23	31	2	3	16.3
01-Jul-16	10:23:46	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:23:56	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:24:06	15	20	15	20	0.0	0.0	23	31	2	3	16.3
01-Jul-16	10:24:16	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:24:26	16	21	16	21	0.0	0.0	25	33	2	3	16.3
01-Jul-16	10:24:36	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:24:46	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:24:56	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:25:06	15	20	15	20	0.0	0.0	23	31	1	1	17.8
01-Jul-16	10:25:16	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:25:26	15	20	15	20	0.0	0.0	23	31	1	1	16.0
01-Jul-16	10:25:36	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:25:46	15	20	15	21	0.3	0.6	23	31	2	3	16.3
01-Jul-16	10:25:56	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:26:06	15	20	15	20	0.0	0.0	23	31	2	3	16.3
01-Jul-16	10:26:16	15	20	15	21	0.3	0.6	23	31	1	1	16.4
01-Jul-16	10:26:26	15	20	16	21	0.3	0.6	23	31	2	3	17.0
01-Jul-16	10:26:36	15	20	15	21	0.3	0.6	23	31	1	1	16.4
01-Jul-16	10:26:46	15	20	15	20	0.0	0.0	23	31	2	3	16.5
01-Jul-16	10:26:56	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:27:06	16	21	16	21	0.0	0.0	25	33	1	1	16.3
01-Jul-16	10:27:16	15	20	15	21	0.3	0.6	23	31	1	1	16.0
01-Jul-16	10:27:26	15	20	16	21	0.3	0.6	23	31	1	1	16.2
01-Jul-16	10:27:36	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:27:46	15	20	16	21	0.3	0.6	23	31	2	3	16.3
01-Jul-16	10:27:56	16	21	16	21	0.0	0.0	25	33	0	0	16.2
01-Jul-16	10:28:06	15	20	15	20	0.0	0.0	23	31	1	1	16.7
01-Jul-16	10:28:16	15	20	15	20	0.0	0.0	23	31	1	1	16.2
01-Jul-16	10:28:26	15	20	15	21	0.3	0.6	23	31	2	3	16.2
01-Jul-16	10:28:36	15	20	15	21	0.3	0.6	23	31	1	1	16.7
01-Jul-16	10:28:46	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:28:56	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:29:06	15	20	15	21	0.3	0.6	23	31	1	1	16.2
01-Jul-16	10:29:16	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:29:26	16	21	16	21	0.0	0.0	25	33	1	1	16.2
01-Jul-16	10:29:36	15	20	16	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:29:46	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:29:56	15	20	16	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:30:06	15	20	15	20	0.0	0.0	23	31	2	3	16.3
01-Jul-16	10:30:16	15	20	15	20	0.0	0.0	23	31	1	1	16.2
01-Jul-16	10:30:26	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:30:36	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:30:46	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:30:56	15	20	15	21	0.3	0.6	23	31	2	3	16.5
01-Jul-16	10:31:06	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:31:16	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:31:26	15	20	15	20	0.0	0.0	23	31	1	1	16.5
01-Jul-16	10:31:36	15	20	15	20	0.0	0.0	23	31	1	1	16.2
01-Jul-16	10:31:46	15	20	16	21	0.3	0.6	23	31	2	3	16.3
01-Jul-16	10:31:56	15	20	16	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:32:06	15	20	16	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:32:16	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:32:26	15	20	15	20	0.0	0.0	23	31	2	3	16.3
01-Jul-16	10:32:36	15	20	15	20	0.0	0.0	23	31	2	3	16.8
01-Jul-16	10:32:46	15	20	15	20	0.0	0.0	23	31	1	1	16.3

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)	O2 (%)
01-Jul-16	10:32:56	15	20	15	20	0.0	0.0	23	31	2	3	16.1
01-Jul-16	10:33:06	16	21	16	21	0.0	0.0	25	33	1	1	16.3
01-Jul-16	10:33:16	15	20	15	20	0.0	0.0	23	31	1	1	16.0
01-Jul-16	10:33:26	17	23	17	23	0.3	0.6	26	36	1	1	16.1
01-Jul-16	10:33:36	15	20	15	20	0.0	0.0	23	31	1	1	16.2
01-Jul-16	10:33:46	15	20	15	20	0.0	0.0	23	31	2	3	16.2
01-Jul-16	10:33:56	15	20	16	21	0.3	0.6	23	31	1	1	16.2
01-Jul-16	10:34:06	16	21	16	21	0.0	0.0	25	33	1	1	16.3
01-Jul-16	10:34:16	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:34:26	15	20	15	20	0.0	0.0	23	31	0	0	16.3
01-Jul-16	10:34:36	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:34:46	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:34:56	15	20	16	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:35:06	15	20	15	20	0.0	0.0	23	31	2	3	16.4
01-Jul-16	10:35:16	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:35:26	15	20	15	20	0.0	0.0	23	31	1	1	16.3
01-Jul-16	10:35:36	16	21	16	22	0.3	0.6	25	33	0	0	16.2
01-Jul-16	10:35:46	16	21	16	21	0.0	0.0	25	33	1	1	16.2
01-Jul-16	10:35:56	16	21	17	22	0.5	1.0	25	34	1	1	16.2
01-Jul-16	10:36:06	16	21	16	22	0.3	0.6	25	33	1	1	16.3
01-Jul-16	10:36:16	15	20	16	21	0.3	0.6	23	31	1	1	16.2
01-Jul-16	10:36:26	16	21	16	22	0.3	0.6	25	33	1	1	16.8
01-Jul-16	10:36:36	17	23	17	24	0.5	1.0	27	36	1	1	16.0
01-Jul-16	10:36:46	17	23	17	23	0.3	0.6	26	36	1	1	15.9
01-Jul-16	10:36:56	17	23	17	23	0.3	0.6	26	36	0	0	16.2
01-Jul-16	10:37:06	15	20	16	21	0.3	0.6	23	31	0	0	16.3
01-Jul-16	10:37:16	15	20	16	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:37:26	15	20	16	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:37:36	15	20	16	21	0.5	1.0	24	32	0	0	16.3
01-Jul-16	10:37:46	16	21	16	22	0.3	0.6	25	33	1	1	16.3
01-Jul-16	10:37:56	16	21	16	21	0.0	0.0	25	33	1	1	16.3
01-Jul-16	10:38:06	16	21	16	22	0.3	0.6	25	33	1	1	16.3
01-Jul-16	10:38:16	16	21	16	22	0.3	0.6	25	33	0	0	16.2
01-Jul-16	10:38:26	16	21	16	22	0.3	0.6	25	33	0	0	16.2
01-Jul-16	10:38:36	16	21	16	22	0.3	0.6	25	33	1	1	16.3
01-Jul-16	10:38:46	15	20	16	21	0.3	0.6	23	31	0	0	16.3
01-Jul-16	10:38:56	15	20	15	20	0.0	0.0	23	31	1	1	16.4
01-Jul-16	10:39:06	15	20	15	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:39:16	16	21	17	22	0.5	1.0	25	34	1	1	16.3
01-Jul-16	10:39:26	15	20	16	21	0.5	1.0	24	32	1	1	16.3
01-Jul-16	10:39:36	15	20	15	20	0.0	0.0	23	31	1	1	16.4
01-Jul-16	10:39:46	15	20	16	21	0.3	0.6	23	31	0	0	16.4
01-Jul-16	10:39:56	16	21	16	22	0.3	0.6	25	33	1	1	16.3
01-Jul-16	10:40:06	16	21	17	22	0.5	1.0	25	34	0	0	16.3
01-Jul-16	10:40:16	17	23	17	24	0.5	1.0	27	36	1	1	16.2
01-Jul-16	10:40:26	16	21	16	22	0.3	0.6	25	33	0	0	16.3
01-Jul-16	10:40:36	15	20	16	21	0.3	0.6	23	31	1	1	16.3
01-Jul-16	10:40:46	17	23	17	23	0.3	0.6	26	36	0	0	16.2
01-Jul-16	10:40:56	15	20	16	21	0.3	0.6	23	31	1	1	16.1
01-Jul-16	10:41:06	15	20	16	21	0.5	1.0	24	32	0	0	16.0
01-Jul-16	10:41:16	15	20	15	20	0.0	0.0	23	31	0	0	16.0
01-Jul-16	10:41:26	15	20	15	21	0.3	0.6	23	31	1	1	15.9
01-Jul-16	10:41:36	15	20	16	21	0.3	0.6	23	31	1	1	15.9
01-Jul-16	10:41:46	15	20	16	21	0.3	0.6	23	31	0	0	15.8
01-Jul-16	10:41:56	15	20	16	21	0.3	0.6	23	31	0	0	15.9
01-Jul-16	10:42:06	15	20	16	21	0.5	1.0	24	32	0	0	15.9
01-Jul-16	10:42:16	16	21	16	22	0.3	0.6	25	33	0	0	15.9
01-Jul-16	10:42:26	15	20	16	21	0.5	1.0	24	32	1	1	15.9
01-Jul-16	10:42:36	15	20	16	21	0.3	0.6	23	31	1	1	15.9
01-Jul-16	10:42:46	16	21	16	22	0.3	0.6	25	33	1	1	15.9
01-Jul-16	10:42:56	15	20	15	20	0.0	0.0	23	31	0	0	15.9
01-Jul-16	10:43:06	15	20	16	21	0.3	0.6	23	31	0	0	15.9
01-Jul-16	10:43:16	15	20	15	21	0.3	0.6	23	31	1	1	16.0
01-Jul-16	10:43:26	15	20	16	21	0.5	1.0	24	32	0	0	15.9
01-Jul-16	10:43:36	15	20	16	21	0.5	1.0	24	32	1	1	15.9
01-Jul-16	10:43:46	15	20	16	22	0.8	1.6	24	32	1	1	16.0
01-Jul-16	10:43:56	15	20	16	21	0.3	0.6	23	31	1	1	16.0
01-Jul-16	10:44:06	15	20	16	21	0.5	1.0	24	32	1	1	15.9
01-Jul-16	10:44:16	15	20	15	21	0.3	0.6	23	31	0	0	16.0
01-Jul-16	10:44:26	15	20	15	21	0.5	1.0	24	32	0	0	15.8
01-Jul-16	10:44:36	15	20	15	21	0.5	1.0	24	32	0	0	15.9
01-Jul-16	10:44:46	15	20	15	21	0.3	0.6	23	31	0	0	16.0
01-Jul-16	10:44:56	15	20	15	21	0.3	0.6	23	31	0	0	15.9
01-Jul-16	10:45:06	14	19	15	20	0.5	1.0	22	30	0	0	16.2
	Average	**12**	**16**	**12**	**17**	**0.2**	**0.5**	**19**	**26**	**1**	**1**	**16.6**
	Maximum	**17**	**23**	**17**	**24**	**4.6**	**9.4**	**27**	**36**	**2**	**3**	**18.8**
	Minimum	**7**	**9**	**7**	**9**	**0.0**	**0.0**	**11**	**14**	**0**	**0**	**15.2**


60489919 Stack 7 Gas Data Plot, 3 August 2016
Concentration (mg/m³)
3
3
2
2
1
1
0
9:30:04
9:31:14
9:32:24
9:33:34
9:34:44
9:35:54
9:37:04
9:38:14
9:39:24
9:40:34
9:41:44
9:42:54
9:44:04
9:45:14
9:46:24
9:47:34
9:48:44
9:49:54
9:51:04
9:52:14
9:53:24
9:54:34
9:55:44
9:56:54
9:58:04
10:04:16
10:05:26
10:06:36
10:07:46
10:08:56
10:10:06
10:11:16
10:12:26
10:13:36
10:14:46
10:15:56
10:17:06
10:18:16
10:19:26
10:20:36
10:21:46
10:22:56
10:24:06
10:25:16
10:26:26
10:27:36
10:28:46
10:29:56
NO (mg/m3)
NOx (mg/m3)
NO2 (mg/m3)
Equiv NO2 (mg/m3)
CO (mg/m3)

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
03-Aug-16	9:30:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:30:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:30:24	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	9:30:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:30:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:30:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:31:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:31:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:31:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:31:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:31:44	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	9:31:54	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	9:32:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:32:14	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:32:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:32:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:32:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:32:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:33:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:33:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:33:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:33:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:33:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:33:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:34:04	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	9:34:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:34:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:34:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:34:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:34:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:35:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:35:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:35:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:35:34	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:35:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:35:54	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	9:36:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:36:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:36:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:36:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:36:44	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:36:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:37:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:37:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:37:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:37:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:37:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:37:54	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:38:04	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:38:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:38:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:38:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:38:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:38:54	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:39:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:39:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:39:24	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:39:34	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:39:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:39:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:40:04	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:40:14	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:40:24	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:40:34	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:40:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:40:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:41:04	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:41:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:41:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:41:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:41:44	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:41:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:42:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:42:14	0	0	0	1	0.3	0.6	0	1	1	1
03-Aug-16	9:42:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:42:34	1	1	1	2	0.3	0.6	2	3	0	0
03-Aug-16	9:42:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:42:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:43:04	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:43:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:43:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:43:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:43:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:43:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:44:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:44:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:44:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:44:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:44:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:44:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:45:04	1	1	1	1	0.0	0.0	2	2	0	0

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
03-Aug-16	9:45:14	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:45:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:45:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:45:44	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:45:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:46:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:46:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:46:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:46:34	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:46:44	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:46:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:47:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:47:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:47:24	0	0	1	1	0.3	0.6	0	1	1	1
03-Aug-16	9:47:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:47:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:47:54	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:48:04	0	0	0	1	0.3	0.6	0	1	0	0
03-Aug-16	9:48:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:48:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:48:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:48:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:48:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:49:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:49:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:49:24	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:49:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:49:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:49:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:50:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:50:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:50:24	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:50:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:50:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:50:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:51:04	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:51:14	0	0	0	1	0.3	0.6	0	1	0	0
03-Aug-16	9:51:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:51:34	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:51:44	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:51:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:52:04	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:52:14	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:52:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:52:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:52:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:52:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:53:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:53:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:53:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:53:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:53:44	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:53:54	0	0	1	1	0.3	0.6	0	1	1	1
03-Aug-16	9:54:04	0	0	1	1	0.3	0.6	0	1	1	1
03-Aug-16	9:54:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:54:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:54:34	0	0	0	1	0.3	0.6	0	1	0	0
03-Aug-16	9:54:44	0	0	0	1	0.3	0.6	0	1	1	1
03-Aug-16	9:54:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:55:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:55:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:55:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:55:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:55:44	0	0	1	1	0.3	0.6	0	1	0	0
03-Aug-16	9:55:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:56:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:56:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:56:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:56:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:56:44	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	9:56:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:57:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:57:14	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:57:24	0	0	0	1	0.3	0.6	0	1	0	0
03-Aug-16	9:57:34	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:57:44	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:57:54	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:58:04	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	9:58:14	0	0	0	1	0.3	0.6	0	1	0	0
03-Aug-16	9:58:24	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:03:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:03:46	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:03:56	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:04:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:04:16	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:04:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:04:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:04:46	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:04:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:05:06	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:05:16	0	0	0	0	0.0	0.0	0	0	0	0

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
03-Aug-16	10:05:26	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	10:05:36	0	0	0	1	0.3	0.6	0	1	0	0
03-Aug-16	10:05:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:05:56	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:06:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:06:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:06:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:06:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:06:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:06:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:07:06	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:07:16	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:07:26	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:07:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:07:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:07:56	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:08:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:08:16	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:08:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:08:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:08:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:08:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:09:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:09:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:09:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:09:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:09:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:09:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:10:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:10:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:10:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:10:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:10:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:10:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:11:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:11:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:11:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:11:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:11:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:11:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:12:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:12:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:12:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:12:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:12:46	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	10:12:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:13:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:13:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:13:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:13:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:13:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:13:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:14:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:14:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:14:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:14:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:14:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:14:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:15:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:15:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:15:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:15:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:15:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:15:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:16:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:16:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:16:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:16:36	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:16:46	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:16:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:17:06	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:17:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:17:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:17:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:17:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:17:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:18:06	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:18:16	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:18:26	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:18:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:18:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:18:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:19:06	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:19:16	0	0	0	1	0.3	0.6	0	1	0	0
03-Aug-16	10:19:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:19:36	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:19:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:19:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:20:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:20:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:20:26	0	0	0	0	0.0	0.0	0	0	0	0

Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)	CO (ppm)	CO (mg/m^3)
03-Aug-16	10:20:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:20:46	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:20:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:21:06	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:21:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:21:26	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:21:36	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:21:46	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:21:56	1	1	1	1	0.0	0.0	2	2	1	1
03-Aug-16	10:22:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:22:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:22:26	1	1	1	1	0.0	0.0	2	2	0	0
03-Aug-16	10:22:36	0	0	0	1	0.3	0.6	0	1	0	0
03-Aug-16	10:22:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:22:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:23:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:23:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:23:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:23:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:23:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:23:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:24:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:24:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:24:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:24:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:24:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:24:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:25:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:25:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:25:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:25:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:25:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:25:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:26:06	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	10:26:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:26:26	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	10:26:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:26:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:26:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:27:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:27:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:27:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:27:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:27:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:27:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:28:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:28:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:28:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:28:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:28:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:28:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:29:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:29:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:29:26	0	0	0	0	0.0	0.0	0	0	1	1
03-Aug-16	10:29:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:29:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:29:56	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:30:06	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:30:16	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:30:26	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:30:36	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:30:46	0	0	0	0	0.0	0.0	0	0	0	0
03-Aug-16	10:30:56	0	0	0	0	0.0	0.0	0	0	1	1
	Average	**0**	**0**	**0**	**0**	**0.0**	**0.0**	**0**	**0**	**0**	**0**
	Maximum	**1**	**1**	**1**	**2**	**0.3**	**0.6**	**2**	**3**	**1**	**1**
	Minimum	**0**	**0**	**0**	**0**	**0.0**	**0.0**	**0**	**0**	**0**	**0**

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