Emissions Testing Report 2013-14

National Ceramic Industries Australia

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1.0 Introduction

AECOM was appointed by National Ceramic Industries Australia Pty Limited (NCIA) to conduct annual air emission measurements at their facility located at Racecourse Road, Rutherford NSW. Emission testing was performed for the assessment of compliance with requirements of the facility's Environment Protection Licence (EPL 11956). Emission sources assessed during the testing period where EPL points 1 (Clay Prep), 2 (Pressing and Drying), 5 (Dryer 1), 6 (Dryer 2), 9 (Glaze Line), 10 (Selection Line), 12 (Spray Dryer), 14 (Kiln 1), 15 (Kiln 2) 18 (Hot Air Cooler 1) and 19 (Hot Air Cooler 2).

Assessment of the following emission parameters associated with each source was performed during October - November 2013 and January - April 2014:

- Velocity;
- Volumetric Flow rate;
- Moisture Content;
- Carbon Monoxide, Carbon Dioxide and Oxygen (for determination of Dry Gas Density);
- Total Particulate Matter; and
- Fine Particulate (PM_{10}).

Concentrations of the following air contaminants were also assessed on Kiln 1 & Kiln 2 stack emissions:

- Total Fluoride;
- Sulfur Dioxide (SO_2 as SO_3) and Sulfuric Acid Mist (H_2SO_4 as SO_3);
- Hazardous Substances; and
- Oxides of Nitrogen (NO, NO_2, NO_x and Equivalent NO_2).

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 5399-0-P, 5399-0-M, 5930-0-P, 5930-0-M & 6326-0-M:
  - Total Particulate;
  - Fine Particulate (PM_{10}); and
  - Moisture
- Australian Laboratory Services (ALS), laboratory NATA accreditation number 825, performed the following analysis detailed in reports numbered EN1400365 & EN1401194:
  - Total Fluoride;
  - Sulfuric Acid Mist (H_2SO_4 as SO_3); and
  - Sulfur Dioxide (SO_2 as SO_3).
- Leeder Consulting, NATA accreditation number 14429, performed the following analysis detailed in report numbers M140192:
  - Hazardous Substances (Metals).

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2.0 Sampling Plane Requirements

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

Table 1 Criteria for Selection of Sampling Planes (AS4323.1-1995)

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

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

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

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

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

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

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

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

The following stacks did not meet the above criteria in regards to distances from disturbances; as a result extra sampling points were added in accordance with AS 4323.1 – 1995 section 4.2:

- Kiln 1 & 2;
- Pressing and Drying;
- Glaze Line;
- Selection Line;
- Spray Dryer; and
- Hot Air Coolers 1 & 2.

All other points sampled comply with the above criteria.

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3.0 Methodology

3.1 NATA Accredited Methods

The following methods are within the scope of our National Association of Testing Authorities (NATA) accreditation. Accreditation Number 2778 (14391) and are approved for the sampling and analysis of gases. Specific details of the methods are available on request.

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

Table 2 AECOM NATA Endorsed Methods

NSW EPA Approved Methods	USEPA Methods	Method Title
AS4323.1 (NSW EPA TM-1)	USEPA (2000) Method 1	Selection of sampling positions
AS4323.2 (NSW EPA TM-15)	USEPA (2000) Method 5 under approved circumstances	Determination of total particulate matter – isokinetic manual sampling – gravimetric method
NSW EPA TM-2	USEPA (2000) Method 2 or 2C or USEPA (1999) Method 2F or 2G or 2H (as appropriate)	Determination of stack gas velocity and volumetric flow rate (type s pitot tube)
NSW EPA TM-3	USEPA (2000) Method 8 (for sampling and analysis only if interference from fluorides, free ammonia and/or dimethyl aniline has been demonstrated to the satisfaction of the chief Scientist, EPA) (as appropriate)	Determination of sulfuric acid mist emissions from stationary sources
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)	Determination of Sulfur Dioxide (SO_2) emissions from stationary sources
NSW EPA TM-9	USEPA (2000) Method 13A or 13B (as appropriate)	Determination of total fluoride emissions from stationary sources
NSW EPA TM-11	USEPA (2000) Method 7 or 7A or 7B or 7C or 7D or USEPA (1990) Method 7E or USEPA (1996) Method 20 or ISO (1993) Method 10396 (as appropriate). NO_x analysers may be substituted in Method 7E provided the performance Specifications of the method are met. Both NO and NO_x must be directly measured.	Nitrogen dioxide (NO_2) or nitric oxide (NO)
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)

Table 2 Continued AECOM NATA Endorsed Methods

NSW EPA Approved Methods	USEPA Methods	Method Title
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	USEPA (2000) Method 29	Cadmium (Cd) or mercury (Hg) or any compound containing one or more of those elements
NSW EPA TM-22	USEPA (2000) Method 4	Determination of moisture content in stack gases
NSW EPA TM-23	USEPA (2000) Method 3	Gas analysis for the determination of dry molecular weight
NSW EPA OM-5	USEPA (1997) Method 201 or 201A (as appropriate)	Determination of PM_{10} emissions

4.0 Sampling Location

Table 3 provides a summary of the locations sampled by AECOM at the National Ceramic Industries Australia Rutherford Site during October - November 2013 and January - April 2014.

Table 3 Sampling Location Summary

Discharge Description	Clay Preparation (CP1) (EPL 1)	Pressing and Drying (PD1) (EPL2)	Dryer (D1) (EPL5)	Dryer (D2) (EPL6)	Glaze Line (EPL9)
Duct Shape	Circular	Circular	Circular	Circular	Circular
Construction Material	Metal	Metal	Metal	Metal	Metal
Duct Dimensions (mm)	995	1000	490	490	1000
Minimum No. Sampling Points	12	12	8	8	12
Sampling Ports	2	2	2	2	2
Min. Points/Traverse	6	6	4	4	6
Disturbance	No	Yes	No	No	Yes
Distance from Upstream Disturbance[1]	6	4	10	8	4
Type of Disturbance	Junction	Junction	Fan	Fan	Junction
Distance from Downstream Disturbance[1]	15	15	8	20	15
Type of Disturbance	Stack Exit	Stack Exit	Stack Exit	Stack Exit	Stack Exit
Ideal Sampling Location	Yes	No	Yes	Yes	No
Correction Factors Applied	No	Yes	No	No	Yes
Total No. Points Sampled	12	16	8	8	16
Points/Traverse	6	8	4	4	8
Sampling Performed to Standard [2]	Yes[3]	Yes[4]	Yes[3]	Yes[3]	Yes[4]

Notes
[1] Expressed in equivalent stack diameters
[2] AS 4323.1 (1995) Stationary source emissions Method 1 – Selection of sampling positions
[3] AS 4323.1 (1995) Section 4.1
[4] AS 4323.1 (1995) Section 4.2

Emission Source Sampling Location Summary (continued)

Discharge Description	Selection Line (SL1,2,3,4) (EPL10)	Spray Dryer (SD1) (EPL12)	Kiln (KP1) (EPL14)[5]	Kiln (KP2) (EPL15)[5]	Hot Air Cooler (HAC1) (EPL18)	Hot Air Cooler (HAC2) (EPL19)
Duct Shape	Circular	Circular	Circular	Circular	Circular	Circular
Construction Material	Metal	Metal	Metal	Metal	Metal	Metal
Duct Dimensions (mm)	490	1385	980	980	1000	1200
Minimum No. Sampling Points	8	12	12	12	12	12
Sampling Ports	2	2	2	2	2	2
Min. Points/Traverse	4	6	6	6	6	6
Disturbance	Yes	Yes	Yes	Yes	Yes	Yes
Distance from Upstream Disturbance[1]	4	7	3	3	3	4
Type of Disturbance	Fan	Bend	Change in Diameter	Change in Diameter	Bend	Fan
Distance from Downstream Disturbance[1]	6	5	5	5	3	4
Type of Disturbance	Stack Exit	Stack Exit	Bend	Bend	Stack Exit	Stack Exit
Ideal Sampling Location	No	No	No	No	No	No
Correction Factors Applied	Yes	Yes	Yes	Yes	Yes	Yes
Total No. Points Sampled	12	16	16	16	16	16
Points/Traverse	6	8	8	8	8	8
Sampling Performed to Standard [2]	Yes[4]	Yes[4]	Yes[4]	Yes[4]	Yes[4]	Yes[4]

Notes
[1] Expressed in equivalent stack diameters
[2] AS 4323.1 (1995) Stationary source emissions Method 1 – Selection of sampling positions
[3] AS 4323.1 (1995) Section 4.1
[4] AS 4323.1 (1995) Section 4.2
[5] Sampling occurred prior to the baghouse as per client request

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 results obtained from stack emissions testing performed during October - November 2013 and January – April 2014, are provided in **Tables 4 - 6**.

Emission data particular to each emission source investigated is presented in **Tables 8 - 21**. Element Hazardous Substances (metals) results are presented in **Table 22** and **23**. All emission concentrations are converted to standard conditions of 0^oC, dry gas and 1 atmosphere pressure for comparison with appropriate regulatory limits.

For comparison with EPL requirements Oxides of Nitrogen, Total Particulate and Fine Particulate (PM_{10}) emission concentrations determined within the Kiln stacks exhausts have been corrected to 18% O_2 based on the measured oxygen content within the sampling plane during the testing period.

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

Field sheets and final calculations can be referred to in **Appendix A**. Raw and Calculated Oxides of Nitrogen data is attached in **Appendix B**. Analytical laboratory result certificates are provided in **Appendix C**.

Table 4 Summary Particulate Emission Monitoring Results, October and November 2013

Stack	Fine Particulate (PM_{10}) (mg/m^3)	Total Particulate (mg/m^3)	Regulatory Limit (mg/m^3)*
Clay Preparation (CP1) (EPL 1)	0.55	1.2	20
Pressing and Drying (PD1) (EPL 2)	2.8	12	20
Dryer (D1) (EPL 5)	0.97	2.3	20
Dryer (D2) (EPL 6)	0.9	2.2	20
Glaze Line (EPL 9)	<0.22	0.52	20
Selection Line (SL 1,2,3,4) (EPL 10)	0.69	1.1	20
Spray Dryer (SD1) (EPL 10)	6.3	13	20
Hot Air Cooler (HAC 1) (EPL 18)	0.35	0.6	5
Hot Air Cooler (HAC 2) (EPL 19)	0.25	0.5	5

*Note:- Regulatory limit only applies to Total Particulate.

Table 5 Kiln 1 and Kiln 2 Emission Monitoring Results Summary, January & April 2014

Pollutant	Kiln 1 (EPL 14)	Kiln 2 (EPL 15)	Regulatory Limit
Fine Particulate (at 18% O_2) (PM_{10}) (mg/m^3)	2	13	N/A
Total Particulate (at 18% O_2) (mg/m^3)	8	18	20
Total Fluoride (as HF) (mg/m^3)	4.4	1.3	5
Sulfuric Acid Mist (H_2SO_4 as SO_3) (mg/m^3)	<2.1	29	100
Sulfur Dioxide (SO_2 as SO_3) (mg/m^3)	16	230	NA
Total Hazardous Substances (Metals) (mg/m^3)	0.12	0.17	1
Cadmium (mg/m^3)	0.017	0.026	0.1
Mercury (mg/m^3)	<0.000022	0.0026	0.1

Table 6 Kiln 1 and 2 Gaseous Data Results, January 2014

Pollutant	Kiln 1 (EPL 14)	Kiln 2 (EPL 15)	Regulatory Limit
Date Sampled	29/01/2014	31/01/2014	-
Time Sampled	10:46:21 – 11:46:21	9:10:50 – 10:10:50	-
Stack Gas Flowrate (m^3/s) (0^0C, dry gas, 1atm pressure)	5.5	5.3	-
Total Oxides of Nitrogen (as Equivalent NO_2) (mg/m^3) at 18% O_2	75	88	100
Total Oxides of Nitrogen (as Equivalent NO_2) (mg/s) at 18% O_2	412.5	466.4	NA
Nitrogen Oxide (NO) (mg/m^3) at 18% O_2	8	7	NA
Nitrogen Oxide (NO) (mg/s) at 18% O_2	44	37.1	NA
Nitrogen Dioxide (NO2) (mg/m^3) at 18% O_2	63	78	NA
Nitrogen Dioxide (NO2) (mg/s) at 18% O_2	346.5	413.4	NA
Total Oxides of Nitrogen (NOx) (mg/m^3) at 18% O_2	70	84	NA
Total Oxides of Nitrogen (NOx) (mg/s) at 18% O_2	385	445.2	NA
Oxygen (O_2) %	16.15	15.60	NA

Table 7 Clay Prep Stack Total Particulate and Fine Particulate (PM_{10}) Results, 30 October 2013

Sampling Conditions:				
Stack internal diameter at test location	995	mm		
Stack gas temperature (average)	25.0	^{o}C	298.2	K
Stack pressure (average)	1014	hPa		
Stack gas velocity (average, stack conditions)	14	m/s		
Stack gas flowrate (stack conditions)	11	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	9.7	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	10:40	-	11:45	
Fine Particulate (PM_{10}) Mass	0.4	mg		
Gas Volume Sampled	0.728	m^3		
Fine Particulate (PM_{10}) Emission*[1]	0.55	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	5.4	mg/s		
Regulatory Limit	N/A			
Total Particulate Testing				
Test Period	10:40	-	11:43	
Total Particulate Mass	0.8	mg		
Gas Volume Sampled	0.652	m^3		
Total Particulate Emission*[1]	1.2	mg/m^3		
Total Particulate Mass Emission Rate*[2]	12	mg/s		
Regulatory Limit	20	mg/m^3		
Moisture Content (%)	**1.9**			
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 8 Pressing and Drying Stack Total Particulate and Fine Particulate (PM_{10}) Results, 30 October 2013

Sampling Conditions:				
Stack internal diameter at test location	1000	mm		
Stack gas temperature (average)	37.5	^{o}C	310.7	K
Stack pressure (average)	1013	hPa		
Stack gas velocity (average, stack conditions)	13	m/s		
Stack gas flowrate (stack conditions)	10	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	8.8	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	10:08	-	11:30	
Fine Particulate (PM_{10}) Mass	2.7	mg		
Gas Volume Sampled	0.964	m^3		
Fine Particulate (PM_{10}) Emission*[1]	2.8	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	25	mg/s		
Regulatory Limit	N/A			
Total Particulate Testing				
Test Period	10:08	-	11:30	
Total Particulate Mass	8.5	mg		
Gas Volume Sampled	0.71	m^3		
Total Particulate Emission*[1]	12	mg/m^3		
Total Particulate Mass Emission Rate*[2]	100	mg/s		
Regulatory Limit	20	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 9 Dryer 1 Stack Total Particulate and Fine Particulate (PM_{10}) Results, 1 November 2013

Sampling Conditions:				
Stack internal diameter at test location	490	mm		
Stack gas temperature (average)	102.3	^{o}C	375.5	K
Stack pressure (average)	1018	hPa		
Stack gas velocity (average, stack conditions)	9.6	m/s		
Stack gas flowrate (stack conditions)	1.8	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	1.3	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	9:52	-	10:32	
Fine Particulate (PM_{10}) Mass	0.4	mg		
Gas Volume Sampled	0.413	m^3		
Fine Particulate (PM_{10}) Emission*[1]	0.97	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	1.2	mg/s		
Regulatory Limit	N/A			
Total Particulate Testing				
Test Period	9:52	-	10:32	
Total Particulate Mass	1	mg		
Gas Volume Sampled	0.437	m^3		
Total Particulate Emission*[1]	2.3	mg/m^3		
Total Particulate Mass Emission Rate*[2]	2.9	mg/s		
Regulatory Limit	20	mg/m^3		
Moisture Content (%)	**3.9**			
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 10 Dryer 2 Stack Total Particulate and Fine Particulate (PM_{10}) Results, 1 November 2013

Sampling Conditions:				
Stack internal diameter at test location	490	mm		
Stack gas temperature (average)	105.8	^{o}C	379.0	K
Stack pressure (average)	1011	hPa		
Stack gas velocity (average, stack conditions)	12	m/s		
Stack gas flowrate (stack conditions)	2.2	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	1.5	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	11:42	-	12:24	
Fine Particulate (PM_{10}) Mass	0.4	mg		
Gas Volume Sampled	0.444	m^3		
Fine Particulate (PM_{10}) Emission*[1]	0.9	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	1.4	mg/s		
Regulatory Limit	NA			
Total Particulate Testing				
Test Period	11:42	-	12:24	
Total Particulate Mass	1.1	mg		
Gas Volume Sampled	0.511	m^3		
Total Particulate Emission*[1]	2.2	mg/m^3		
Total Particulate Mass Emission Rate*[2]	3.3	mg/s		
Regulatory Limit	20	mg/m^3		
Moisture Content (%)	**5.1**			
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 11 Glaze Line Stack Total Particulate and Fine Particulate (PM_{10}) Results, 30 October 2013

Sampling Conditions:				
Stack internal diameter at test location	1000	mm		
Stack gas temperature (average)	29.9	^{o}C	303.1	K
Stack pressure (average)	1014	hPa		
Stack gas velocity (average, stack conditions)	14	m/s		
Stack gas flowrate (stack conditions)	11	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	9.7	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	11:37	-	13:00	
Fine Particulate (PM_{10}) Mass	<0.2	mg		
Gas Volume Sampled	0.915	m^3		
Fine Particulate (PM_{10}) Emission*[1]	<0.22	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	<2.2	mg/s		
Regulatory Limit	N/A			
Total Particulate Testing				
Test Period	11:37	-	13:00	
Total Particulate Mass	0.4	mg		
Gas Volume Sampled	0.765	m^3		
Total Particulate Emission*[1]	0.52	mg/m^3		
Total Particulate Mass Emission Rate*[2]	5	mg/s		
Regulatory Limit	20	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 12 Selection Line Stack Total Particulate and Fine Particulate (PM_{10}) Results, 29 October 2013

Sampling Conditions:				
Stack internal diameter at test location	490	mm		
Stack gas temperature (average)	39.5	^{o}C	312.7	K
Stack pressure (average)	1000	hPa		
Stack gas velocity (average, stack conditions)	4.3	m/s		
Stack gas flowrate (stack conditions)	0.8	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	0.67	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	13:15	-	14:16	
Fine Particulate (PM_{10}) Mass	0.5	mg		
Gas Volume Sampled	0.728	m^3		
Fine Particulate (PM_{10}) Emission*[1]	0.69	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	0.47	mg/s		
Regulatory Limit	N/A			
Total Particulate Testing				
Test Period	13:15	-	14:16	
Total Particulate Mass	0.6	mg		
Gas Volume Sampled	0.56	m^3		
Total Particulate Emission*[1]	1.1	mg/m^3		
Total Particulate Mass Emission Rate*[2]	0.73	mg/s		
Regulatory Limit	20	mg/m^3		
Moisture Content (%)	**4.0**			
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 13 Spray Dryer Stack Total Particulate and Fine Particulate (PM_{10}) Results, 29 October 2013

Sampling Conditions:				
Stack internal diameter at test location	1385	mm		
Stack gas temperature (average)	89.1	^{o}C	362.3	K
Stack pressure (average)	1000	hPa		
Stack gas velocity (average, stack conditions)	20	m/s		
Stack gas flowrate (stack conditions)	31	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	21	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	10:43	-	12:03	
Fine Particulate (PM_{10}) Mass	4.3	mg		
Gas Volume Sampled	0.685	m^3		
Fine Particulate (PM_{10}) Emission*[1]	6.3	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	130	mg/s		
Regulatory Limit	N/A			
Total Particulate Testing				
Test Period	10:43	-	12:03	
Total Particulate Mass	8.3	mg		
Gas Volume Sampled	0.663	m^3		
Total Particulate Emission*[1]	13	mg/m^3		
Total Particulate Mass Emission Rate*[2]	260	mg/s		
Regulatory Limit	20	mg/m^3		
Moisture Content (%)	**9.9**			
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 14 Hot Air Cooler Stack Total Particulate and Fine Particulate (PM_{10}) Results, 28 October 2013

Sampling Conditions:				
Stack internal diameter at test location	1000	mm		
Stack gas temperature (average)	87.7	^{o}C	360.9	K
Stack pressure (average)	1011	hPa		
Stack gas velocity (average, stack conditions)	24	m/s		
Stack gas flowrate (stack conditions)	19	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	14	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	11:25	-	12:46	
Fine Particulate (PM_{10}) Mass	0.4	mg		
Gas Volume Sampled	1.14	m^3		
Fine Particulate (PM_{10}) Emission*[1]	0.35	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	4.9	mg/s		
Regulatory Limit	N/A			
Total Particulate Testing				
Test Period	11:25	-	12:46	
Total Particulate Mass	0.7	mg		
Gas Volume Sampled	1.16	m^3		
Total Particulate Emission*[1]	0.6	mg/m^3		
Total Particulate Mass Emission Rate*[2]	8.3	mg/s		
Regulatory Limit	5	mg/m^3		
Moisture Content (%)	**1.6**			
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 Hot Air Cooler 2 Stack Total Particulate and Fine Particulate (PM_{10}) Results, 28 October 2013

Sampling Conditions:				
Stack internal diameter at test location	1200	mm		
Stack gas temperature (average)	90.0	^{o}C	363.2	K
Stack pressure (average)	1012	hPa		
Stack gas velocity (average, stack conditions)	19	m/s		
Stack gas flowrate (stack conditions)	21	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	16	m^3/s		
Fine Particulate (PM_{10}) Testing				
Test Period	13:00	-	14:22	
Fine Particulate (PM_{10}) Mass	0.3	mg		
Gas Volume Sampled	1.22	m^3		
Fine Particulate (PM_{10}) Emission*[1]	0.25	mg/m^3		
Fine Particulate (PM_{10}) Mass Emission Rate*[2]	4	mg/s		
Regulatory Limit	N/A			
Total Particulate Testing				
Test Period	13:00	-	14:22	
Total Particulate Mass	0.4	mg		
Gas Volume Sampled	0.807	m^3		
Total Particulate Emission*[1]	0.5	mg/m^3		
Total Particulate Mass Emission Rate*[2]	7.8	mg/s		
Regulatory Limit	5	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 16 Kiln 1 Stack Total Particulate, Fine Particulate (PM_{10}) and Fluoride Results, 29 January 2013

Sampling Conditions:			
Stack internal diameter at test location	980	mm	
Stack gas temperature (average)	229.6	^{o}C	502.8 K
Stack pressure (average)	1011	hPa	
Stack gas velocity (average, stack conditions)	15	m/s	
Stack gas flowrate (stack conditions)	11	m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	5.8	m^3/s	
Fine Particulate (PM10) Testing			
Test Period	10:15	-	11:36
Fine Particulate (PM_{10}) Mass	3.2	mg	
Gas Volume Sampled	0.967	m^3	
Fine Particulate (PM_{10}) Emission*[1] at 18% O_2	2	mg/m^3	
Fine Particulate (PM_{10}) Mass Emission Rate*[2] at 18% O_2	12	mg/s	
Regulatory Limit at 18% O_2	N/A		
Total Particulate Testing			
Test Period	10:15	-	11:36
Total Particulate Mass	13.7	mg	
Gas Volume Sampled	1.1	m^3	
Total Particulate Emission*[1] at 18% O_2	8	mg/m^3	
Total Particulate Mass Emission Rate*[2] at 18% O_2	47	mg/s	
Regulatory Limit at 18% O_2	20	mg/m^3	
Total Fluoride Testing			
Test Period	10:15	-	11:36
Total Fluoride Mass	3.55	mg	
Gas Volume Sampled	0.801	m^3	
Total Fluoride Emission*[1]	4.4	mg/m^3	
Total Fluoride Mass Emission Rate*[2]	26	mg/s	
Regulatory Limit	5	mg/m^3	
Moisture Content (%)	**3.3**		
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 17 Kiln 1 Hazardous Substances (Metals), Sulfuric Acid Mist (H_2SO_4 as SO_3) and Sulfur Dioxide (SO_2 as SO_3) Results 30 January 2014

Sampling Conditions:			
Stack internal diameter at test location	980	mm	
Stack gas temperature (average)	272.7	^oC	545.9 K
Stack pressure (average)	1014	hPa	
Stack gas velocity (average, stack conditions)	14	m/s	
Stack gas flowrate (stack conditions)	11	m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	5.2	m^3/s	
Hazardous Substances (Metals) Testing			
Test Period	8:30	-	10:08
Hazardous Substances (Metals) Mass	0.14	mg	
Gas Volume Sampled	1.15	m^3	
Hazardous Substances (Metals) Emission*[1]	0.12	mg/m^3	
Hazardous Substances (Metals) Mass Emission Rate*[2]	0.62	mg/s	
Regulatory Limit	1	mg/m^3	
Sulfuric Acid Mist (H2SO4 as SO3) Testing			
Test Period	8:30	-	10:08
Sulfuric Acid Mist (H_2SO_4 as SO_3) Mass	<2	mg	
Gas Volume Sampled	0.951	m^3	
Sulfuric Acid Mist (H_2SO_4 as SO_3) Emission*[1]	<2.1	mg/m^3	
Sulfuric Acid Mist (H_2SO_4 as SO_3) Mass Emission Rate*[2]	<11	mg/s	
Regulatory Limit	100	mg/m^3	
Sulfur Dioxide (SO2 as SO3) Testing			
Test Period	8:30	-	10:08
Sulfur Dioxide (SO_2 as SO_3) Mass	15	mg	
Gas Volume Sampled	0.951	m^3	
Sulfur Dioxide (SO_2 as SO_3) Emission*[1]	16	mg/m^3	
Sulfur Dioxide (SO_2 as SO_3) Mass Emission Rate*[2]	84	mg/s	
Regulatory Limit	N/A		
Moisture Content (%)	**4.6**		
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 18 Kiln 2 Stack Total Particulate, Fine Particulate (PM_{10}) and Total Fluoride 30 January 2014

Sampling Conditions:			
Stack internal diameter at test location	980	mm	
Stack gas temperature (average)	196.4	^{o}C	469.6 K
Stack pressure (average)	1013	hPa	
Stack gas velocity (average, stack conditions)	13	m/s	
Stack gas flowrate (stack conditions)	9.8	m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	5.4	m^3/s	
Fine Particulate (PM10) Testing			
Test Period	10:16	-	11:36
Fine Particulate (PM_{10}) Mass	8.7	mg	
Gas Volume Sampled	0.949	m^3	
Fine Particulate (PM_{10}) Emission*[1] at 18% O_2	13	mg/m^3	
Fine Particulate (PM_{10}) Mass Emission Rate*[2] at 18% O_2	67	mg/s	
Regulatory Limit at 18% O_2	N/A	mg/m^3	
Total Particulate Testing			
Test Period	10:16	-	11:36
Total Particulate Mass	13.1	mg	
Gas Volume Sampled	0.971	m^3	
Total Particulate Emission*[1] at 18% O_2	18	mg/m^3	
Total Particulate Mass Emission Rate*[2] at 18% O_2	94	mg/s	
Regulatory Limit at 18% O_2	20	mg/m^3	
Total Fluoride Testing			
Test Period	10:16	-	11:36
Total Fluoride Mass	0.55	mg	
Gas Volume Sampled	0.416	m^3	
Total Fluoride Emission*[1]	1.3	mg/m^3	
Total Fluoride Mass Emission Rate*[2]	7.1	mg/s	
Regulatory Limit	5	mg/m^3	
Moisture Content (%)	**5.1**		
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 19 Kiln 2 Hazardous Substances (Metals) Results 31 January 2014

Sampling Conditions:				
Stack internal diameter at test location	980	mm		
Stack gas temperature (average)	179.5	^{o}C	452.7	K
Stack pressure (average)	1014	hPa		
Stack gas velocity (average, stack conditions)	12	m/s		
Stack gas flowrate (stack conditions)	9.2	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	5.2	m^3/s		
Hazardous Substances (Metals) Testing				
Test Period	8:47	-	10:17	
Hazardous Substances (Metals) Mass	0.2	mg		
Gas Volume Sampled	1.16	m^3		
Hazardous Substances (Metals) Emission*[1]	0.17	mg/m^3		
Hazardous Substances (Metals) Mass Emission Rate*[2]	0.87	mg/s		
Regulatory Limit	1	mg/m^3		
Moisture Content (%)	**7.8**			
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 20 Kiln 2 Sulfuric Acid Mist (H_2SO_4 as SO_3) and Sulfur Dioxide (SO_2 as SO_3) Results, 3 April 2014

Sampling Conditions:				
Stack internal diameter at test location	980	mm		
Stack gas temperature (average)	249.3	^oC	522.5	K
Stack pressure (average)	1012	hPa		
Stack gas velocity (average, stack conditions)	13	m/s		
Stack gas flowrate (stack conditions)	10	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	4.8	m^3/s		
Sulfuric Acid Mist (H2SO4 as SO3) Testing				
Test Period	11:08	-	12:35	
Sulfuric Acid Mist (H_2SO_4 as SO_3) Mass	26	mg		
Gas Volume Sampled	0.907	m^3		
Sulfuric Acid Mist (H_2SO_4 as SO_3) Emission*[1]	29	mg/m^3		
Sulfuric Acid Mist (H_2SO_4 as SO_3) Mass Emission Rate*[2]	140	mg/s		
Regulatory Limit	100	mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing				
Test Period	11:08	-	12:35	
Sulfur Dioxide (SO_2 as SO_3) Mass	210	mg		
Gas Volume Sampled	0.907	m^3		
Sulfur Dioxide (SO_2 as SO_3) Emission*[1]	230	mg/m^3		
Sulfur Dioxide (SO_2 as SO_3) Mass Emission Rate*[2]	1100	mg/s		
Regulatory Limit	N/A			
Moisture Content (%)	**9.1**			
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 21 Kiln 1 Elemental Hazardous Substances (Metals) Results

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	0.00015	0.00013	0.0023	0.002			0.002	0.0017	0.0088
Arsenic	0.0038	0.0033	0.00085	0.00074			0.005	0.0043	0.022
Beryllium	<0.0001	<0.000087	<0.0001	<0.000087			<0.000015	<0.000013	<0.000067
Cadmium	0.014	0.012	0.0097	0.0084			0.02	0.017	0.088
Chromium	0.019	0.017	0.00035	0.0003			0.02	0.017	0.088
Cobalt	<0.0001	<0.000087	<0.0001	<0.000087			<0.00015	<0.00013	<0.00067
Copper	0.015	0.013	<0.0006	<0.00052			0.015	0.013	0.067
Lead	0.045	0.039	0.00035	0.0003			0.05	0.043	0.22
Magnesium	0.055	0.048	0.00053	0.00046			0.06	0.052	0.27
Manganese	0.007	0.0061	<0.0071	<0.0062			0.007	0.0061	0.031
Mercury	<0.0001	<0.000087	<0.0001	<0.000087	<0.0005	<0.00043	<0.000025	<0.000022	<0.00011
Nickel	0.0018	0.0016	0.00035	0.0003			0.002	0.0017	0.0088
Selenium	0.0012	0.001	0.015	0.013			0.02	0.017	0.088
Thallium	0.0024	0.0021	<0.0001	<0.000087			0.0024	0.0021	0.011
Tin	0.0062	0.0054	0.0022	0.0019			0.008	0.007	0.036
Vanadium	0.0004	0.00035	<0.0001	<0.000087			0.0004	0.00035	0.0018
Zinc	1.4	1.2	0.0027	0.0023			1	0.87	4.5
Total Hazardous Metals*	**0.095**	**0.083**	**0.029**	**0.025**	**<0.0005**	**<0.00043**	**0.14**	**0.12**	**0.61**
Total Metals	**1.6**	**1.3**	**0.034**	**0.03**			**1.2**	**1.1**	**5.4**

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

Table 22 Kiln 2 Elemental Hazardous Substances (Metals) Results

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	0.00045	0.00039	0.00054	0.00047			0.001	0.00086	0.0044
Arsenic	0.014	0.012	0.0014	0.0012			0.02	0.017	0.087
Beryllium	<0.0001	<0.000086	<0.0001	<0.000086			<0.000015	<0.000013	<0.000067
Cadmium	0.021	0.018	0.006	0.0052			0.03	0.026	0.13
Chromium	0.022	0.019	0.0048	0.0041			0.03	0.026	0.13
Cobalt	<0.0001	<0.000086	<0.0001	<0.000086			<0.00015	<0.00013	<0.00067
Copper	0.0034	0.0029	0.00014	0.00012			0.004	0.0034	0.017
Lead	0.06	0.052	0.016	0.014			0.08	0.069	0.35
Magnesium	0.068	0.059	0.0023	0.002			0.07	0.06	0.31
Manganese	0.0094	0.0081	<0.0071	<0.0061			0.0094	0.0081	0.041
Mercury	0.00095	0.00082	0.0022	0.0019	0.0047	0.004	0.003	0.0026	0.013
Nickel	0.0024	0.0021	<0.0001	<0.000086			0.0024	0.0021	0.011
Selenium	0.0083	0.0071	0.0023	0.002			0.01	0.0086	0.044
Thallium	0.004	0.0034	0.0016	0.0014			0.006	0.0052	0.027
Tin	0.0065	0.0056	0.00055	0.00047			0.007	0.006	0.031
Vanadium	0.0004	0.00034	<0.0001	<0.000086			0.0004	0.00034	0.0017
Zinc	1.7	1.5	0.27	0.23			2	1.7	8.7
Total Hazardous Metals*	**0.14**	**0.12**	**0.035**	**0.03**	**0.0047**	**0.004**	**0.2**	**0.17**	**0.88**
Total Metals	**1.9**	**1.7**	**0.31**	**0.26**			**2.3**	**2**	**10**

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

Appendix A

Field Sheets and Final Calculations (190 pages)

Appendix A Field Sheets and Final Calculations (190 pages)

AECOM

NCIA

AECOM's Project Number: 60305580

Emission Source: Clay Prep

Date Sampled: 30-Oct-13

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

Observations made during testing period:

Sampling Performed By:

for James Lang

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Clay Prep
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Measurement/Observations

Stack Internal Dimensions:

Diameter 995 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area 0.78 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) = 15
No. Diameters = 15.1
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	44	14	44	14
2	145	115	145	115
3	295	265	295	265
4	700	670	700	670
5	850	820	850	820
6	951	921	951	921
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Clay Prep
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

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): 1.20 %

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:	20.6 %,(wet)
H_2O:	1.20 %(=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

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Clay Prep
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	12:10	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:10	0	20.9	0.0
2	12:11	0	20.9	0.0
3	12:12	0	20.9	0.0
4	12:13	0	20.9	0.0
5	12:14	0	20.9	0.0
6	12:15	0	20.9	0.0
7	12:16	0	20.9	0.0
8	12:17	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.58 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	77.8 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.58 %(=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

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Clay Prep
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	10:20	Barometric Pressure :		1014	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	0.147	25.0	298.2	13.3
1/2	115	0.167	25.0	298.2	14.1
1/3	265	0.167	25.0	298.2	14.1
1/4	670	0.152	25.0	298.2	13.5
1/5	820	0.162	25.0	298.2	13.9
1/6	921	0.147	25.0	298.2	13.3
2/1	14	0.172	24.0	297.2	14.3
2/2	115	0.177	25.0	298.2	14.6
2/3	265	0.167	25.0	298.2	14.1
2/4	670	0.152	25.0	298.2	13.5
2/5	820	0.147	24.0	297.2	13.3
2/6	921	0.118	24.0	297.2	11.9
Average			24.8	298.0	13.7

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 4 mm
Absolute pressure in stack (hPa) : 1014.39 hPa

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STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Clay Prep
Sample Nozzle No.: fine3
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.05 x $10^{-5}m^2$
Thimble No: T131
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 98.9198 Meter finish: 98.9198
Time start: 10:37 Time finish: 10:38

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 99.7390 Meter finish: 99.7390
Time start: 11:47 Time finish: 11:48

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 98.9206 Time start: 10:40
Meter correction factor (GMf) : 1.0129

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	44	13.6	38.0	30.0		Yes
1/2	0:05:15	145	13.6	39.0	32.0		Yes
1/3	0:05:15	295	13.6	41.0	32.0		Yes
1/4	0:05:00	700	13.6	41.0	33.0		Yes
1/5	0:05:00	850	13.6	43.0	34.0		Yes
1/6	0:04:45	951	13.6	44.0	34.0		Yes
2/1	0:05:15	44	13.6	39.0	33.0		Yes
2/2	0:05:15	145	13.6	42.0	33.0		Yes
2/3	0:05:15	295	13.6	43.0	34.0		Yes
2/4	0:05:00	700	13.6	45.0	34.0		Yes
2/5	0:04:45	850	13.6	49.0	34.0		Yes
2/6	0:04:30	951	13.6	49.0	35.0		Yes
Averages				42.8	33.2	no result	

Meter Finish: 99.7384 Time Finish: 11:45
Total Condensate collected: 0 ml Silica gel No(s) used: Z18

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STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Clay Prep
Sample Nozzle No.: s9
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.41 x $10^{-5}m^2$
Thimble No: T132
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 64.3390 Meter finish: 64.3390
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: 65.0502 Meter finish: 65.0502
Time start: 11:49 Time finish: 11:50

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 64.3396 Time start: 10:40
Meter correction factor (GMf) : 1.0159

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	11.4	34.0	26.0		Yes
1/2	0:10:00	145	12.1	33.0	26.0		Yes
1/3	0:15:00	295	12.1	33.0	26.0		Yes
1/4	0:20:00	700	11.6	33.0	26.0		Yes
1/5	0:25:00	850	11.9	34.0	25.0		Yes
1/6	0:30:00	951	11.4	34.0	25.0		Yes
2/1	0:35:00	44	12.3	35.0	26.0		Yes
2/2	0:40:00	145	12.5	34.0	26.0		Yes
2/3	0:45:00	295	12.1	34.0	25.0		Yes
2/4	0:50:00	700	11.6	34.0	25.0		Yes
2/5	0:55:00	850	11.4	33.0	24.0		Yes
2/6	1:00:00	951	10.2	31.0	24.0		Yes
Averages				33.5	25.3	no result	

Meter Finish: 65.0494 Time Finish: 11:43
Total Condensate collected: 0 ml Silica gel No(s) used: Z12

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

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Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Clay Prep
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	11:55	Barometric Pressure :		1014	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	0.157	25.0	298.2	13.7
1/2	115	0.167	25.0	298.2	14.2
1/3	265	0.172	25.0	298.2	14.4
1/4	670	0.162	25.0	298.2	13.9
1/5	820	0.147	25.0	298.2	13.3
1/6	921	0.147	25.0	298.2	13.3
2/1	14	0.167	25.0	298.2	14.2
2/2	115	0.181	25.0	298.2	14.8
2/3	265	0.186	26.0	299.2	15.0
2/4	670	0.177	26.0	299.2	14.6
2/5	820	0.162	26.0	299.2	14.0
2/6	921	0.137	26.0	299.2	12.9
Average			25.3	298.5	14.0

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 3 mm
Absolute pressure in stack (hPa) : 1014.29 hPa

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STACK ANALYSIS - PM10 CALCULATIONS

Date:	30-Oct-13	Client:	NCIA
AECOM's Project No:	60305560	Stack/Duct Description:	Clay Prep

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)	28.71

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	101400	29.93
Stack Static Pressure (Pg)	101429	29.94
Absolute Stack Pressure		29.94

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	25.3	77.6
Average Meter Temperature:	38.0	
Stack Gas Viscosity		182.6

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.45	0.0159	15.93	0.27

6. Nozzle Velocity, Rmin and Rmax

Nozzle Number	Nozzle Diameter	Nozzle Velocity		Rmin	Rmax	Vmin	Vmin	Vmax	Vmax
	(inches)	ft/sec	m/s	[-]	[-]	ft/sec	m/s	ft/sec	m/s
0	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1	0.135	75.17	24.74	0.754	1.232	56.66	18.59	92.59	30.38
2	0.157	55.59	18.30	0.725	1.249	40.33	13.23	69.46	22.79
3	0.201	34.06	11.21	0.629	1.300	21.41	7.02	44.28	14.53
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	0.220	28.57	9.40	0.559	1.328	15.97	5.24	37.93	12.44
7	0.243	23.36	7.69	0.402	1.369	11.68	3.83	31.98	10.49
8	0.261	20.30	6.68	#NUM!	1.404	10.15	3.33	28.49	9.35
9	0.292	16.16	5.32	#NUM!	1.476	8.08	2.65	23.84	7.82
10	0.341	11.89	3.91	#NUM!	1.607	5.94	1.95	17.83	5.85
11	0.391	9.04	2.98	#NUM!	1.766	4.52	1.48	13.56	4.45

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
3	0.201	0.005	0.000021	14.3

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STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 30-Oct-13 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Clay Prep

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

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
156.96	0.63	0.79	4.9
166.77	0.67	0.82	5.1
171.68	0.69	0.83	5.1
161.87	0.65	0.81	5.0
147.15	0.59	0.77	4.7
147.15	0.59	0.77	4.7
166.77	0.67	0.82	5.1
181.49	0.73	0.85	5.3
186.39	0.75	0.86	5.3
176.58	0.71	0.84	5.2
161.87	0.65	0.81	5.0
137.34	0.55	0.74	4.6
	Average	0.81	60.00
	Square	0.65	

Total time min	Full hours	Full minutes	Seconds
4.8	0	4	45
10.0	0	10	0
15.3	0	15	15
20.3	0	20	15
25.3	0	25	15
30.0	0	30	0
35.3	0	35	15
40.5	0	40	30
45.8	0	45	45
50.8	0	50	45
55.5	0	55	30
60.0	1	0	0

Aerodynamic Cut Size (u_{cyc})
183.5

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0125

Actual D_{50}
10.2

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STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 30-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Clay Prep

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.8283 m^3

Average gas meter temp. ($T_{M,2}$): 38.0 °C

311.2 K

Average barometric pressure (P_{BARO}) 1014 hPa

Average pressure at meter ($P_{M,2}$) 1014.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.7277 m^3

(B) PM10 concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T131

Blank weight: g

PM10 Weight 0.0004 g

Final PM10 Weight (Mp1): 0.00040 g

PM10 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: Z18

V_v = 67 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 ($V_{wsg(std)}$) = 0.0089

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

B_{ws} = 1.21 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED
Fine Particulate (PM10)

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(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 $\frac{(Ps)}{(1013.25)}$

= 1.174 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.66 m/s

(ii) Average of post-sampling velocities: 14.03 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 13.84 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 = 10.76 m^3/s (stack conditions)

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

Qstd = 9.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0054	g/s (0°C, dry gas, 1 atm pressure)		
	=	5.4	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0054	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	5.4	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.75	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	750	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 30-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Clay Prep

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.7211 m^3

Average gas meter temp. ($T_{M,2}$): 29.4 °C / 302.6 K

Average barometric pressure (P_{BARO}) 1014 hPa

Average pressure at meter ($P_{M,2}$) 1014.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.6515 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T132

Blank weight: g

Total Particulate Weight 0.0008 g

Final Total Particulate Weight (Mp1): 0.00080 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.0012 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 1.2 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0012 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 1.2 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.17 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 170 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z12

V_v = 9.7 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 ($V_{wsg(std)}$) = 0.0129

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

B_{ws} = 1.95 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED
Total Particulate

AECOM

(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 $\frac{(Ps)}{(1013.25)}$

= 1.183 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.66 m/s

(ii) Average of post-sampling velocities: 14.03 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.) 13.84 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 = 10.76 m^3/s (stack conditions)

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

Qstd = 9.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.012	g/s (0°C, dry gas, 1 atm pressure)		
	=	12	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.012	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	12	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, CLAY PREP
NCIA
30-Oct-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:			
Stack internal diameter at test location	995 mm		
Stack gas temperature (average)	25.0 °C		298.2 K
Stack pressure (average)	1014 hPa		
Stack gas velocity (average, stack conditions)	14 m/s		
Stack gas flowrate (stack conditions)	11 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	9.7 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	10:40	-	11:45
Fine Particulate (PM10) Mass	0.4 mg		
Gas Volume Sampled	0.728 m^3		
Fine Particulate (PM10) Emission*1	0.55 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	5.4 mg/s		
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	10:40	-	11:43
Total Particulate Mass	0.8 mg		
Gas Volume Sampled	0.652 m^3		
Total Particulate Emission*1	1.2 mg/m^3		
Total Particulate Mass Emission Rate*2	12 mg/s		
Regulatory Limit	20 mg/m^3		
Moisture Content (%)	1.9		
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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NCIA

AECOM's Project Number: 60305580

Emission Source: Kiln 2

Date Sampled: 3-Apr-14

ANALYTE(S)	**METHOD**
Sulfuric Acid Mist	NSW EPA TM - 3
Sulfur Dioxide	NSW EPA TM - 4

Observations made during testing period:

Sampling Performed By:

for Chad Whitburn

James Lang

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 3-Apr-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1: Sulfuric Acid Mist (H2SO4 as SO3)
Test 2: Sulfur Dioxide (SO2 as SO3)

Measurement/Observations

Stack Internal Dimensions:

Diameter 980 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area = 0.75 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 3
No. Diameters = 3.1
Type of Upstream Disturbance: Change in Diameter
Downstream (m) = 5
No. Diameters = 5.1
Type of Down Stream Disturbance: Bend

Total No. of sampling points = 16
PM2.5/10= NA
No. of sampling traverses/ports sampled = 2
PM2.5/10= NA
No. of sampling points on each traverse/port = 8
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	32	2		
2	103	73		
3	190	160		
4	317	287		
5	663	633		
6	790	760		
7	877	847		
8	948	918		
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: .....

AECOM

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 3-Apr-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1: Sulfuric Acid Mist (H2SO4 as SO3)
Test 2: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 10:36		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:36	124	15.7	2.9
2	10:37	124	15.4	3.1
3	10:38	124	15.4	3.1
4	10:39	124	15.4	3.1
5	10:40	124	15.4	3.1
6	10:41	124	15.4	3.1
7	10:42	124	15.4	3.1
8	10:43	124	15.4	3.1
	Averages:	124.0 ppm	15.4 %	3.1 %

Moisture content (M3): 0.95
Moisture percentage (M2): 5.10 %

Measurements

CO:	0.0124 %,(dry)	N_2:	81.5 %,(dry)
CO_2:	3.1 %,(dry)	O_2:	15.4 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0118 %,(wet)	N_2:	77.3 %,(wet)
CO_2:	2.9 %,(wet)	O_2:	14.7 %,(wet)
H_2O:	5.10 %(=M2)		

Therefore, stack gas density (GD) =	1.27 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)

AECOM

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 3-Apr-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1: Sulfuric Acid Mist (H2SO4 as SO3)
Test 2: Sulfur Dioxide (SO2 as SO3)

Sampling time start: 12:36		Sampling port No.: 1		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:36	122	16.3	2.6
2	12:37	122	16.3	2.6
3	12:38	122	16.3	2.6
4	12:39	122	16.3	2.6
5	12:40	122	16.3	2.6
6	12:41	122	16.3	2.6
7	12:42	122	16.3	2.6
8	12:43	122	16.3	2.6
	Averages:	122.0 ppm	16.3 %	2.6 %

Moisture content (M3): 0.91
Moisture percentage (M2): 9.12 %

Measurements

CO:	0.0122 %,(dry)	N_2:	81.1 %,(dry)
CO_2:	2.6 %,(dry)	O_2:	16.3 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0111 %,(wet)	N_2:	73.7 %,(wet)
CO_2:	2.4 %,(wet)	O_2:	14.8 %,(wet)
H_2O:	9.12 %(=M2)		
Therefore, stack gas density (GD) =	1.25 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)	

AECOM

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 3-Apr-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1:Sulfuric Acid Mist (H2SO4 as SO3)
Test 2:Sulfur Dioxide (SO2 as SO3)

Time :	10:30	Barometric Pressure :		1012	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	2	0.118	251.0	524.2	15.8
1/2	73	0.117	252.0	525.2	15.8
1/3	160	0.095	253.0	526.2	14.2
1/4	287	0.078	253.0	526.2	12.9
1/5	633	0.094	253.0	526.2	14.2
1/6	760	0.065	251.0	524.2	11.7
1/7	847	0.078	249.0	522.2	12.9
1/8	918	0.066	249.0	522.2	11.8
2/1	2	0.090	241.0	514.2	13.7
2/2	73	0.071	245.0	518.2	12.2
2/3	160	0.069	246.0	519.2	12.0
2/4	287	0.062	246.0	519.2	11.4
2/5	633	0.088	247.0	520.2	13.6
2/6	760	0.090	247.0	520.2	13.8
2/7	847	0.100	248.0	521.2	14.5
2/8	918	0.121	249.0	522.2	16.0
Average			248.8	522.0	13.5

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 5 mm
Absolute pressure in stack (hPa) : 1012.49 hPa

AECOM

STACK ANALYSIS

SAMPLING OF SULFURIC ACID MIST (H2SO4 AS SO3)

Date: 3-Apr-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 2
Sample Nozzle No.: s3
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.83 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 145.3682 Meter finish: 145.3682
Time start: 11:05 Time finish: 11:06

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 146.4056 Meter finish: 146.4056
Time start: 12:44 Time finish: 12:45

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1012 hPa (start); 1012 hPa (finish)
Meter start: 145.3738 Time start: 11:08
Meter correction factor (GMf) : 1.0114

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	32	15.0	37.0	35.0		Yes
1/2	0:10:00	103	15.0	38.0	35.0		Yes
1/3	0:15:00	190	13.5	39.0	36.0		Yes
1/4	0:20:00	317	12.2	40.0	36.0		Yes
1/5	0:25:00	663	13.5	41.0	36.0		Yes
1/6	0:30:00	790	11.1	44.0	38.0		Yes
1/7	0:35:00	877	12.3	44.0	38.0		Yes
1/8	0:40:00	948	11.3	44.0	38.0		Yes
2/1	0:45:00	32	13.3	43.0	38.0		Yes
2/2	0:50:00	103	11.7	44.0	38.0		Yes
2/3	0:55:00	190	11.5	43.0	38.0		Yes
2/4	1:00:00	317	10.9	43.0	38.0		Yes
2/5	1:05:00	663	13.0	43.0	38.0		Yes
2/6	1:10:00	790	13.2	43.0	38.0		Yes
2/7	1:15:00	877	13.9	44.0	39.0		Yes
2/8	1:20:00	948	15.3	44.0	40.0		Yes
Averages				42.1	37.4	no result	

Meter Finish: 146.4028 Time Finish: 12:35
Total Condensate collected: 55 ml Silica gel No(s) used: F27

AECOM

STACK ANALYSIS

SAMPLING OF SULFUR DIOXIDE (SO2 AS SO3)

Date: 3-Apr-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 2
Sample Nozzle No.: s3
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.83 x $10^{-5}m^2$
Thimble No: NA
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 145.3682 Meter finish: 145.3682
Time start: 11:05 Time finish: 11:06

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 146.4056 Meter finish: 146.4056
Time start: 12:44 Time finish: 12:45

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure; 1012 hPa (start); 1012 hPa (finish)
Meter start: 145.3738 Time start: 11:08
Meter correction factor (GMf) : 1.0114

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	32	15.0	37.0	35.0		Yes
1/2	0:10:00	103	15.0	38.0	35.0		Yes
1/3	0:15:00	190	13.5	39.0	36.0		Yes
1/4	0:20:00	317	12.2	40.0	36.0		Yes
1/5	0:25:00	663	13.5	41.0	36.0		Yes
1/6	0:30:00	790	11.1	44.0	38.0		Yes
1/7	0:35:00	877	12.3	44.0	38.0		Yes
1/8	0:40:00	948	11.3	44.0	38.0		Yes
2/1	0:45:00	32	13.3	43.0	38.0		Yes
2/2	0:50:00	103	11.7	44.0	38.0		Yes
2/3	0:55:00	190	11.5	43.0	38.0		Yes
2/4	1:00:00	317	10.9	43.0	38.0		Yes
2/5	1:05:00	663	13.0	43.0	38.0		Yes
2/6	1:10:00	790	13.2	43.0	38.0		Yes
2/7	1:15:00	877	13.9	44.0	39.0		Yes
2/8	1:20:00	948	15.3	44.0	40.0		Yes
Averages				42.1	37.4	no result	

Meter Finish: 146.4028 Time Finish: 12:35
Total Condensate collected: 55 ml Silica gel No(s) used: F27

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 3-Apr-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1:Sulfuric Acid Mist (H2SO4 as SO3)
Test 2:Sulfur Dioxide (SO2 as SO3)

Time :	12:36	Barometric Pressure :		1012	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.25	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	2	0.103	245.0	518.2	14.8
1/2	73	0.091	246.0	519.2	14.0
1/3	160	0.078	246.0	519.2	13.0
1/4	287	0.055	247.0	520.2	10.9
1/5	633	0.076	247.0	520.2	12.7
1/6	760	0.065	247.0	520.2	11.8
1/7	847	0.072	248.0	521.2	12.4
1/8	918	0.054	248.0	521.2	10.8
2/1	2	0.091	252.0	525.2	14.1
2/2	73	0.069	252.0	525.2	12.2
2/3	160	0.066	253.0	526.2	11.9
2/4	287	0.064	253.0	526.2	11.8
2/5	633	0.088	253.0	526.2	13.8
2/6	760	0.109	253.0	526.2	15.4
2/7	847	0.106	253.0	526.2	15.2
2/8	918	0.092	253.0	526.2	14.1
Average			249.8	523.0	13.1

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : 5 mm
Absolute pressure in stack (hPa) : 1012.49 hPa

AECOM

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-Apr-14 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Kiln 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.0407 m^3

Average gas meter temp. ($T_{M,2}$): 39.8 °C

313.0 K

Average barometric pressure (P_{BARO}) 1012 hPa

Average pressure at meter ($P_{M,2}$) 1012.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.9072 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 0.026 g

Final H2SO4 as SO3 Weight (Mp1): 0.02600 g

H2SO4 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ 0.029 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 29 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.8 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.12 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 120 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 15.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.079 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 79 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F27

V_v = 133 g (from laboratory report) V_w = 55 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0733

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0178

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

B_{ws} = 9.12 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfuric Acid Mist (H2SO4 as SO3)

AECOM

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.31 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 $\frac{(Ps)}{(1013.25)}$

= 0.684 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.53 m/s

(ii) Average of post-sampling velocities: 13.06 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 13.29 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 = 10.02 m^3/s (stack conditions)

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

Qstd = 4.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.14	g/s (0°C, dry gas, 1 atm pressure)		
	=	140	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.58	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	580	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.38	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	380	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

AECOM

STACK ANALYSIS - FINAL CALCULATIONS

Sulfur Dioxide (SO2 as SO3)

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

Date: 3-Apr-14 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Kiln 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.0407 m^3	Average barometric pressure (P_{BARO})	1012 hPa
Average gas meter temp. ($T_{M,2}$):	39.8 °C		
	313.0 K	Average pressure at meter ($P_{M,2}$)	1012.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.9072 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 0.21 g

Final SO2 as SO3 Weight (Mp1): 0.21000 g

SO2 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ 0.23 g/m^3 (0°C, dry gas, 1atm pressure)

;and $C_2 =$ 230 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.8 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.97 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and $C_{c1} =$ 970 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 15.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.63 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and $C_{b1} =$ 630 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F27

$V_v =$ 13.3 g (from laboratory report) $V_w =$ 55 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0733

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0178

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

$B_{ws} =$ 9.12 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED
Sulfur Dioxide (SO2 as SO3)

AECOM

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.31 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 $\frac{(Ps)}{(1013.25)}$

= 0.684 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.53 m/s

(ii) Average of post-sampling velocities: 13.06 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 13.29 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 = 10.02 m^3/s (stack conditions)

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

Qstd = 4.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	1.1	g/s (0°C, dry gas, 1 atm pressure)		
	=	1100	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	4.6	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	4600	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	3	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	3000	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

EMISSION MONITORING RESULTS, KILN 2
NCIA
3-Apr-14
SULFURIC ACID MIST (H2SO4 AS SO3)
SULFUR DIOXIDE (SO2 AS SO3)

Sampling Conditions:			
Stack internal diameter at test location	980 mm		
Stack gas temperature (average)	249.3 °C		522.5 K
Stack pressure (average)	1012 hPa		
Stack gas velocity (average, stack conditions)	13 m/s		
Stack gas flowrate (stack conditions)	10 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	4.8 m^3/s		
Sulfuric Acid Mist (H2SO4 as SO3) Testing			
Test Period	11:08	-	12:35
Sulfuric Acid Mist (H2SO4 as SO3) Mass	26 mg		
Gas Volume Sampled	0.907 m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	29 mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	140 mg/s		
Regulatory Limit	100 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing			
Test Period	11:08	-	12:35
Sulfur Dioxide (SO2 as SO3) Mass	210 mg		
Gas Volume Sampled	0.907 m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	230 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	1100 mg/s		
Regulatory Limit	N/A		
Moisture Content (%)	9.1		
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.

AECOM

NCIA

AECOM's Project Number: 60305580

Emission Source: Kiln 2

Date Sampled: 31-Jan-14

ANALYTE(S)	**METHOD**
Hazardous Substances (Metals)	NSW EPA TM - 12, 13 & 14

Observations made during testing period:

Sampling Performed By:

Chris Burns

Colin Clarke

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 31-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1: Hazardous Substances (Metals)

Measurement/Observations

Stack Internal Dimensions:

Diameter 980 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area = 0.75 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 3
No. Diameters = 3.1
Type of Upstream Disturbance: Change in Diameter
Downstream (m) = 5
No. Diameters = 5.1
Type of Down Stream Disturbance: Bend

Total No. of sampling points = 16
PM2.5/10= NA
No. of sampling traverses/ports sampled = 2
PM2.5/10= NA
No. of sampling points on each traverse/port = 8
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	32	2		
2	103	73		
3	190	160		
4	317	287		
5	663	633		
6	790	760		
7	877	847		
8	948	918		
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 31-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1: Hazardous Substances (Metals)

Sampling time start:	8:20	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	8:20	89	15.6	3.0
2	8:21	89	15.6	3.0
3	8:22	89	15.6	3.0
4	8:23	89	15.6	3.0
5	8:24	89	15.6	3.0
6	8:25	89	15.6	3.0
7	8:26	89	15.6	3.0
8	8:27	89	15.6	3.0
	Averages:	89.0 ppm	15.6 %	3.0 %

Moisture content (M3): 0.95
Moisture percentage (M2): 5.00 %

Measurements

CO:	0.0089 %,(dry)	N_2:	81.4 %,(dry)
CO_2:	3.0 %,(dry)	O_2:	15.6 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0085 %,(wet)	N_2:	77.3 %,(wet)
CO_2:	2.9 %,(wet)	O_2:	14.8 %,(wet)
H_2O:	5.00 %(=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)

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STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 31-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1: Hazardous Substances (Metals)

Sampling time start:	10:20	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:20	90	15.9	2.8
2	10:21	90	15.9	2.8
3	10:22	90	15.9	2.8
4	10:23	90	15.9	2.8
5	10:24	90	15.9	2.8
6	10:25	90	15.9	2.8
7	10:26	90	15.9	2.8
8	10:27	90	15.9	2.8
	Averages:	90.0 ppm	15.9 %	2.8 %

Moisture content (M3): 0.93
Moisture percentage (M2): 6.83 %

Measurements

CO:	0.0090 %,(dry)	N_2:	81.3 %,(dry)
CO_2:	2.8 %,(dry)	O_2:	15.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0084 %,(wet)	N_2:	75.7 %,(wet)
CO_2:	2.6 %,(wet)	O_2:	14.8 %,(wet)
H_2O:	6.83 %(=M2)		
Therefore, stack gas density (GD) =	1.27 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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Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 31-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1:Hazardous Substances (Metals)

Time :	8:30	Barometric Pressure :		1014	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	2	0.117	175.0	448.2	14.6
1/2	73	0.125	175.0	448.2	15.0
1/3	160	0.084	175.0	448.2	12.4
1/4	287	0.076	175.0	448.2	11.7
1/5	633	0.077	175.0	448.2	11.8
1/6	760	0.080	176.0	449.2	12.1
1/7	847	0.067	177.0	450.2	11.0
1/8	918	0.065	180.0	453.2	10.9
2/1	2	0.092	167.0	440.2	12.8
2/2	73	0.091	168.0	441.2	12.8
2/3	160	0.080	169.0	442.2	12.0
2/4	287	0.080	172.0	445.2	12.0
2/5	633	0.081	174.0	447.2	12.1
2/6	760	0.110	178.0	451.2	14.2
2/7	847	0.104	183.0	456.2	13.9
2/8	918	0.092	185.0	458.2	13.1
Average			175.3	448.5	12.7

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -3.2 mm
Absolute pressure in stack (hPa) : 1013.69 hPa

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STACK ANALYSIS

SAMPLING OF HAZARDOUS SUBSTANCES (METALS)

Date: 31-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 2
Sample Nozzle No.: g6
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.81 x $10^{-5}m^2$
Thimble No: 0
Blank thimble No: 0

Leak Check (Pre-Sampling)
Meter start: 118.6026 Meter finish: 118.6026
Time start: 8:42 Time finish: 8:43

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 119.8903 Meter finish: 119.8903
Time start: 10:19 Time finish: 10:20

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 118.6039 Time start: 8:47
Meter correction factor (GMf) : 1.0129

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	0:05:36	32	16.1	31.0	20.0		Yes
1/2	0:11:12	103	16.6	34.0	22.0		Yes
1/3	0:16:48	190	13.7	35.0	23.0		Yes
1/4	0:22:24	317	12.9	35.0	23.0		Yes
1/5	0:28:00	663	13.0	37.0	25.0		Yes
1/6	0:33:36	790	13.3	38.0	25.0		Yes
1/7	0:39:12	877	12.1	39.0	25.0		Yes
1/8	0:44:48	948	11.9	40.0	26.0		Yes
2/1	0:50:24	32	14.4	42.0	26.0		Yes
2/2	0:56:00	103	14.4	44.0	26.0		Yes
2/3	1:01:36	190	13.4	45.0	27.0		Yes
2/4	1:07:12	317	13.3	47.0	27.0		Yes
2/5	1:12:48	663	13.4	47.0	27.0		Yes
2/6	1:18:24	790	15.6	48.0	27.0		Yes
2/7	1:24:00	877	15.1	48.0	28.0		Yes
2/8	1:29:36	948	14.2	48.0	28.0		Yes
Averages				41.1	25.3	no result	

Meter Finish: 119.8883 Time Finish: 10:17
Total Condensate collected: 62 ml Silica gel No(s) used: T2

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Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

Date: 31-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 2
Test 1:Hazardous Substances (Metals)

Time :	10:30	Barometric Pressure :		1014	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	2	0.087	181.0	454.2	12.7
1/2	73	0.089	181.0	454.2	12.9
1/3	160	0.093	182.0	455.2	13.2
1/4	287	0.075	182.0	455.2	11.8
1/5	633	0.050	183.0	456.2	9.7
1/6	760	0.069	183.0	456.2	11.3
1/7	847	0.064	184.0	457.2	10.9
1/8	918	0.062	185.0	458.2	10.8
2/1	2	0.084	183.0	456.2	12.5
2/2	73	0.079	183.0	456.2	12.2
2/3	160	0.064	184.0	457.2	10.9
2/4	287	0.059	185.0	458.2	10.5
2/5	633	0.060	185.0	458.2	10.6
2/6	760	0.077	186.0	459.2	12.1
2/7	847	0.089	186.0	459.2	12.9
2/8	918	0.093	187.0	460.2	13.2
Average			183.8	457.0	11.8

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -4.1 mm
Absolute pressure in stack (hPa) : 1013.60 hPa

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Stack Analysis - Hazardous Substances Elemental Analysis Results

Date: 31-Jan-14 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Kiln 2

	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	0.00045	0.00054			
Arsenic	0.014	0.0014			
Beryllium	<0.0001	<0.0001			
Cadmium	0.021	0.006			
Chromium	0.022	0.0048			
Cobalt	<0.0001	<0.0001			
Copper	0.0034	0.00014			
Lead	0.06	0.016			
Magnesium	0.068	0.0023			
Manganese	0.0094	<0.0071			
Mercury	0.00095	0.0022	<0.0001	0.0047	<0.0005
Nickel	0.0024	<0.0001			
Selenium	0.0083	0.0023			
Thallium	0.004	0.0016			
Tin	0.0065	0.00055			
Vanadium	0.0004	<0.0001			
Zinc	1.7	0.27			

Note: Where the blank has returned a less then 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: 31-Jan-14 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Kiln 2

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	0.00045	0.00039	0.00054	0.00047			0.001	0.00086	0.0044
Arsenic	0.014	0.012	0.0014	0.0012			0.02	0.017	0.087
Beryllium	<0.0001	<0.000086	<0.0001	<0.000086			<0.000015	<0.000013	<0.000067
Cadmium	0.021	0.018	0.006	0.0052			0.03	0.026	0.13
Chromium	0.022	0.019	0.0048	0.0041			0.03	0.026	0.13
Cobalt	<0.0001	<0.000086	<0.0001	<0.000086			<0.00015	<0.00013	<0.00067
Copper	0.0034	0.0029	0.00014	0.00012			0.004	0.0034	0.017
Lead	0.06	0.052	0.016	0.014			0.08	0.069	0.35
Magnesium	0.068	0.059	0.0023	0.002			0.07	0.06	0.31
Manganese	0.0094	0.0081	<0.0071	<0.0061			0.0094	0.0081	0.042
Mercury	0.00095	0.00082	0.0022	0.0019	0.0047	0.004	0.003	0.0026	0.013
Nickel	0.0024	0.0021	<0.0001	<0.000086			0.0024	0.0021	0.011
Selenium	0.0083	0.0071	0.0023	0.002			0.01	0.0086	0.044
Thallium	0.004	0.0034	0.0016	0.0014			0.006	0.0052	0.027
Tin	0.0065	0.0056	0.00055	0.00047			0.007	0.006	0.031
Vanadium	0.0004	0.00034	<0.0001	<0.000086			0.0004	0.00034	0.0017
Zinc	1.7	1.5	0.27	0.23			2	1.7	8.7
Total Hazardous Metals*	0.14	0.12	0.035	0.03	0.0047	0.004	0.2	0.17	0.88
Total Metals	1.9	1.7	0.31	0.26			2.3	2	10

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

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STACK ANALYSIS - FINAL CALCULATIONS

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

Date: 31-Jan-14 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Kiln 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.3010 m^3
Average gas meter temp. ($T_{M,2}$): 33.2 °C, 306.4 K
Average barometric pressure (P_{BARO}) 1014 hPa
Average pressure at meter ($P_{M,2}$) 1014.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.1609 m^3

(B) Metals concentration at standard conditions
Blank thimble No.: 0
Thimble No. used: 0
Blank weight: g
Metals Weight 0.0002 g
Final Metals Weight (Mp1): 0.00020 g
Metals Concentration (C1): $=M_{p1}/MV_4=$ 0.00017 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.17 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %
Average CO_2%: 2.9 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0007 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.7 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %
Average O_2%: 15.8 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.00045 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.45 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content
Silica Gel Number: T2
V_v = 11.5 g (from laboratory report)
V_w = 62 mL (=grams) (recorded on Laboratory Form 108)
Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0826
Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0154
Therefore, $B_{ws} = \frac{(V_{wc(std)}+V_{wsg(std)})}{(V_{wc(std)}+V_{wsg(std)}+V_{m(std)})}$

B_{ws} = 7.78 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hazardous Substances (Metals)

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

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

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

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

(iii) Gas density at stack conditions =

$$\text{(ii)} \times \frac{(273.2)}{(273.2+Ts)} \times \frac{(Ps)}{(1013.25)}$$

= 0.785 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.65 m/s

(ii) Average of post-sampling velocities: 11.76 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.)

12.21 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 = 9.21 m^3/s (stack conditions)

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

Qstd = 5.1 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm = C_{1a} x Qstd = 0.00087 g/s (0°C, dry gas, 1 atm pressure)
= 0.87 mg/s (0°C, dry gas, 1 atm pressure)

C_{1a} x Qstd = 0.0036 g/s (0°C, dry gas, 1 atm pressure 12% CO_2)
= 3.6 mg/s (0°C, dry gas, 1 atm pressure 12% CO_2)

C_{1a} x Qstd = 0.0023 g/s (0°C, dry gas, 1 atm pressure 7% O_2)
= 2.3 mg/s (0°C, dry gas, 1 atm pressure 7% O_2)

EMISSION MONITORING RESULTS, KILN 2
NCIA
31-Jan-14
HAZARDOUS SUBSTANCES (METALS)

Sampling Conditions:		
Stack internal diameter at test location	980 mm	
Stack gas temperature (average)	179.5 °C	452.7 K
Stack pressure (average)	1014 hPa	
Stack gas velocity (average, stack conditions)	12 m/s	
Stack gas flowrate (stack conditions)	9.2 m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	5.1 m^3/s	
Hazardous Substances (Metals) Testing		
Test Period	8:47	10:17
Hazardous Substances (Metals) Mass	0.2 mg	
Gas Volume Sampled	1.16 m^3	
Hazardous Substances (Metals) Emission*1	0.17 mg/m^3	
Hazardous Substances (Metals) Mass Emission Rate*2	0.87 mg/s	
Regulatory Limit	1 mg/m^3	
Moisture Content (%)	7.8	
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.

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NCIA

AECOM's Project Number: 60305580

Emission Source: Kiln 1

Date Sampled: 30-Jan-14

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:

for Chris Burns

Colin Clarke

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 30-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 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 980 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area 0.75 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 3
No. Diameters = 3.1
Type of Upstream Disturbance: Change in Diameter
Downstream (m) = 5
No. Diameters = 5.1
Type of Down Stream Disturbance: Bend

Total No. of sampling points = 16
PM2.5/10= NA
No. of sampling traverses/ports sampled = 2
PM2.5/10= NA
No. of sampling points on each traverse/port = 8
PM2.5/10= NA

Position of each sampling point, for each traverse:

Exclusion of any sample point numbers - comments:

No.	A Distance from wall	A S-type Pitot distances	B PM10/2.5 A Distance from wall	B PM2.5/10 B S-Type Pitot distances
1	32	2		
2	103	73		
3	190	160		
4	317	287		
5	663	633		
6	790	760		
7	877	847		
8	948	918		
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 30-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1
Test 1: Hazardous Substances (Metals)
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start:	8:15	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	8:15	27	17.5	1.9
2	8:16	27	17.5	1.9
3	8:17	27	17.5	1.9
4	8:18	27	17.5	1.9
5	8:19	27	17.5	1.9
6	8:20	27	17.5	1.9
7	8:21	27	17.5	1.9
8	8:22	27	17.5	1.9
	Averages:	27.0 ppm	17.5 %	1.9 %

Moisture content (M3): 0.95
Moisture percentage (M2): 5.00 %

Measurements

CO:	0.0027 %,(dry)	N_2:	80.6 %,(dry)
CO_2:	1.9 %,(dry)	O_2:	17.5 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0026 %,(wet)	N_2:	76.6 %,(wet)
CO_2:	1.8 %,(wet)	O_2:	16.6 %,(wet)
H_2O:	5.00 %(=M2)		
Therefore, stack gas density (GD) =		1.27 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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STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 30-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1
Test 1: Hazardous Substances (Metals)
Test 2: Sulfuric Acid Mist (H2SO4 as SO3)
Test 3: Sulfur Dioxide (SO2 as SO3)

Sampling time start:	9:45	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	9:45	42	16.9	2.3
2	9:46	42	16.9	2.3
3	9:47	42	16.9	2.3
4	9:48	42	16.9	2.3
5	9:49	42	16.9	2.3
6	9:50	42	16.9	2.3
7	9:51	42	16.9	2.3
8	9:52	42	16.9	2.3
	Averages:	42.0 ppm	16.9 %	2.3 %

Moisture content (M3): 0.97
Moisture percentage (M2): 3.22 %

Measurements

CO:	0.0042 %,(dry)	N_2:	80.8 %,(dry)
CO_2:	2.3 %,(dry)	O_2:	16.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0041 %,(wet)	N_2:	78.2 %,(wet)
CO_2:	2.2 %,(wet)	O_2:	16.4 %,(wet)
H_2O:	3.22 %(=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)	

AECOM

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 30-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1
Test 1:Hazardous Substances (Metals)
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	8:10	Barometric Pressure :		1014	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	2	0.099	277.0	550.2	14.9
1/2	73	0.116	276.0	549.2	16.1
1/3	160	0.116	274.0	547.2	16.0
1/4	287	0.104	273.0	546.2	15.2
1/5	633	0.066	268.0	541.2	12.0
1/6	760	0.077	266.0	539.2	12.9
1/7	847	0.083	266.0	539.2	13.5
1/8	918	0.065	263.0	536.2	11.9
2/1	2	0.098	253.0	526.2	14.5
2/2	73	0.131	256.0	529.2	16.8
2/3	160	0.127	259.0	532.2	16.5
2/4	287	0.114	271.0	544.2	15.9
2/5	633	0.090	266.0	539.2	14.1
2/6	760	0.095	261.0	534.2	14.4
2/7	847	0.079	260.0	533.2	13.1
2/8	918	0.049	261.0	534.2	10.3
Average			265.6	538.8	14.3

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -4.6 mm
Absolute pressure in stack (hPa) : 1013.55 hPa

AECOM

STACK ANALYSIS

SAMPLING OF HAZARDOUS SUBSTANCES (METALS)

Date: 30-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 1
Sample Nozzle No.: g6
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.81 x $10^{-5}m^2$
Thimble No: N/A
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 116.2148 Meter finish: 116.2148
Time start: 8:26 Time finish: 8:27

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 117.4945 Meter finish: 117.4945
Time start: 10:09 Time finish: 10:10

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 116.2160 Time start: 8:30
Meter correction factor (GMf) : 1.0129

Sampling Position No.	Stopwatch Time at Sampling Position	Distance from far wall (mm)	Isokinetic Flowrate (L/min)	Meter Inlet Temp. (°C)	Meter Outlet Temp. (°C)	Impinger Train Outlet Temp (°C)	Flowrate Attained (Y/N)
1/1	0:06:00	32	13.4	36.0	20.0		Yes
1/2	0:12:00	103	14.5	37.0	21.0		Yes
1/3	0:18:00	190	14.5	38.0	22.0		Yes
1/4	0:24:00	317	13.8	39.0	22.0		Yes
1/5	0:30:00	663	11.0	41.0	23.0		Yes
1/6	0:36:00	790	11.8	42.0	24.0		Yes
1/7	0:42:00	877	12.4	43.0	24.0		Yes
1/8	0:48:00	948	11.0	45.0	26.0		Yes
2/1	0:54:00	32	13.6	45.0	27.0		Yes
2/2	1:00:00	103	15.7	46.0	27.0		Yes
2/3	1:06:00	190	15.3	46.0	28.0		Yes
2/4	1:12:00	317	14.5	46.0	28.0		Yes
2/5	1:18:00	663	12.9	46.0	28.0		Yes
2/6	1:24:00	790	13.3	46.0	28.0		Yes
2/7	1:30:00	877	12.2	46.0	29.0		Yes
2/8	1:36:00	948	9.5	46.0	29.0		Yes
Averages				43.0	25.4	no result	

Meter Finish: 117.4930 Time Finish: 10:08
Total Condensate collected: 29 ml Silica gel No(s) used: F99

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STACK ANALYSIS

SAMPLING OF SULFURIC ACID MIST (H2SO4 AS SO3)

Date: 30-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 1
Sample Nozzle No.: old61
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 2.2 x 10^{-5} m^2
Thimble No: N/A
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 99.9936 Meter finish: 99.9936
Time start: 8:27 Time finish: 8:28

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 101.0339 Meter finish: 101.0339
Time start: 10:10 Time finish: 10:11

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 99.9966 Time start: 8:30
Meter correction factor (GMf) : 1.0159

Sampling Position No.	Stopwatch Time at Sampling Position	Distance from far wall (mm)	Isokinetic Flowrate (L/min)	Meter Inlet Temp. (°C)	Meter Outlet Temp. (°C)	Impinger Train Outlet Temp (°C)	Flowrate Attained (Y/N)
1/1	0:06:00	32	10.5	28.0	24.0		Yes
1/2	0:12:00	103	11.4	28.0	25.0		Yes
1/3	0:18:00	190	11.4	29.0	26.0		Yes
1/4	0:24:00	317	10.8	30.0	27.0		Yes
1/5	0:30:00	663	8.6	30.0	27.0		Yes
1/6	0:36:00	790	9.3	30.0	27.0		Yes
1/7	0:42:00	877	9.7	31.0	27.0		Yes
1/8	0:48:00	948	8.6	31.0	27.0		Yes
2/1	0:54:00	32	10.7	31.0	27.0		Yes
2/2	1:00:00	103	12.3	31.0	28.0		Yes
2/3	1:06:00	190	12.0	32.0	28.0		Yes
2/4	1:12:00	317	11.4	32.0	29.0		Yes
2/5	1:18:00	663	10.2	33.0	29.0		Yes
2/6	1:24:00	790	10.5	33.0	29.0		Yes
2/7	1:30:00	877	9.5	32.0	30.0		Yes
2/8	1:36:00	948	7.5	32.0	30.0		Yes
Averages				30.8	27.5	no result	

Meter Finish: 101.0324 Time Finish: 10:08
Total Condensate collected: 0 ml Silica gel No(s) used: Z11

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STACK ANALYSIS

#N/A

Date: 30-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 1
Sample Nozzle No.: old61
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.2 x 10^{-5} m^2
Thimble No: 0
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 99.9936 Meter finish: 99.9936
Time start: 8:27 Time finish: 8:28

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 101.0339 Meter finish: 101.0339
Time start: 10:10 Time finish: 10:11

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 99.9966 Time start: 8:30
Meter correction factor (GMf) : 1.0159

Sampling Position No.	Stopwatch Time at Sampling Position	Distance from far wall (mm)	Isokinetic Flowrate (L/min)	Meter Inlet Temp. (°C)	Meter Outlet Temp. (°C)	Impinger Train Outlet Temp (°C)	Flowrate Attained (Y/N)
1/1	0:06:00	32	10.5	28.0	24.0		Yes
1/2	0:12:00	103	11.4	28.0	25.0		Yes
1/3	0:18:00	190	11.4	29.0	26.0		Yes
1/4	0:24:00	317	10.8	30.0	27.0		Yes
1/5	0:30:00	663	8.6	30.0	27.0		Yes
1/6	0:36:00	790	9.3	30.0	27.0		Yes
1/7	0:42:00	877	9.7	31.0	27.0		Yes
1/8	0:48:00	948	8.6	31.0	27.0		Yes
2/1	0:54:00	32	10.7	31.0	27.0		Yes
2/2	1:00:00	103	12.3	31.0	28.0		Yes
2/3	1:06:00	190	12.0	32.0	28.0		Yes
2/4	1:12:00	317	11.4	32.0	29.0		Yes
2/5	1:18:00	663	10.2	33.0	29.0		Yes
2/6	1:24:00	790	10.5	33.0	29.0		Yes
2/7	1:30:00	877	9.5	32.0	30.0		Yes
2/8	1:36:00	948	7.5	32.0	30.0		Yes
Averages				30.8	27.5	no result	

Meter Finish: 101.0324 Time Finish: 10:08
Total Condensate collected: 0 ml Silica gel No(s) used: Z11

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 30-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1
Test 1:Hazardous Substances (Metals)
Test 2:Sulfuric Acid Mist (H2SO4 as SO3)
Test 3:Sulfur Dioxide (SO2 as SO3)

Time :	10:14	Barometric Pressure :		1014	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	2	0.094	280.0	553.2	14.5
1/2	73	0.096	281.0	554.2	14.7
1/3	160	0.103	281.0	554.2	15.2
1/4	287	0.099	282.0	555.2	14.9
1/5	633	0.075	282.0	555.2	12.9
1/6	760	0.093	283.0	556.2	14.5
1/7	847	0.078	281.0	554.2	13.2
1/8	918	0.070	279.0	552.2	12.5
2/1	2	0.106	278.0	551.2	15.3
2/2	73	0.127	278.0	551.2	16.8
2/3	160	0.139	278.0	551.2	17.6
2/4	287	0.103	279.0	552.2	15.1
2/5	633	0.089	279.0	552.2	14.1
2/6	760	0.093	278.0	551.2	14.4
2/7	847	0.075	278.0	551.2	12.9
2/8	918	0.057	278.0	551.2	11.2
Average			279.7	552.9	14.4

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -5.4 mm
Absolute pressure in stack (hPa) : 1013.47 hPa

AECOM

Stack Analysis - Hazardous Substances Elemental Analysis Results

Date: 30-Jan-14 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

	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	0.00015	0.0023			
Arsenic	0.0038	0.00085			
Beryllium	<0.0001	<0.0001			
Cadmium	0.014	0.0097			
Chromium	0.019	0.00035			
Cobalt	<0.0001	<0.0001			
Copper	0.015	<0.0006			
Lead	0.045	0.00035			
Magnesium	0.055	0.00053			
Manganese	0.007	<0.0071			
Mercury	<0.0001	<0.0001	<0.0001	<0.0005	<0.0005
Nickel	0.0018	0.00035			
Selenium	0.0012	0.015			
Thallium	0.0024	<0.0001			
Tin	0.0062	0.0022			
Vanadium	0.0004	<0.0001			
Zinc	1.4	0.0027			

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: 30-Jan-14 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

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	0.00015	0.00013	0.0023	0.002			0.002	0.0017	0.0088
Arsenic	0.0038	0.0033	0.00085	0.00074			0.005	0.0043	0.022
Beryllium	<0.0001	<0.000087	<0.0001	<0.000087			<0.000015	<0.000013	<0.000067
Cadmium	0.014	0.012	0.0097	0.0084			0.02	0.017	0.088
Chromium	0.019	0.017	0.00035	0.0003			0.02	0.017	0.088
Cobalt	<0.0001	<0.000087	<0.0001	<0.000087			<0.00015	<0.00013	<0.00067
Copper	0.015	0.013	<0.0006	<0.00052			0.015	0.013	0.067
Lead	0.045	0.039	0.00035	0.0003			0.05	0.043	0.22
Magnesium	0.055	0.048	0.00053	0.00046			0.06	0.052	0.27
Manganese	0.007	0.0061	<0.0071	<0.0062			0.007	0.0061	0.031
Mercury	<0.0001	<0.000087	<0.0001	<0.000087	<0.0005	<0.00043	<0.000025	<0.000022	<0.00011
Nickel	0.0018	0.0016	0.00035	0.0003			0.002	0.0017	0.0088
Selenium	0.0012	0.001	0.015	0.013			0.02	0.017	0.088
Thallium	0.0024	0.0021	<0.0001	<0.000087			0.0024	0.0021	0.011
Tin	0.0062	0.0054	0.0022	0.0019			0.008	0.007	0.036
Vanadium	0.0004	0.00035	<0.0001	<0.000087			0.0004	0.00035	0.0018
Zinc	1.4	1.2	0.0027	0.0023			1	0.87	4.5
Total Hazardous Metals*	0.095	0.083	0.029	0.025	<0.0005	<0.00043	0.14	0.12	0.61
Total Metals	1.6	1.3	0.034	0.03			1.2	1.1	5.4

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

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STACK ANALYSIS - FINAL CALCULATIONS

Hazardous Substances (Metals)

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

Date: 30-Jan-14 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.2935 m^3

Average gas meter temp. ($T_{M,2}$): 34.2 °C

307.4 K

Average barometric pressure (P_{BARO}) 1014 hPa

Average pressure at meter ($P_{M,2}$) 1014.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.1504 m^3

(B) Metals concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: N/A

Blank weight: g

Metals Weight 0.00014 g

Final Metals Weight (Mp1): 0.00014 g

Metals Concentration (C1): $=M_{p1}/MV_4=$ 0.00012 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.12 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00069 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.69 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 17.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.00044 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 0.44 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F99

V_v = 12.2 g (from laboratory report) V_w = 29 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0387

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0163

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

B_{ws} = 4.56 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Hazardous Substances (Metals)

AECOM

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.27 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 $\frac{(Ps)}{(1013.25)}$

= 0.636 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 14.26 m/s

(ii) Average of post-sampling velocities: 14.36 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 14.31 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 = 10.79 m^3/s (stack conditions)

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

Qstd = 5.2 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 =	0.0035	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	3.5	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.0023	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	2.3	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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STACK ANALYSIS - FINAL CALCULATIONS

Sulfuric Acid Mist (H2SO4 as SO3)

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

Date: 30-Jan-14 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.0523 m^3

Average gas meter temp. ($T_{M,2}$): 29.2 °C / 302.4 K

Average barometric pressure (P_{BARO}) 1014 hPa

Average pressure at meter ($P_{M,2}$) 1014.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.9514 m^3

(B) H2SO4 as SO3 concentration at standard conditions

Blank thimble No.: N/A Blank weight: <0.002 g

Thimble No. used: N/A H2SO4 as SO3 Weight <0.002 g

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

H2SO4 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ <0.0021 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <2.1 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.012 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

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

O_2 Basis 7 %

Average O_2%: 17.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.0077 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <7.7 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z11

V_v = 18.7 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 ($V_{wsg(std)}$) = 0.0250

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

B_{ws} = 2.56 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfuric Acid Mist (H2SO4 as SO3)

AECOM

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.25 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 $\frac{(Ps)}{(1013.25)}$

= 0.626 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 14.26 m/s

(ii) Average of post-sampling velocities: 14.36 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 14.31 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 = 10.79 m^3/s (stack conditions)

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

Qstd = 5.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	<0.011	g/s (0°C, dry gas, 1 atm pressure)		
	=	<11	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	<0.063	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	<63	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	<0.041	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	<41	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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STACK ANALYSIS - FINAL CALCULATIONS

Sulfur Dioxide (SO2 as SO3)

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

Date: 30-Jan-14 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.0523	m^3	Average barometric pressure (P_{BARO})	1014 hPa
Average gas meter temp. ($T_{M,2}$):	29.2	°C		
	302.4	K	Average pressure at meter ($P_{M,2}$)	1014.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.9514	m^3		

(B) SO2 as SO3 concentration at standard conditions

Blank thimble No.: N/A Blank weight: <0.010 g

Thimble No. used: 0 SO2 as SO3 Weight 0.02 g

Final SO2 as SO3 Weight (Mp1): 0.01500 g

SO2 as SO3 Concentration (C1): $=M_{p1}/MV_4=$ 0.016 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 16 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.091 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 91 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 17.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.059 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 59 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z11

V_v = 18.7 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 ($V_{wsg(std)}$) = 0.0250

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

B_{ws} = 2.56 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Sulfur Dioxide (SO2 as SO3)

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.25 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 $\frac{(Ps)}{(1013.25)}$

= 0.626 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 14.26 m/s

(ii) Average of post-sampling velocities: 14.36 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 14.31 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 = 10.79 m^3/s (stack conditions)

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

Qstd = 5.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.084	g/s (0°C, dry gas, 1 atm pressure)		
	=	84	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.48	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	480	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.31	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	310	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

EMISSION MONITORING RESULTS, KILN 1
NCIA
30-Jan-14
HAZARDOUS SUBSTANCES (METALS)
SULFURIC ACID MIST (H2SO4 AS SO3)
SULFUR DIOXIDE (SO2 AS SO3)

Sampling Conditions:			
Stack internal diameter at test location	980 mm		
Stack gas temperature (average)	272.7 °C		545.9 K
Stack pressure (average)	1014 hPa		
Stack gas velocity (average, stack conditions)	14 m/s		
Stack gas flowrate (stack conditions)	11 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	5.2 m^3/s		
Hazardous Substances (Metals) Testing			
Test Period	8:30	-	10:08
Hazardous Substances (Metals) Mass	0.14 mg		
Gas Volume Sampled	1.15 m^3		
Hazardous Substances (Metals) Emission*1	0.12 mg/m^3		
Hazardous Substances (Metals) Mass Emission Rate*2	0.62 mg/s		
Regulatory Limit	1 mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Testing			
Test Period	8:30	-	10:08
Sulfuric Acid Mist (H2SO4 as SO3) Mass	<2 mg		
Gas Volume Sampled	0.951 m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Emission*1	<2.1 mg/m^3		
Sulfuric Acid Mist (H2SO4 as SO3) Mass Emission Rate*2	<11 mg/s		
Regulatory Limit	100 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Testing			
Test Period	8:30	-	10:08
Sulfur Dioxide (SO2 as SO3) Mass	15 mg		
Gas Volume Sampled	0.951 m^3		
Sulfur Dioxide (SO2 as SO3) Emission*1	16 mg/m^3		
Sulfur Dioxide (SO2 as SO3) Mass Emission Rate*2	84 mg/s		
Regulatory Limit	N/A		
Moisture Content (%)	4.6		
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.

NCIA

AECOM's Project Number: 60305580

Emission Source: Kiln 1

Date Sampled: 29-Jan-14

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:

for Chris Burns

Nic Baldwin

Peter Waddingham

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 29-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Measurement/Observations

Stack Internal Dimensions:

Diameter 980 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area 0.75 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 3
No. Diameters = 3.1
Type of Upstream Disturbance: Change in Diameter
Downstream (m) = 5
No. Diameters = 5.1
Type of Down Stream Disturbance: Bend

Total No. of sampling points = 16
PM2.5/10= 12
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 8
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	32	2	43	13
2	103	73	143	113
3	190	160	290	260
4	317	287	690	660
5	663	633	837	807
6	790	760	937	907
7	877	847		
8	948	918		
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 29-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Sampling time start:	9:34	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	9:34	112	16.3	2.6
2	9:35	112	16.3	2.6
3	9:36	112	16.3	2.6
4	9:37	112	16.3	2.6
5	9:38	112	16.3	2.6
6	9:39	112	16.3	2.6
7	9:40	112	16.3	2.6
8	9:41	112	16.3	2.6
	Averages:	112.0 ppm	16.3 %	2.6 %

Moisture content (M3): 0.95
Moisture percentage (M2): 5.00 %

Measurements

CO:	0.0112 %,(dry)	N_2:	81.1 %,(dry)
CO_2:	2.6 %,(dry)	O_2:	16.3 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0106 %,(wet)	N_2:	77.0 %,(wet)
CO_2:	2.5 %,(wet)	O_2:	15.5 %,(wet)
H_2O:	5.00 %(=M2)		
Therefore, stack gas density (GD) =	1.27 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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STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 29-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate
Test 3: Total Fluoride

Sampling time start: 11:20		Sampling port No.: 0		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:20	98	16.0	2.8
2	11:21	98	16.0	2.8
3	11:22	98	16.0	2.8
4	11:23	98	16.0	2.8
5	11:24	98	16.0	2.8
6	11:25	98	16.0	2.8
7	11:26	98	16.0	2.8
8	11:27	98	16.0	2.8
	Averages:	98.0 ppm	16.0 %	2.8 %

Moisture content (M3): 0.96
Moisture percentage (M2): 3.52 %

Measurements

CO:	0.0098 %,(dry)	N_2:	81.2 %,(dry)
CO_2:	2.8 %,(dry)	O_2:	16.0 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0095 %,(wet)	N_2:	78.3 %,(wet)
CO_2:	2.7 %,(wet)	O_2:	15.4 %,(wet)
H_2O:	3.52 %(=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)	

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Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 29-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1

Test 2:Total Particulate
Test 3:Total Fluoride

Time :	9:40	Barometric Pressure :		1012	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	2	0.106	220.0	493.2	14.6
1/2	73	0.134	226.0	499.2	16.5
1/3	160	0.108	230.0	503.2	14.9
1/4	287	0.094	228.0	501.2	13.9
1/5	633	0.084	227.0	500.2	13.1
1/6	760	0.103	225.0	498.2	14.4
1/7	847	0.108	225.0	498.2	14.8
1/8	918	0.088	224.0	497.2	13.4
2/1	2	0.130	231.0	504.2	16.4
2/2	73	0.128	235.0	508.2	16.2
2/3	160	0.142	238.0	511.2	17.2
2/4	287	0.130	238.0	511.2	16.5
2/5	633	0.106	238.0	511.2	14.8
2/6	760	0.103	237.0	510.2	14.6
2/7	847	0.088	238.0	511.2	13.5
2/8	918	0.068	235.0	508.2	11.8
Average			230.9	504.1	14.8

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -8.5 mm
Absolute pressure in stack (hPa) : 1011.17 hPa

AECOM

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 29-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 1
Sample Nozzle No.: Fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.86 x $10^{-5}m^2$
Thimble No: T19
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 115.1218 Meter finish: 115.1218
Time start: 10:00 Time finish: 10:01

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 116.2078 Meter finish: 116.2078
Time start: 11:42 Time finish: 11:43

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1012 hPa (start); 1012 hPa (finish)
Meter start: 115.1220 Time start: 10:15
Meter correction factor (GMf) : 1.0129

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	0:07:15	43	13.3	34.0	26.0		Yes
1/2	0:06:45	143	13.3	37.0	26.0		Yes
1/3	0:06:45	290	13.3	39.0	26.0		Yes
1/4	0:06:30	690	13.3	40.0	27.0		Yes
1/5	0:06:15	837	13.3	43.0	29.0		Yes
1/6	0:06:15	937	13.3	44.0	30.0		Yes
2/1	0:07:00	43	13.3	45.0	31.0		Yes
2/2	0:07:45	143	13.3	47.0	31.0		Yes
2/3	0:08:00	290	13.3	47.0	33.0		Yes
2/4	0:06:15	690	13.3	48.0	34.0		Yes
2/5	0:05:45	837	13.3	48.0	35.0		Yes
2/6	0:05:30	937	13.3	50.0	35.0		Yes
Averages				43.5	30.3	no result	

Meter Finish: 116.2072 Time Finish: 11:36
Total Condensate collected: 13 ml Silica gel No(s) used: Z13

AECOM

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 29-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 1
Sample Nozzle No.: S3
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 2.83 x 10^{-5} m^2
Thimble No: T23
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 98.7856 Meter finish: 98.7856
Time start: 10:05 Time finish: 10:06

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 99.9921 Meter finish: 99.9921
Time start: 11:42 Time finish: 11:43

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1012 hPa (start); 1012 hPa (finish)
Meter start: 98.7860 Time start: 10:15
Meter correction factor (GMf) : 1.0159

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	32	14.8	28.0	26.0		Yes
1/2	0:10:00	103	16.5	30.0	26.0		Yes
1/3	0:15:00	190	14.8	31.0	26.0		Yes
1/4	0:20:00	317	13.9	32.0	26.0		Yes
1/5	0:25:00	663	13.1	32.0	26.0		Yes
1/6	0:30:00	790	14.4	34.0	27.0		Yes
1/7	0:35:00	877	14.8	35.0	28.0		Yes
1/8	0:40:00	948	13.5	35.0	29.0		Yes
2/1	0:45:00	32	16.3	36.0	30.0		Yes
2/2	0:50:00	103	15.9	37.0	30.0		Yes
2/3	0:55:00	190	16.8	37.0	30.0		Yes
2/4	1:00:00	317	16.1	37.0	31.0		Yes
2/5	1:05:00	663	14.5	37.0	31.0		Yes
2/6	1:10:00	790	14.3	38.0	32.0		Yes
2/7	1:15:00	877	13.2	39.0	32.0		Yes
2/8	1:20:00	948	11.6	39.0	32.0		Yes
Averages				34.8	28.9	no result	

Meter Finish: 99.9916 Time Finish: 11:36
Total Condensate collected: 11 ml Silica gel No(s) used: P31

AECOM

STACK ANALYSIS

SAMPLING OF TOTAL FLUORIDE

Date: 29-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Kiln 1
Sample Nozzle No.: old61
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sampie Nozzle Area (An): 2.2 x $10^{-5}m^2$
Thimble No: N/A
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 199.6120 Meter finish: 199.6120
Time start: 10:06 Time finish: 10:07

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 200.5251 Meter finish: 200.5251
Time start: 11:45 Time finish: 11:46

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1012 hPa (start); 1012 hPa (finish)
Meter start: 199.6122 Time start: 10:15
Meter correction factor (GMf) : 0.9932

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	32	11.2	35.0	25.0		Yes
1/2	0:10:00	103	12.6	36.0	25.0		Yes
1/3	0:15:00	190	11.2	37.0	25.0		Yes
1/4	0:20:00	317	10.5	38.0	26.0		Yes
1/5	0:25:00	663	9.9	39.0	27.0		Yes
1/6	0:30:00	790	11.0	41.0	28.0		Yes
1/7	0:35:00	877	11.3	41.0	28.0		Yes
1/8	0:40:00	948	10.2	41.0	28.0		Yes
2/1	0:45:00	32	12.4	43.0	29.0		Yes
2/2	0:50:00	103	12.1	45.0	30.0		Yes
2/3	0:55:00	190	12.8	45.0	30.0		Yes
2/4	1:00:00	317	12.3	46.0	31.0		Yes
2/5	1:05:00	663	11.0	46.0	31.0		Yes
2/6	1:10:00	790	10.9	46.0	31.0		Yes
2/7	1:15:00	877	10.0	47.0	32.0		Yes
2/8	1:20:00	948	8.8	47.0	32.0		Yes
Averages				42.1	28.6	no result	

Meter Finish: 200.5242 Time Finish: 11:36
Total Condensate collected: 10 ml Silica gel No(s) used: Z16

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 29-Jan-14
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Kiln 1

Test 2:Total Particulate
Test 3:Total Fluoride

Time :	11:40	Barometric Pressure :	1012	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	2	0.099	219.0	492.2	14.0
1/2	73	0.117	220.0	493.2	15.2
1/3	160	0.099	223.0	496.2	14.1
1/4	287	0.104	224.0	497.2	14.4
1/5	633	0.093	225.0	498.2	13.7
1/6	760	0.099	226.0	499.2	14.1
1/7	847	0.107	228.0	501.2	14.7
1/8	918	0.113	230.0	503.2	15.1
2/1	2	0.138	232.0	505.2	16.8
2/2	73	0.124	232.0	505.2	15.9
2/3	160	0.127	232.0	505.2	16.1
2/4	287	0.125	233.0	506.2	16.0
2/5	633	0.099	235.0	508.2	14.3
2/6	760	0.098	235.0	508.2	14.2
2/7	847	0.084	235.0	508.2	13.2
2/8	918	0.071	237.0	510.2	12.1
Average			229.1	502.3	14.6

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -7.5 mm
Absolute pressure in stack (hPa) : 1011.26 hPa

STACK ANALYSIS - PM10 CALCULATIONS

AECOM

Date:	29-Jan-14	Client:	NCIA
AECOM's Project No:	60305580	Stack/Duct Description:	Kiln 1

1. Gas Analysis

	%		
$\%CO_2$	2.8		
$\%O_2$	16.0		
$\%N_2+\%CO$	81.1		
Fraction Moisture Content, Bws	0.04	M_d=	0.96

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	29.07
Mol. Wt. of Stack Gas (wet)	28.51

3. Absolute Stack Pressure

	Pascals	In. Hg
Barometric Pressure (Pbar)	101200	29.88
Stack Static Pressure (Pg)	101126	29.85
Absolute Stack Pressure		29.85

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	226.8	440.3
Average Meter Temperature:	36.9	
Stack Gas Viscosity		276.7

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.80	0.0282	28.18	0.47

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	0.131	142.73	46.98	0.765	1.225	109.16	35.81	174.79	57.34
2	0.159	96.39	31.73	0.735	1.244	70.83	23.24	119.89	39.33
3	0.165	90.04	29.64	0.727	1.248	65.48	21.48	112.40	36.88
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.191	66.61	21.92	0.680	1.275	45.31	14.87	84.91	27.86
6	0.214	53.16	17.50	0.622	1.303	33.04	10.84	69.27	22.73
7	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	0.272	33.04	10.88	#NUM!	1.398	16.52	5.42	46.21	15.16
9	0.311	25.21	8.30	#NUM!	1.484	12.60	4.14	37.40	12.27
10	0.339	21.27	7.00	#NUM!	1.552	10.64	3.49	31.91	10.47
11	0.429	13.27	4.37	#NUM!	1.824	6.63	2.18	19.90	6.53

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
5	0.191	0.005	0.000019	14.4

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STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 29-Jan-14 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

7.Sampling Time Total Run Time 80 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
113.80	0.46	0.68	7.0
114.78	0.46	0.68	7.0
122.63	0.49	0.70	7.3
99.08	0.40	0.63	6.5
90.25	0.36	0.60	6.2
85.35	0.34	0.59	6.1
97.12	0.39	0.62	6.5
123.61	0.50	0.70	7.3
146.17	0.59	0.77	7.9
93.20	0.37	0.61	6.3
77.50	0.31	0.56	5.8
81.42	0.33	0.57	5.9
	Average	0.64	80.00
	Square	0.41	

Total time min	Full hours	Full minutes	Seconds
7.3	0	7	15
14.0	0	14	0
20.8	0	20	45
27.3	0	27	15
33.5	0	33	30
39.8	0	39	45
46.8	0	46	45
54.5	0	54	30
62.5	1	2	30
68.8	1	8	45
74.5	1	14	30
80.0	1	20	0

Aerodynamic Cut Size (u_{cyc})
274.8
PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0216
Actual D_{50}
10.3

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STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 29-Jan-14 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.0992	m^3	Average barometric pressure (P_{BARO})	1012 hPa
Average gas meter temp. ($T_{M,2}$):	36.9	°C		
	310.1	K	Average pressure at meter ($P_{M,2}$)	1012.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.9672	m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.:	N/A		Blank weight:	g
Thimble No. used:	T19		PM10 Weight	0.0032 g
Final PM10 Weight (Mp1):	0.00320	g		
PM10 Concentration (C1):		$=M_{p1}/MV_4=$	0.0033	g/m^3 (0°C, dry gas, 1atm pressure)
		;and C_2 =	3.3	mg/m^3 (0°C, dry gas, 1atm pressure)
CO_2 Basis	12 %			
Average CO_2%:	2.7 %			
Therefore, C_c:		$= C_a \times 12/CO_2\% =$	0.015	g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)
		;and C_{c1} =	15	mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)
O_2 Basis	18 %			
Average O_2%:	16.2 %			
Therefore, C_b:		$=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$	0.002	g/m^3 (0°C, dry gas, 1atm pressure, 18% O_2)
		;and C_{b1} =	2	mg/m^3 (0°C, dry gas, 1atm pressure, 18% O_2)

(C) Moisture content

Silica Gel Number: Z13

V_v = 16.6 g (from laboratory report) V_w = 13 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0173

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0222

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

B_{ws} = 3.92 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.26 kg/m^3 (0^oC, wet, 1 atm pressure)
1.30 kg/m^3 (0^oC, dry, 1 atm pressure)

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

= 0.684 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 14.50 m/s

(ii) Average of post-sampling velocities: 14.40 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 14.45 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 = 10.90 m^3/s (stack conditions)

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

Qstd = 5.7 m^3/s (0^oC, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.019	g/s (0^oC, dry gas, 1 atm pressure)		
	=	19	mg/s (0^oC, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.083	g/s (0^oC, dry gas, 1 atm pressure	12%	CO_2)
	=	83	mg/s (0^oC, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.012	g/s (0^oC, dry gas, 1 atm pressure	18%	O_2)
	=	12	mg/s (0^oC, dry gas, 1 atm pressure	18%	O_2)

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STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 29-Jan-14 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.2248 m^3

Average gas meter temp. ($T_{M,2}$): 31.8 °C

305.0 K

Average barometric pressure (P_{BARO}) 1012 hPa

Average pressure at meter ($P_{M,2}$) 1012.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.0957 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T23

Blank weight: g

Total Particulate Weight 0.0137 g

Final Total Particulate Weight (Mp1): 0.01370 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%: 2.7 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.058 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 58 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 18 %

Average O_2%: 16.2 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.008 g/m^3 (0°C, dry gas, 1atm pressure, 18% O_2)

;and C_{b1} = 8 mg/m^3 (0°C, dry gas, 1atm pressure, 18% O_2)

(C) Moisture content

Silica Gel Number: P31

V_v = 17.1 g (from laboratory report) V_w = 11 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0147

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0228

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

B_{ws} = 3.31 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

AECOM

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.26 kg/m^3 (0°C, wet, 1 atm pressure)
1.30 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.683 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 14.79 m/s

(ii) Average of post-sampling velocities: 14.62 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.) 14.70 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 = 11.09 m^3/s (stack conditions)

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

Qstd = 5.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.076	g/s (0°C, dry gas, 1 atm pressure)		
	=	76	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.34	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	340	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.047	g/s (0°C, dry gas, 1 atm pressure	18%	O_2)
	=	47	mg/s (0°C, dry gas, 1 atm pressure	18%	O_2)

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STACK ANALYSIS - FINAL CALCULATIONS

Total Fluoride

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

Date: 29-Jan-14 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Kiln 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.9058 m^3

Average gas meter temp. ($T_{M,2}$): 35.3 °C

308.5 K

Average barometric pressure (P_{BARO}) 1012 hPa

Average pressure at meter ($P_{M,2}$) 1012.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.8012 m^3

(B) Total Fluoride concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: N/A

Blank weight: <0.0001 g

Total Fluoride Weight 0.0036 g

Final Total Fluoride Weight (Mp1): 0.00355 g

Total Fluoride Concentration (C1): $=M_{p1}/MV_4=$ 0.0044 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 4.4 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 2.7 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.02 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 20 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 16.2 %

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: Z16

V_v = 10.6 g (from laboratory report) V_w = 10 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0133

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0142

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

B_{ws} = 3.32 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED
Total Fluoride

AECOM

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.26 kg/m^3 (0°C, wet, 1 atm pressure)
1.30 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 0.683 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 14.79 m/s

(ii) Average of post-sampling velocities: 14.62 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 14.70 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 = 11.09 m^3/s (stack conditions)

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

Qstd = 5.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm = C_{1a} x Qstd = 0.026 g/s (0°C, dry gas, 1 atm pressure)
= 26 mg/s (0°C, dry gas, 1 atm pressure)

C_{1a} x Qstd = 0.11 g/s (0°C, dry gas, 1 atm pressure 12% CO_2)
= 110 mg/s (0°C, dry gas, 1 atm pressure 12% CO_2)

C_{1a} x Qstd = 0.074 g/s (0°C, dry gas, 1 atm pressure 7% O_2)
= 74 mg/s (0°C, dry gas, 1 atm pressure 7% O_2)

EMISSION MONITORING RESULTS, KILN 1
NCIA
29-Jan-14
FINE PARTICULATE (PM10)
TOTAL PARTICULATE
TOTAL FLUORIDE

Sampling Conditions:		
Stack internal diameter at test location	980 mm	
Stack gas temperature (average)	229.6 °C	502.8 K
Stack pressure (average)	1011 hPa	
Stack gas velocity (average, stack conditions)	15 m/s	
Stack gas flowrate (stack conditions)	11 m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	5.8 m^3/s	
Fine Particulate (PM10) Testing		
Test Period	10:15 -	11:36
Fine Particulate (PM10) Mass	3.2 mg	
Gas Volume Sampled	0.967 m^3	
Fine Particulate (PM10) Emission*1 at 18% O2	2 mg/m^3	
Fine Particulate (PM10) Mass Emission Rate*2 at 18% O2	12 mg/s	
Regulatory Limit at 18% O2	N/A mg/m^3	
Total Particulate Testing		
Test Period	10:15 -	11:36
Total Particulate Mass	13.7 mg	
Gas Volume Sampled	1.1 m^3	
Total Particulate Emission*1 at 18% O2	8 mg/m^3	
Total Particulate Mass Emission Rate*2 at 18% O2	47 mg/s	
Regulatory Limit at 18% O2	20 mg/m^3	
Total Fluoride Testing		
Test Period	10:15 -	11:36
Total Fluoride Mass	3.55 mg	
Gas Volume Sampled	0.801 m^3	
Total Fluoride Emission*1	4.4 mg/m^3	
Total Fluoride Mass Emission Rate*2	26 mg/s	
Regulatory Limit	5 mg/m^3	
Moisture Content (%)	3.3	
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.

NCIA

AECOM's Project Number: 60305580

Emission Source: Selection Line

Date Sampled: 29-Oct-13

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

Observations made during testing period:

Sampling Performed By:

for Chris Burns

Nic Baldwin

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Selection Line
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Measurement/Observations

Stack Internal Dimensions:

Diameter 490 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area 0.19 m^2

Minimum No. of sampling points= 8

Distance from sampling plane to nearest disturbances:

Upstream (m) = 2
No. Diameters = 4.1
Type of Upstream Disturbance: Change in Diameter
Downstream (m) = 3
No. Diameters = 6.1
Type of Down Stream Disturbance: Change in Diameter

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	51	21	51	21
2	95	65	95	65
3	158	128	158	128
4	332	302	332	302
5	395	365	395	365
6	439	409	439	409
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Selection Line
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	12:55	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:55	0	20.9	0.0
2	12:56	0	20.9	0.0
3	12:57	0	20.9	0.0
4	12:58	0	20.9	0.0
5	12:59	0	20.9	0.0
6	13:00	0	20.9	0.0
7	13:01	0	20.9	0.0
8	13:02	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

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

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	77.8 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.60 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0^oC, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0^oC, dry, 1 atm pressure)	

AECOM

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Selection Line
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	14:02	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	14:02	0	20.9	0.0
2	14:03	0	20.9	0.0
3	14:04	0	20.9	0.0
4	14:05	0	20.9	0.0
5	14:06	0	20.9	0.0
6	14:07	0	20.9	0.0
7	14:08	0	20.9	0.0
8	14:09	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.97
Moisture percentage (M2): 2.74 %

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:	76.9 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.3 %,(wet)
H_2O:	2.74 %(=M2)		

Therefore, stack gas density (GD) =	1.27 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

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Selection Line
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	13:10	Barometric Pressure :		1000	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	21	0.017	38.0	311.2	4.6
1/2	65	0.015	38.0	311.2	4.3
1/3	128	0.017	38.0	311.2	4.6
1/4	302	0.014	39.0	312.2	4.2
1/5	365	0.013	38.0	311.2	4.0
1/6	409	0.012	39.0	312.2	3.9
2/1	21	0.015	39.0	312.2	4.3
2/2	65	0.015	40.0	313.2	4.3
2/3	128	0.015	40.0	313.2	4.3
2/4	302	0.013	41.0	314.2	4.0
2/5	365	0.013	41.0	314.2	4.0
2/6	409	0.014	41.0	314.2	4.2
Average			39.3	312.5	4.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -0.5 mm
Absolute pressure in stack (hPa) : 999.95 hPa

AECOM

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Selection Line
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.73 x $10^{-5}m^2$
Thimble No: T119
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 63.3612 Meter finish: 63.3612
Time start: 13:09 Time finish: 13:10

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 64.1978 Meter finish: 64.1978
Time start: 14:18 Time finish: 14:19

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1000 hPa (start); 1000 hPa (finish)
Meter start: 63.3620 Time start: 13:15
Meter correction factor (GMf) : 1.0159

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	51	13.9	40.0	35.0		Yes
1/2	0:05:00	95	13.9	41.0	35.0		Yes
1/3	0:05:30	158	13.9	43.0	35.0		Yes
1/4	0:05:00	332	13.9	45.0	36.0		Yes
1/5	0:04:45	395	13.9	45.0	36.0		Yes
1/6	0:04:30	439	13.9	46.0	37.0		Yes
2/1	0:05:00	51	13.9	47.0	37.0		Yes
2/2	0:05:00	95	13.9	48.0	38.0		Yes
2/3	0:05:15	158	13.9	48.0	38.0		Yes
2/4	0:04:45	332	13.9	48.0	38.0		Yes
2/5	0:04:45	395	13.9	48.0	38.0		Yes
2/6	0:05:00	439	13.9	48.0	38.0		Yes
Averages				45.6	36.8	no result	

Meter Finish: 64.1972 Time Finish: 14:16
Total Condensate collected: 0 ml Silica gel No(s) used: Z13

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STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Selection Line
Sample Nozzle No.: s18
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 4.47 x $10^{-5}m^2$
Thimble No: T117
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 282.6246 Meter finish: 282.6246
Time start: 13:10 Time finish: 13:11

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 283.2834 Meter finish: 283.2834
Time start: 14:19 Time finish: 14:20

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1000 hPa (start); 1000 hPa (finish)
Meter start: 282.6260 Time start: 13:15
Meter correction factor (GMf) : 0.9981

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	51	11.9	41.0	36.0		Yes
1/2	0:10:00	95	11.1	41.0	36.0		Yes
1/3	0:15:00	158	11.9	42.0	37.0		Yes
1/4	0:20:00	332	10.8	43.0	37.0		Yes
1/5	0:25:00	395	10.3	44.0	40.0		Yes
1/6	0:30:00	439	10.1	45.0	40.0		Yes
2/1	0:35:00	51	11.1	46.0	41.0		Yes
2/2	0:40:00	95	11.1	47.0	42.0		Yes
2/3	0:45:00	158	11.1	47.0	42.0		Yes
2/4	0:50:00	332	10.3	49.0	42.0		Yes
2/5	0:55:00	395	10.3	50.0	42.0		Yes
2/6	1:00:00	439	10.8	50.0	42.0		Yes
Averages				45.4	39.8	no result	

Meter Finish: 283.2826 Time Finish: 14:16
Total Condensate collected: 10 ml Silica gel No(s) used: P27

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Selection Line
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	14:02	Barometric Pressure :		1000	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	21	0.016	39.0	312.2	4.5
1/2	65	0.015	39.0	312.2	4.3
1/3	128	0.015	39.0	312.2	4.3
1/4	302	0.015	40.0	313.2	4.4
1/5	365	0.014	40.0	313.2	4.2
1/6	409	0.013	40.0	313.2	4.0
2/1	21	0.016	40.0	313.2	4.5
2/2	65	0.015	40.0	313.2	4.4
2/3	128	0.015	40.0	313.2	4.4
2/4	302	0.015	40.0	313.2	4.4
2/5	365	0.014	40.0	313.2	4.2
2/6	409	0.013	40.0	313.2	4.0
Average			39.8	313.0	4.3

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -0.5 mm
Absolute pressure in stack (hPa) : 999.95 hPa

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STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 29-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Selection Line

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.8485	m^3	Average barometric pressure (P_{BARO})	1000 hPa
Average gas meter temp. ($T_{M,2}$):	41.2	°C		
	314.4	K	Average pressure at meter ($P_{M,2}$)	1000.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7277	m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.: N/A Blank weight: g

Thimble No. used: T119 PM10 Weight 0.0005 g

Final PM10 Weight (Mp1): 0.00050 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ 0.00069 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.69 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00069 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.69 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.097 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 97 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z13

V_v = 7.9 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 ($V_{wsg(std)}$) = 0.0105

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

B_{ws} = 1.43 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

AECOM

(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 $\frac{(Ps)}{(1013.25)}$

= 1.104 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 4.23 m/s

(ii) Average of post-sampling velocities: 4.30 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 4.26 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 = 0.80 m^3/s (stack conditions)

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

Qstd = 0.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.00047	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.47	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.00047	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.47	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.066	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	66	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

STACK ANALYSIS - FINAL CALCULATIONS

AECOM

Total Particulate

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

Date: 29-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Selection Line

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.6554 m^3

Average gas meter temp. ($T_{M,2}$): 42.6 °C

315.8 K

Average barometric pressure (P_{BARO}) 1000 hPa

Average pressure at meter ($P_{M,2}$) 1000.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.5596 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T117

Blank weight: g

Total Particulate Weight 0.0006 g

Final Total Particulate Weight (Mp1): 0.00060 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.0011 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 1.1 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0011 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 1.1 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.15 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 150 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P27

V_v = 7.7 g (from laboratory report) V_w = 10 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0133

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0103

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

B_{ws} = 4.05 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

AECOM

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

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

(ii) Re-calculated gas density based on moisture content in (c): 1.30 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.121 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 4.23 m/s

(ii) Average of post-sampling velocities: 4.30 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 4.26 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 = 0.80 m^3/s (stack conditions)

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

Qstd = 0.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.00073	g/s (0°C, dry gas, 1 atm pressure)		
	=	0.73	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.00073	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	0.73	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.1	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	100	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

EMISSION MONITORING RESULTS, SELECTION LINE
NCIA
29-Oct-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:			
Stack internal diameter at test location	490 mm		
Stack gas temperature (average)	39.5 °C		312.7 K
Stack pressure (average)	1000 hPa		
Stack gas velocity (average, stack conditions)	4.3 m/s		
Stack gas flowrate (stack conditions)	0.8 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	0.67 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	13:15	-	14:16
Fine Particulate (PM10) Mass	0.5 mg		
Gas Volume Sampled	0.728 m^3		
Fine Particulate (PM10) Emission*1	0.69 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	0.47 mg/s		
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	13:15	-	14:16
Total Particulate Mass	0.6 mg		
Gas Volume Sampled	0.56 m^3		
Total Particulate Emission*1	1.1 mg/m^3		
Total Particulate Mass Emission Rate*2	0.73 mg/s		
Regulatory Limit	20 mg/m^3		
Moisture Content (%)	4.0		
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.

AECOM

NCIA

AECOM's Project Number: 60305580

Emission Source: Spray Dryer

Date Sampled: 29-Oct-13

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

Observations made during testing period:

Sampling Performed By:

for Chris Burns

Nic Baldwin

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Spray Dryer
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Measurement/Observations

Stack Internal Dimensions:

Diameter 1385 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area 1.51 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 5
No. Diameters = 3.6
Type of Upstream Disturbance: Fan
Downstream (m) = 10
No. Diameters = 7.2
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 16
PM2.5/10= 12
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 8
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	46	16	61	31
2	145	115	202	172
3	269	239	410	380
4	447	417	975	945
5	938	908	1183	1153
6	1116	1086	1324	1294
7	1240	1210		
8	1339	1309		
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Spray Dryer
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

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	24	18.7	1.2
2	10:01	24	18.7	1.2
3	10:02	24	18.7	1.2
4	10:03	24	18.7	1.2
5	10:04	24	18.7	1.2
6	10:05	24	18.7	1.2
7	10:06	24	18.7	1.2
8	10:07	24	18.7	1.2
	Averages:	24.0 ppm	18.7 %	1.2 %

Moisture content (M3): 0.89
Moisture percentage (M2): 11.00 %

Measurements

CO:	0.0024 %,(dry)	N_2:	80.1 %,(dry)
CO_2:	1.2 %,(dry)	O_2:	18.7 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0021 %,(wet)	N_2:	71.3 %,(wet)
CO_2:	1.1 %,(wet)	O_2:	16.6 %,(wet)
H_2O:	11.00 %(=M2)		

Therefore, stack gas density (GD) =	1.24 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

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Spray Dryer
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	11:35	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:35	25	18.7	1.2
2	11:36	25	18.7	1.2
3	11:37	25	18.7	1.2
4	11:38	25	18.7	1.2
5	11:39	25	18.7	1.2
6	11:40	25	18.7	1.2
7	11:41	25	18.7	1.2
8	11:42	25	18.7	1.2
	Averages:	25.0 ppm	18.7 %	1.2 %

Moisture content (M3): 0.91
Moisture percentage (M2): 9.35 %

Measurements

CO:	0.0025 %,(dry)	N_2:	80.1 %,(dry)
CO_2:	1.2 %,(dry)	O_2:	18.7 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0023 %,(wet)	N_2:	72.6 %,(wet)
CO_2:	1.1 %,(wet)	O_2:	17.0 %,(wet)
H_2O:	9.35 %(=M2)		
Therefore, stack gas density (GD) =		1.25 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)

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Spray Dryer

Test 2:Total Particulate

Time :	9:45	Barometric Pressure :		1002	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.24	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	16	0.387	85.0	358.2	24.2
1/2	115	0.349	89.0	362.2	23.1
1/3	239	0.389	90.0	363.2	24.4
1/4	417	0.331	90.0	363.2	22.5
1/5	908	0.134	89.0	362.2	14.3
1/6	1086	0.166	89.0	362.2	15.9
1/7	1210	0.159	89.0	362.2	15.6
1/8	1309	0.142	88.0	361.2	14.7
2/1	16	0.392	89.0	362.2	24.5
2/2	115	0.451	89.0	362.2	26.3
2/3	239	0.412	89.0	362.2	25.1
2/4	417	0.353	89.0	362.2	23.2
2/5	908	0.235	89.0	362.2	19.0
2/6	1086	0.177	89.0	362.2	16.4
2/7	1210	0.177	89.0	362.2	16.4
2/8	1309	0.147	88.0	361.2	15.0
Average			88.8	362.0	20.0

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -16.5 mm
Absolute pressure in stack (hPa) : 1000.38 hPa

AECOM

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Spray Dryer
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.73 x 10^{-5} m^2
Thimble No: T106
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 62.5942 Meter finish: 62.5942
Time start: 10:29 Time finish: 10:30

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 63.3588 Meter finish: 63.3588
Time start: 12:05 Time finish: 12:06

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1002 hPa (start); 1002 hPa (finish)
Meter start: 62.5994 Time start: 10:43
Meter correction factor (GMf) : 1.0159

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	61	10.8	28.0	26.0		Yes
1/2	0:07:45	202	10.8	30.0	26.0		Yes
1/3	0:07:30	410	10.8	30.0	26.0		Yes
1/4	0:05:45	975	10.8	32.0	26.0		Yes
1/5	0:06:00	1183	10.8	32.0	27.0		Yes
1/6	0:05:00	1324	10.8	34.0	27.0		Yes
2/1	0:08:30	61	10.8	36.0	27.0		Yes
2/2	0:08:30	202	10.8	36.0	28.0		Yes
2/3	0:07:30	410	10.8	37.0	30.0		Yes
2/4	0:05:45	975	10.8	37.0	30.0		Yes
2/5	0:05:15	1183	10.8	37.0	31.0		Yes
2/6	0:05:15	1324	10.8	37.0	31.0		Yes
Averages				33.8	27.9	no result	

Meter Finish: 63.3578 Time Finish: 12:03
Total Condensate collected: 40 ml Silica gel No(s) used: FA6

AECOM

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Spray Dryer
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.26 x 10^{-5} m^2
Thimble No: T104
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 281.2658 Meter finish: 281.2658
Time start: 10:28 Time finish: 10:29

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 282.0228 Meter finish: 282.0228
Time start: 12:06 Time finish: 12:07

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1002 hPa (start); 1002 hPa (finish)
Meter start: 281.2685 Time start: 10:43
Meter correction factor (GMf) : 0.9981

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	46	13.9	28.0	28.0		Yes
1/2	0:10:00	145	13.1	30.0	28.0		Yes
1/3	0:15:00	269	13.8	32.0	28.0		Yes
1/4	0:20:00	447	12.7	32.0	30.0		Yes
1/5	0:25:00	938	8.1	34.0	30.0		Yes
1/6	0:30:00	1116	9.0	34.0	30.0		Yes
1/7	0:35:00	1240	8.8	34.0	32.0		Yes
1/8	0:40:00	1339	8.4	34.0	32.0		Yes
2/1	0:45:00	46	13.9	36.0	32.0		Yes
2/2	0:50:00	145	14.9	36.0	32.0		Yes
2/3	0:55:00	269	14.2	36.0	34.0		Yes
2/4	1:00:00	447	13.2	38.0	34.0		Yes
2/5	1:05:00	938	10.8	38.0	34.0		Yes
2/6	1:10:00	1116	9.3	38.0	34.0		Yes
2/7	1:15:00	1240	9.3	38.0	34.0		Yes
2/8	1:20:00	1339	8.5	38.0	34.0		Yes
Averages				34.8	31.6	no result	

Meter Finish: 282.0220 Time Finish: 12:03
Total Condensate collected: 46 ml Silica gel No(s) used: F24

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 29-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Spray Dryer

Test 2:Total Particulate

Time :	11:50	Barometric Pressure :		1002	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.25	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	16	0.384	87.0	360.2	24.1
1/2	115	0.369	88.0	361.2	23.6
1/3	239	0.394	89.0	362.2	24.5
1/4	417	0.350	89.0	362.2	23.1
1/5	908	0.138	90.0	363.2	14.5
1/6	1086	0.169	90.0	363.2	16.0
1/7	1210	0.161	90.0	363.2	15.7
1/8	1309	0.132	90.0	363.2	14.2
2/1	16	0.404	89.0	362.2	24.8
2/2	115	0.444	89.0	362.2	26.0
2/3	239	0.424	89.0	362.2	25.4
2/4	417	0.364	90.0	363.2	23.6
2/5	908	0.246	90.0	363.2	19.4
2/6	1086	0.176	90.0	363.2	16.4
2/7	1210	0.181	90.0	363.2	16.6
2/8	1309	0.150	90.0	363.2	15.1
Average			89.4	362.6	20.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -17 mm
Absolute pressure in stack (hPa) : 1000.33 hPa

AECOM

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 29-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Spray Dryer

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.7705 m^3

Average gas meter temp. ($T_{M,2}$): 30.9 °C

304.1 K

Average barometric pressure (P_{BARO}) 1002 hPa

Average pressure at meter ($P_{M,2}$) 1002.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.6845 m^3

(B) PM10 concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T106

Blank weight: g

PM10 Weight 0.0043 g

Final PM10 Weight (Mp1): 0.00430 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ 0.0063 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 6.3 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 1.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.063 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 63 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 18.7 %

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: FA6

V_v = 9.6 g (from laboratory report) V_w = 40 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0533

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0128

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

B_{ws} = 8.81 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED
Fine Particulate (PM10)

AECOM

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

(i) Initial gas density for sampling: 1.24 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.22 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 $\frac{(Ps)}{(1013.25)}$

= 0.908 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 20.51 m/s

(ii) Average of post-sampling velocities: 20.36 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 20.43 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 = 30.78 m^3/s (stack conditions)

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

Qstd = 20.9 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.13	g/s (0°C, dry gas, 1 atm pressure)		
	=	130	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	1.3	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	1300	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.8	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	800	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

AECOM

STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 29-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Spray Dryer

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.7521 m^3

Average gas meter temp. ($T_{M,2}$): 33.2 °C / 306.4 K

Average barometric pressure (P_{BARO}) 1002 hPa

Average pressure at meter ($P_{M,2}$) 1002.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.6632 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T104

Blank weight: g

Total Particulate Weight 0.0083 g

Final Total Particulate Weight (Mp1): 0.00830 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%: 1.2 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.13 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 130 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 18.7 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.079 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 79 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: F24

V_v = 8.6 g (from laboratory report) V_w = 46 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0613

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0115

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

B_{ws} = 9.89 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED
Total Particulate

AECOM

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

(i) Initial gas density for sampling: 1.24 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.23 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 $\frac{(Ps)}{(1013.25)}$

= 0.916 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 20.04 m/s

(ii) Average of post-sampling velocities: 20.19 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 20.11 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 = 30.30 m^3/s (stack conditions)

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

Qstd = 20.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.26	g/s (0°C, dry gas, 1 atm pressure)		
	=	260	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	2.6	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	2600	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, SPRAY DRYER
NCIA
29-Oct-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:		
Stack internal diameter at test location	1385 mm	
Stack gas temperature (average)	89.1 °C	362.3 K
Stack pressure (average)	1000 hPa	
Stack gas velocity (average, stack conditions)	20 m/s	
Stack gas flowrate (stack conditions)	31 m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	21 m^3/s	
Fine Particulate (PM10) Testing		
Test Period	10:43 -	12:03
Fine Particulate (PM10) Mass	4.3 mg	
Gas Volume Sampled	0.685 m^3	
Fine Particulate (PM10) Emission*1	6.3 mg/m^3	
Fine Particulate (PM10) Mass Emission Rate*2	130 mg/s	
Regulatory Limit	N/A	
Total Particulate Testing		
Test Period	10:43 -	12:03
Total Particulate Mass	8.3 mg	
Gas Volume Sampled	0.663 m^3	
Total Particulate Emission*1	13 mg/m^3	
Total Particulate Mass Emission Rate*2	260 mg/s	
Regulatory Limit	20 mg/m^3	
Moisture Content (%)	9.9	
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.

NCIA

AECOM's Project Number: 60305580

Emission Source: Pressing & Drying

Date Sampled: 30-Oct-13

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

Observations made during testing period:

Sampling Performed By:

Nic Baldwin

Colin Clarke

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Pressing & Drying
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

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) = 4
No. Diameters = 4.0
Type of Upstream Disturbance: Fan
Downstream (m) = 20
No. Diameters = 20.0
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 16
PM2.5/10= 12
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 8
PM2.5/10= 6

Position of each sampling point, for each traverse:

Exclusion of any sample point numbers - comments:

	A	B	PM10/2.5 A	PM2.5/10 B
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot distances
1	33	3	44	14
2	105	75	146	116
3	194	164	296	266
4	323	293	704	674
5	677	647	854	824
6	806	776	956	926
7	895	865		
8	967	937		
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Pressing & Drying
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	9:30	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	9:30	0	20.9	0.0
2	9:31	0	20.9	0.0
3	9:32	0	20.9	0.0
4	9:33	0	20.9	0.0
5	9:34	0	20.9	0.0
6	9:35	0	20.9	0.0
7	9:36	0	20.9	0.0
8	9:37	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.97
Moisture percentage (M2): 3.50 %

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:	76.3 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.2 %,(wet)
H_2O:	3.50 %(=M2)		

Therefore, stack gas density (GD) =	1.27 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

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Pressing & Drying
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	11:20	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:20	0	20.9	0.0
2	11:21	0	20.9	0.0
3	11:22	0	20.9	0.0
4	11:23	0	20.9	0.0
5	11:24	0	20.9	0.0
6	11:25	0	20.9	0.0
7	11:26	0	20.9	0.0
8	11:27	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.49 %

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:	1.49 %(=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)	

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Pressing & Drying

Test 2:Total Particulate

Time :	9:30	Barometric Pressure :		1014	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	3	0.092	38.0	311.2	10.8
1/2	75	0.108	38.0	311.2	11.7
1/3	164	0.129	38.0	311.2	12.8
1/4	293	0.152	38.0	311.2	13.9
1/5	647	0.134	38.0	311.2	13.0
1/6	776	0.141	38.0	311.2	13.4
1/7	865	0.120	38.0	311.2	12.3
1/8	937	0.103	37.0	310.2	11.4
2/1	3	0.129	35.0	308.2	12.7
2/2	75	0.157	36.0	309.2	14.0
2/3	164	0.181	36.0	309.2	15.1
2/4	293	0.163	36.0	309.2	14.3
2/5	647	0.131	36.0	309.2	12.9
2/6	776	0.119	36.0	309.2	12.2
2/7	865	0.092	36.0	309.2	10.8
2/8	937	0.091	36.0	309.2	10.7
Average			36.9	310.1	12.6

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -5.7 mm
Absolute pressure in stack (hPa) : 1013.44 hPa

AECOM

STACK ANALYSIS
SAMPLING OF FINE PARTICULATE (PM10)

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Pressing & Drying
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.73 x $10^{-5}m^2$
Thimble No: T110
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 171.6028 Meter finish: 171.6028
Time start: 9:51 Time finish: 9:52

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 172.6626 Meter finish: 172.6626
Time start: 11:32 Time finish: 11:33

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 171.6039 Time start: 10:08
Meter correction factor (GMf) : 0.9932

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	44	12.6	28.0	18.0		Yes
1/2	0:06:00	146	12.6	26.0	18.0		Yes
1/3	0:06:30	296	12.6	27.0	19.0		Yes
1/4	0:07:00	704	12.6	28.0	20.0		Yes
1/5	0:06:45	854	12.6	28.0	20.0		Yes
1/6	0:06:45	956	12.6	28.0	20.0		Yes
2/1	0:06:30	44	12.6	29.0	20.0		Yes
2/2	0:07:15	146	12.6	29.0	20.0		Yes
2/3	0:07:45	296	12.6	30.0	20.0		Yes
2/4	0:07:15	704	12.6	31.0	21.0		Yes
2/5	0:06:30	854	12.6	31.0	21.0		Yes
2/6	0:06:15	956	12.6	31.0	21.0		Yes
Averages				28.8	19.8	no result	

Meter Finish: 172.6600
Time Finish: 11:30
Total Condensate collected: 2 ml
Silica gel No(s) used: Z15

AECOM

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Pressing & Drying
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.26 x 10^{-5} m^2
Thimble No: T118
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 283.3315 Meter finish: 283.3315
Time start: 9:52 Time finish: 9:53

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 284.1056 Meter finish: 284.1056
Time start: 11:33 Time finish: 11:34

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 283.3363 Time start: 10:08
Meter correction factor (GMf) : 0.9981

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	33	7.6	20.0	20.0		Yes
1/2	0:10:00	105	8.2	20.0	20.0		Yes
1/3	0:15:00	194	9.0	21.0	20.0		Yes
1/4	0:20:00	323	9.8	21.0	21.0		Yes
1/5	0:25:00	677	9.1	21.0	21.0		Yes
1/6	0:30:00	806	9.4	22.0	21.0		Yes
1/7	0:35:00	895	8.6	23.0	22.0		Yes
1/8	0:40:00	967	8.0	24.0	22.0		Yes
2/1	0:45:00	33	9.0	24.0	22.0		Yes
2/2	0:50:00	105	9.9	24.0	22.0		Yes
2/3	0:55:00	194	10.7	24.0	22.0		Yes
2/4	1:00:00	323	10.1	24.0	22.0		Yes
2/5	1:05:00	677	9.1	24.0	22.0		Yes
2/6	1:10:00	806	8.6	24.0	22.0		Yes
2/7	1:15:00	895	7.6	24.0	22.0		Yes
2/8	1:20:00	967	7.6	24.0	22.0		Yes
Averages				22.8	21.4	no result	

Meter Finish: 284.1044 Time Finish: 11:30
Total Condensate collected: 3 ml Silica gel No(s) used: B66

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Pressing & Drying

Test 2:Total Particulate

Time :	11:22	Barometric Pressure :		1014	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.28	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.104	38.0	311.2	11.4
1/2	75	0.113	38.0	311.2	11.9
1/3	164	0.119	38.0	311.2	12.2
1/4	293	0.154	38.0	311.2	13.9
1/5	647	0.138	38.0	311.2	13.2
1/6	776	0.144	38.0	311.2	13.5
1/7	865	0.133	38.0	311.2	12.9
1/8	937	0.116	38.0	311.2	12.1
2/1	3	0.129	38.0	311.2	12.7
2/2	75	0.160	38.0	311.2	14.2
2/3	164	0.170	38.0	311.2	14.6
2/4	293	0.161	38.0	311.2	14.2
2/5	647	0.152	38.0	311.2	13.8
2/6	776	0.131	38.0	311.2	12.8
2/7	865	0.101	38.0	311.2	11.3
2/8	937	0.112	38.0	311.2	11.8
Average			38.0	311.2	12.9

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -6 mm
Absolute pressure in stack (hPa) : 1013.41 hPa

STACK ANALYSIS - PM10 CALCULATIONS

AECOM

Date:	30-Oct-13	Client:	NCIA
AECOM's Project No:	60305580	Stack/Duct Description:	Pressing & Drying

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)	28.46

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	101400	29.93
Stack Static Pressure (Pg)	101341	29.92
Absolute Stack Pressure		29.92

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	38.0	100.4
Average Meter Temperature:	24.3	
Stack Gas Viscosity		188.5

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.47	0.0167	16.70	0.28

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	0.131	84.57	27.84	0.759	1.228	64.22	21.07	103.88	34.08
2	0.159	57.40	18.89	0.725	1.250	41.61	13.65	71.74	23.54
3	0.165	52.85	17.39	0.714	1.256	37.73	12.38	66.38	21.78
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.185	42.20	13.89	0.675	1.278	28.48	9.34	53.92	17.69
6	0.216	30.93	10.18	0.579	1.320	17.90	5.87	40.84	13.40
7	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	0.267	20.22	6.66	#NUM!	1.415	10.11	3.32	28.62	9.39
9	0.306	15.48	5.10	#NUM!	1.505	7.74	2.54	23.22	7.62
10	0.339	12.60	4.15	#NUM!	1.596	6.30	2.07	18.91	6.20
11	0.431	7.79	2.56	#NUM!	1.902	3.89	1.28	11.68	3.83

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
5	0.185	0.005	0.000017	13.6

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STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 30-Oct-13 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Pressing & Drying

7.Sampling Time Total Run Time 80 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
105.95	0.43	0.65	5.7
112.82	0.45	0.67	5.9
167.75	0.67	0.82	7.2
154.02	0.62	0.79	6.9
138.32	0.56	0.75	6.6
144.21	0.58	0.76	6.7
129.49	0.52	0.72	6.3
159.90	0.64	0.80	7.0
169.71	0.68	0.83	7.3
160.88	0.65	0.80	7.1
152.06	0.61	0.78	6.9
131.45	0.53	0.73	6.4
	Average	0.76	80.00
	Square	0.57	

Total time min	Full hours	Full minutes	Seconds
5.5	0	5	30
11.5	0	11	30
18.0	0	18	0
25.0	0	25	0
31.8	0	31	45
38.5	0	38	30
45.0	0	45	0
52.3	0	52	15
60.0	1	0	0
67.3	1	7	15
73.8	1	13	45
80.0	1	20	0

Aerodynamic Cut Size (u_{cyc})
189.1

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

Actual D_{50}
10.3

AECOM

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 30-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Pressing & Drying

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.0489 m^3

Average gas meter temp. ($T_{M,2}$): 24.3 °C

297.5 K

Average barometric pressure (P_{BARO}) 1014 hPa

Average pressure at meter ($P_{M,2}$) 1014.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.9639 m^3

(B) PM10 concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T110

Blank weight: g

PM10 Weight 0.0027 g

Final PM10 Weight (Mp1): 0.00270 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ 0.0028 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 2.8 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0028 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%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.39 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 390 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z15

V_v = 7.3 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 ($V_{wsg(std)}$) = 0.0097

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

B_{ws} = 1.27 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED
Fine Particulate (PM10)

AECOM

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.25 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 $\frac{(Ps)}{(1013.25)}$

= 1.099 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.07 m/s

(ii) Average of post-sampling velocities: 13.40 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 13.23 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 = 10.39 m^3/s (stack conditions)

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

Qstd = 9.0 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 =	0.025	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	25	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	3.5	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	3500	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: 30-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Pressing & Drying

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.7666 m^3	Average barometric pressure (P_{BARO})	1014 hPa
Average gas meter temp. ($T_{M,2}$):	22.1 °C		
	295.3 K	Average pressure at meter ($P_{M,2}$)	1014.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.7098 m^3		

(B) Total Particulate concentration at standard conditions

Blank thimble No.:	N/A	Blank weight:	g
Thimble No. used:	T118	Total Particulate Weight	0.0085 g

Final Total Particulate Weight (Mp1): 0.00850 g

Total Particulate 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%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.012 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

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

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 1.7 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 1700 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: B66

V_v = 6.3 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 ($V_{wsg(std)}$) = 0.0084

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

B_{ws} = 1.72 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

AECOM

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.26 kg/m^3 (0°C, wet, 1 atm pressure)
1.29 kg/m^3 (0°C, dry, 1 atm pressure)

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

= 1.108 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 12.63 m/s

(ii) Average of post-sampling velocities: 12.91 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 12.77 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 = 10.03 m^3/s (stack conditions)

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

Qstd = 8.7 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.1	g/s (0°C, dry gas, 1 atm pressure)		
	=	100	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.1	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	100	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	15	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	15000	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

EMISSION MONITORING RESULTS, PRESSING & DRYING
NCIA
30-Oct-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:			
Stack internal diameter at test location	1000	mm	
Stack gas temperature (average)	37.5	°C	310.7 K
Stack pressure (average)	1013	hPa	
Stack gas velocity (average, stack conditions)	13	m/s	
Stack gas flowrate (stack conditions)	10	m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	8.8	m^3/s	
Fine Particulate (PM10) Testing			
Test Period	10:08	-	11:30
Fine Particulate (PM10) Mass	2.7	mg	
Gas Volume Sampled	0.964	m^3	
Fine Particulate (PM10) Emission*1	2.8	mg/m^3	
Fine Particulate (PM10) Mass Emission Rate*2	25	mg/s	
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	10:08	-	11:30
Total Particulate Mass	8.5	mg	
Gas Volume Sampled	0.71	m^3	
Total Particulate Emission*1	12	mg/m^3	
Total Particulate Mass Emission Rate*2	100	mg/s	
Regulatory Limit	20	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.

AECOM

NCIA

AECOM's Project Number: 60305580

Emission Source: Dryer 1

Date Sampled: 1-Nov-13

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

Observations made during testing period:

Sampling Performed By:

Nic Baldwin

for Peter Waddingham

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Measurement/Observations

Stack Internal Dimensions:

Diameter 490 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area 0.19 m^2

Minimum No. of sampling points= 8

Distance from sampling plane to nearest disturbances:

Upstream (m) = 4
No. Diameters = 8.2
Type of Upstream Disturbance: Fan
Downstream (m) = 10
No. Diameters = 20.4
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 8
PM2.5/10= 8
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 4
PM2.5/10= 4

Position of each sampling point, for each traverse:

Exclusion of any sample point numbers - comments:

	A	B	PM10/2.5 A	PM2.5/10 B
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot distances
1	33	3	33	3
2	123	93	123	93
3	368	338	368	338
4	457	427	457	427
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	9:20	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	9:20	180	19.0	1.1
2	9:21	183	19.0	1.1
3	9:22	181	19.0	1.1
4	9:23	180	19.0	1.1
5	9:24	179	19.0	1.1
6	9:25	175	19.0	1.1
7	9:26	171	19.0	1.1
8	9:27	176	19.0	1.1
	Averages:	178.1 ppm	19.0 %	1.1 %

Moisture content (M3): 0.94
Moisture percentage (M2): 6.40 %

Measurements

CO:	0.0178 %,(dry)	N_2:	79.9 %,(dry)
CO_2:	1.1 %,(dry)	O_2:	19.0 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0167 %,(wet)	N_2:	74.8 %,(wet)
CO_2:	1.0 %,(wet)	O_2:	17.8 %,(wet)
H_2O:	6.40 %(=M2)		
Therefore, stack gas density (GD) =	1.26 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

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	10:14	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	10:14	175	19.0	1.1
2	10:15	175	19.0	1.1
3	10:16	173	19.0	1.1
4	10:17	172	19.0	1.1
5	10:18	176	19.0	1.1
6	10:19	175	19.0	1.1
7	10:20	178	19.0	1.1
8	10:21	179	19.0	1.1
	Averages:	175.4 ppm	19.0 %	1.1 %

Moisture content (M3): 0.96
Moisture percentage (M2): 4.10 %

Measurements

CO:	0.0175 %,(dry)	N_2:	79.9 %,(dry)
CO_2:	1.1 %,(dry)	O_2:	19.0 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0168 %,(wet)	N_2:	76.6 %,(wet)
CO_2:	1.1 %,(wet)	O_2:	18.2 %,(wet)
H_2O:	4.10 %(=M2)		
Therefore, stack gas density (GD) =	1.27 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)	

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 1
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	9:29	Barometric Pressure :		1019	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.26	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.053	96.0	369.2	8.9
1/2	93	0.065	104.0	377.2	10.0
1/3	338	0.070	105.0	378.2	10.4
1/4	427	0.064	94.0	367.2	9.8
2/1	3	0.058	105.0	378.2	9.4
2/2	93	0.068	107.0	380.2	10.2
2/3	338	0.064	108.0	381.2	10.0
2/4	427	0.052	99.0	372.2	8.9
Average			102.3	375.5	9.7

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -10 mm
Absolute pressure in stack (hPa) : 1018.02 hPa

AECOM

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Dryer 1
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.73 x $10^{-5}m^2$
Thimble No: T137
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 173.6984 Meter finish: 173.6984
Time start: 9:40 Time finish: 9:41

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 174.1680 Meter finish: 174.1680
Time start: 10:40 Time finish: 10:41

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1012 hPa (start); 1012 hPa (finish)
Meter start: 173.6985 Time start: 9:52
Meter correction factor (GMf) : 0.9932

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	33	11.8	30.0	21.0		Yes
1/2	0:05:15	123	11.8	31.0	21.0		Yes
1/3	0:05:15	368	11.8	31.0	21.0		Yes
1/4	0:05:00	457	11.8	33.0	25.0		Yes
2/1	0:04:45	33	11.8	32.0	24.0		Yes
2/2	0:05:15	123	11.8	34.0	25.0		Yes
2/3	0:05:00	368	11.8	35.0	25.0		Yes
2/4	0:04:30	457	11.8	36.0	25.0		Yes
Averages				32.8	23.4	no result	

Meter Finish: 174.1581 Time Finish: 10:32
Total Condensate collected: 5 ml Silica gel No(s) used: P22

AECOM

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Dryer 1
Sample Nozzle No.: s3
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 2.85 x $10^{-5}m^2$
Thimble No: T138
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 284.9702 Meter finish: 284.9702
Time start: 9:41 Time finish: 9:42

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 285.4578 Meter finish: 285.4578
Time start: 10:42 Time finish: 10:43

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1012 hPa (start); 1012 hPa (finish)
Meter start: 284.9703 Time start: 9:52
Meter correction factor (GMf) : 0.9981

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	33	11.6	24.0	22.0		Yes
1/2	0:10:00	123	12.7	26.0	23.0		Yes
1/3	0:15:00	368	13.2	27.0	24.0		Yes
1/4	0:20:00	457	12.8	28.0	25.0		Yes
2/1	0:25:00	33	11.9	28.0	25.0		Yes
2/2	0:30:00	123	12.9	28.0	25.0		Yes
2/3	0:35:00	368	12.6	30.0	25.0		Yes
2/4	0:40:00	457	11.5	30.0	26.0		Yes
Averages				27.6	24.4	no result	

Meter Finish: 285.4500 Time Finish: 10:32
Total Condensate collected: 5 ml Silica gel No(s) used: P6

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 1
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	10:22	Barometric Pressure :		1019	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	3	0.049	98.0	371.2	8.6
1/2	93	0.058	99.0	372.2	9.3
1/3	338	0.066	104.0	377.2	10.0
1/4	427	0.061	100.0	373.2	9.6
2/1	3	0.059	101.0	374.2	9.4
2/2	93	0.069	105.0	378.2	10.2
2/3	338	0.067	106.0	379.2	10.1
2/4	427	0.056	105.0	378.2	9.2
Average			102.3	375.5	9.6

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -10 mm
Absolute pressure in stack (hPa) : 1018.02 hPa

STACK ANALYSIS - PM10 CALCULATIONS

AECOM

Date:	1-Nov-13	Client:	NCIA
AECOM's Project No:	60305580	Stack/Duct Description:	Dryer 1

1. Gas Analysis

	%		
$\%CO_2$	1.1		
$\%O_2$	19.0		
$\%N_2+\%CO$	79.9		
Fraction Moisture Content, Bws	0.04	M_s=	0.96

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	28.94
Mol. Wt. of Stack Gas (wet)	28.24

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	101900	30.08
Stack Static Pressure (Pg)	101802	30.05
Absolute Stack Pressure		30.05

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	102.3	216.1
Average Meter Temperature:	28.1	
Stack Gas Viscosity		216.0

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.57	0.0202	20.24	0.34

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	0.131	102.49	33.74	0.762	1.227	78.06	25.61	125.73	41.25
2	0.159	69.56	22.90	0.729	1.247	50.73	16.64	86.75	28.46
3	0.165	64.04	21.08	0.719	1.253	46.06	15.11	80.26	26.33
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.185	51.14	16.83	0.683	1.274	34.91	11.45	65.13	21.37
6	0.216	37.48	12.34	0.595	1.314	22.29	7.31	49.26	16.16
7	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	0.267	24.50	8.07	#NUM!	1.405	12.25	4.02	34.42	11.29
9	0.306	18.76	6.18	#NUM!	1.491	9.38	3.08	27.97	9.18
10	0.339	15.28	5.03	#NUM!	1.578	7.64	2.51	22.91	7.52
11	0.431	9.44	3.11	#NUM!	1.873	4.72	1.55	14.16	4.65

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
5	0.185	0.005	0.000017	13.1

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STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 1-Nov-13 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Dryer 1

7.Sampling Time Total Run Time 40 Number of points 8

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
49.05	0.20	0.44	4.5
57.86	0.23	0.48	4.9
65.73	0.26	0.51	5.2
60.82	0.24	0.49	5.0
58.86	0.24	0.49	4.9
68.67	0.28	0.52	5.3
66.71	0.27	0.52	5.3
55.92	0.22	0.47	4.8
	Average	0.49	40.00
	Square	0.24	

Total time min	Full hours	Full minutes	Seconds
4.8	0	4	45
10.0	0	10	0
15.3	0	15	15
20.3	0	20	15
25.0	0	25	0
30.3	0	30	15
35.3	0	35	15
39.8	0	39	45

Aerodynamic Cut Size (u_{cyc})
218.9

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0137

Actual D_{50}
11.3

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STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 1-Nov-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Dryer 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.4565 m^3	Average barometric pressure (P_{BARO})	1012 hPa
Average gas meter temp. ($T_{M,2}$):	28.1 °C		
	301.3 K	Average pressure at meter ($P_{M,2}$)	1012.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.4134 m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.:	N/A	Blank weight:	g
Thimble No. used:	T137	PM10 Weight	0.0004 g

Final PM10 Weight (Mp1): 0.00040 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ 0.00097 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.97 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 1.1 %

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 7 %

Average O_2%: 19.0 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.0068 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 6.8 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P22

V_v = 8.9 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 ($V_{wsg(std)}$) = 0.0119

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

B_{ws} = 4.29 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.26 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.24 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 $\frac{(Ps)}{(1013.25)}$

= 0.906 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 9.70 m/s

(ii) Average of post-sampling velocities: 9.55 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 9.63 m/s (stack conditions, wet)
N/A m/s (stack conditions, wet)
(**Note**: (Vs) is from all individual data, **not** from (i) and (ii) alone.)

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

Qstack = Vs x A = 1.82 m^3/s (stack conditions)

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

Qstd = 1.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0012	g/s (0°C, dry gas, 1 atm pressure)		
	=	1.2	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 =	0.0086	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	8.6	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 1-Nov-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Dryer 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	0.4788	m^3	Average barometric pressure (P_{BARO})	1012 hPa
Average gas meter temp. ($T_{M,2}$):	26.0	°C		
	299.2	K	Average pressure at meter ($P_{M,2}$)	1012.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.4367	m^3		

(B) Total Particulate concentration at standard conditions

Blank thimble No.: N/A Blank weight: g

Thimble No. used: T138 Total Particulate Weight 0.001 g

Final Total Particulate Weight (Mp1): 0.00100 g

Total Particulate 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%: 1.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.025 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 25 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 19.0 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.016 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 16 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P6

V_v = 8.3 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 ($V_{wsg(std)}$) = 0.0111

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

B_{ws} = 3.91 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

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

(i) Initial gas density for sampling: 1.26 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.24 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 $\frac{(Ps)}{(1013.25)}$

= 0.906 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 9.70 m/s

(ii) Average of post-sampling velocities: 9.55 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 9.63 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 = 1.82 m^3/s (stack conditions)

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

Qstd = 1.3 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0029	g/s (0°C, dry gas, 1 atm pressure)		
	=	2.9	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.032	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	32	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.021	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	21	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

EMISSION MONITORING RESULTS, DRYER 1
NCIA
1-Nov-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:			
Stack internal diameter at test location	490 mm		
Stack gas temperature (average)	102.3 °C		375.5 K
Stack pressure (average)	1018 hPa		
Stack gas velocity (average, stack conditions)	9.6 m/s		
Stack gas flowrate (stack conditions)	1.8 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	1.3 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	9:52	-	10:32
Fine Particulate (PM10) Mass	0.4 mg		
Gas Volume Sampled	0.413 m^3		
Fine Particulate (PM10) Emission*1	0.97 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	1.2 mg/s		
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	9:52	-	10:32
Total Particulate Mass	1 mg		
Gas Volume Sampled	0.437 m^3		
Total Particulate Emission*1	2.3 mg/m^3		
Total Particulate Mass Emission Rate*2	2.9 mg/s		
Regulatory Limit	20 mg/m^3		
Moisture Content (%)	3.9		
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.

NCIA

AECOM's Project Number: 60305580

Emission Source: Dryer 2

Date Sampled: 1-Nov-13

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

Observations made during testing period:

Sampling Performed By:

Nic Baldwin

for Peter Waddingham

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STACK ANALYSIS - PRE-SAMPLING

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Measurement/Observations

Stack Internal Dimensions:

Diameter 490 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area 0.19 m^2

Minimum No. of sampling points= 8

Distance from sampling plane to nearest disturbances:

Upstream (m) = 4
No. Diameters = 8.2
Type of Upstream Disturbance: Fan
Downstream (m) = 10
No. Diameters = 20.4
Type of Down Stream Disturbance: Stack Exit

Total No. of sampling points = 8
PM2.5/10= 8
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 4
PM2.5/10= 4

Position of each sampling point, for each traverse:

Exclusion of any sample point numbers - comments:

	A		B		PM10/2.5 A		PM2.5/10 B	
No.	Distance from wall		S-type Pitot distances		Distance from wall		S-Type Pitot distances	
1	33		3		33		3	
2	123		93		123		93	
3	368		338		368		338	
4	457		427		457		427	
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	11:20	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:20	157	19.0	0.1
2	11:21	170	19.0	0.1
3	11:22	172	19.0	0.1
4	11:23	181	19.0	0.1
5	11:24	180	19.1	0.1
6	11:25	165	18.9	0.1
7	11:26	160	18.9	0.1
8	11:27	154	18.9	0.1
	Averages:	167.4 ppm	19.0 %	0.1 %

Moisture content (M3): 0.94
Moisture percentage (M2): 5.70 %

Measurements

CO:	0.0167 %,(dry)	N_2:	80.9 %,(dry)
CO_2:	0.1 %,(dry)	O_2:	19.0 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0158 %,(wet)	N_2:	76.3 %,(wet)
CO_2:	0.1 %,(wet)	O_2:	17.9 %,(wet)
H_2O:	5.70 %(=M2)		
Therefore, stack gas density (GD) =	1.26 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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STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start: 12:11		Sampling port No.: 0		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:11	164	19.0	0.1
2	12:12	164	19.0	0.1
3	12:13	165	19.0	0.1
4	12:14	166	19.0	0.1
5	12:15	167	19.0	0.1
6	12:16	172	19.0	0.1
7	12:17	174	19.1	0.1
8	12:18	171	19.1	0.1
	Averages:	167.9 ppm	19.0 %	0.1 %

Moisture content (M3): 0.95
Moisture percentage (M2): 4.92 %

Measurements

CO:	0.0168 %,(dry)	N_2:	80.9 %,(dry)
CO_2:	0.1 %,(dry)	O_2:	19.0 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0160 %,(wet)	N_2:	76.9 %,(wet)
CO_2:	0.1 %,(wet)	O_2:	18.1 %,(wet)
H_2O:	4.92 %(=M2)		
Therefore, stack gas density (GD) =	1.26 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)	

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 2
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	11:15	Barometric Pressure :		1012	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.26	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.080	105.0	378.2	11.2
1/2	93	0.092	107.0	380.2	12.0
1/3	338	0.085	101.0	374.2	11.5
1/4	427	0.068	100.0	373.2	10.2
2/1	3	0.098	110.0	383.2	12.4
2/2	93	0.118	112.0	385.2	13.7
2/3	338	0.080	111.0	384.2	11.3
2/4	427	0.066	106.0	379.2	10.1
Average			106.5	379.7	11.6

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -7.6 mm
Absolute pressure in stack (hPa) : 1011.25 hPa

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STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Dryer 2
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 1.73 x $10^{-5}m^2$
Thimble No: T127
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 174.1692 Meter finish: 174.1692
Time start: 11:30 Time finish: 11:31

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 174.6697 Meter finish: 174.6697
Time start: 12:30 Time finish: 12:31

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1012 hPa (start); 1012 hPa (finish)
Meter start: 174.1702 Time start: 11:42
Meter correction factor (GMf) : 0.9932

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	33	12.1	33.0	26.0		Yes
1/2	0:05:15	123	12.1	34.0	26.0		Yes
1/3	0:05:00	368	12.1	35.0	26.0		Yes
1/4	0:04:30	457	12.1	36.0	26.0		Yes
2/1	0:05:15	33	12.1	36.0	26.0		Yes
2/2	0:06:00	123	12.1	36.0	26.0		Yes
2/3	0:04:45	368	12.1	37.0	26.0		Yes
2/4	0:04:30	457	12.1	38.0	28.0		Yes
Averages				35.6	26.3	no result	

Meter Finish: 174.6686 Time Finish: 12:24
Total Condensate collected: 7 ml Silica gel No(s) used: P40

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STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Dryer 2
Sample Nozzle No.: s3
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 2.85 x $10^{-5}m^2$
Thimble No: T136
Blank thimble No: NA

Leak Check (Pre-Sampling)
Meter start: 285.4582 Meter finish: 285.4582
Time start: 11:31 Time finish: 11:32

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 286.0306 Meter finish: 286.0306
Time start: 12:34 Time finish: 12:35

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1012 hPa (start); 1012 hPa (finish)
Meter start: 285.4596 Time start: 11:42
Meter correction factor (GMf) : 0.9981

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	33	14.3	28.0	26.0		Yes
1/2	0:10:00	123	15.3	30.0	28.0		Yes
1/3	0:15:00	368	14.9	31.0	29.0		Yes
1/4	0:20:00	457	13.2	32.0	30.0		Yes
2/1	0:25:00	33	15.6	32.0	30.0		Yes
2/2	0:30:00	123	17.2	32.0	30.0		Yes
2/3	0:35:00	368	14.2	33.0	30.0		Yes
2/4	0:40:00	457	12.9	34.0	31.0		Yes
Averages				31.5	29.3	no result	

Meter Finish: 286.0292 Time Finish: 12:24
Total Condensate collected: 9 ml Silica gel No(s) used: P38

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 1-Nov-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Dryer 2
Test 1:Fine Particulate (PM10)
Test 2:Total Particulate

Time :	12:40	Barometric Pressure :		1012	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.26	kg/m^3 (0 °C, Wet, 1 Atm)
Pitot Tube Type :	S				

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.081	100.0	373.2	11.2
1/2	93	0.098	102.0	375.2	12.3
1/3	338	0.089	108.0	381.2	11.8
1/4	427	0.069	104.0	377.2	10.3
2/1	3	0.109	103.0	376.2	13.0
2/2	93	0.117	109.0	382.2	13.5
2/3	338	0.088	110.0	383.2	11.8
2/4	427	0.077	105.0	378.2	10.9
Average			105.1	378.3	11.9

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -7.5 mm
Absolute pressure in stack (hPa) : 1011.26 hPa

STACK ANALYSIS - PM10 CALCULATIONS

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Date:	1-Nov-13	Client:	NCIA
AECOM's Project No:	60305580	Stack/Duct Description:	Dryer 2

1. Gas Analysis

	%		
$\%CO_2$	0.1		
$\%O_2$	19.0		
$\%N_2+\%CO$	80.9		
Fraction Moisture Content, Bws	0.05	M_s=	0.95

2. Molecular Weight of Stack Gas (Dry Basis)

Mol. Wt. of Stack Gas (dry)	28.78
Mol. Wt. of Stack Gas (wet)	28.16

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	101200	29.88
Stack Static Pressure (Pg)	101126	29.85
Absolute Stack Pressure		29.85

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	105.1	221.2
Average Meter Temperature:	30.9	
Stack Gas Viscosity		217.0

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.58	0.0204	20.44	0.34

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	0.131	103.52	34.07	0.762	1.227	78.86	25.87	126.98	41.66
2	0.159	70.26	23.13	0.730	1.247	51.26	16.82	87.61	28.74
3	0.165	64.68	21.29	0.720	1.253	46.55	15.27	81.04	26.59
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.185	51.65	17.00	0.683	1.273	35.29	11.58	65.77	21.58
6	0.216	37.86	12.46	0.596	1.314	22.56	7.40	49.74	16.32
7	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	0.267	24.75	8.15	#NUM!	1.404	12.37	4.06	34.74	11.40
9	0.306	18.95	6.24	#NUM!	1.490	9.47	3.11	28.23	9.26
10	0.339	15.43	5.08	#NUM!	1.576	7.71	2.53	23.14	7.59
11	0.431	9.53	3.14	#NUM!	1.870	4.77	1.56	14.30	4.69

Selected Nozzle	Nozzle Diameter (inches)	Nozzle Diameter (m)	Nozzle Area (m^2)	Sample Rate (L/min)
5	0.185	0.005	0.000017	13.1

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STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 1-Nov-13 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Dryer 2

7.Sampling Time Total Run Time 40 Number of points 11

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
81.42	0.33	0.57	4.7
98.10	0.39	0.63	5.2
89.27	0.36	0.60	5.0
68.67	0.28	0.52	4.4
108.89	0.44	0.66	5.5
116.74	0.47	0.68	5.7
88.29	0.35	0.60	4.9
76.52	0.31	0.55	4.6
	Average	0.60	40.00
	Square	0.36	

Total time min	Full hours	Full minutes	Seconds
4.8	0	4	45
10.0	0	10	0
15.0	0	15	0
19.5	0	19	30
24.8	0	24	45
30.8	0	30	45
35.5	0	35	30
40.0	0	40	0

Aerodynamic Cut Size (u_{cvc})
220.5

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0151

Actual D_{50}
10.6

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STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 1-Nov-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Dryer 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.4950 m^3

Average gas meter temp. ($T_{M,2}$): 30.9 °C

304.1 K

Average barometric pressure (P_{BARO}) 1012 hPa

Average pressure at meter ($P_{M,2}$) 1012.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.4442 m^3

(B) PM10 concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T127

Blank weight: g

PM10 Weight 0.0004 g

Final PM10 Weight (Mp1): 0.00040 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ 0.0009 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.9 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.11 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 110 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 19.0 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.0063 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 6.3 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P40

V_v = 9.6 g (from laboratory report) V_w = 7 mL (=grams) (recorded on Laboratory Form 108)

Volume of Water Vapour Condensed ($V_{wc(std)}$) = 0.0093

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0128

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

B_{ws} = 4.75 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED
Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.26 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.25 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 $\frac{(Ps)}{(1013.25)}$

= 0.899 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 11.55 m/s

(ii) Average of post-sampling velocities: 11.85 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 11.70 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 = 2.21 m^3/s (stack conditions)

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

Qstd = 1.5 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0014	g/s (0°C, dry gas, 1 atm pressure)		
	=	1.4	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.16	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	160	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.0095	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	9.5	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

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STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 1-Nov-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Dryer 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.5685 m^3

Average gas meter temp. ($T_{M,2}$): 30.4 °C

303.6 K

Average barometric pressure (P_{BARO}) 1012 hPa

Average pressure at meter ($P_{M,2}$) 1012.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.5109 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: NA

Thimble No. used: T136

Blank weight: g

Total Particulate Weight 0.0011 g

Final Total Particulate Weight (Mp1): 0.00110 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%: 0.1 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.26 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 260 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 19.0 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.015 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 15 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: P38

V_v = 11.5 g (from laboratory report) V_w = 9 mL (=grams) (recorded on Laboratory Form 108)

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

Volume of Water Vapour Condensed ($V_{wsg(std)}$) = 0.0154

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

B_{ws} = 5.08 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

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

(i) Initial gas density for sampling: 1.26 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.25 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 =

$$\text{(ii)} \times \frac{(273.2)}{(273.2+Ts)} \times \frac{(Ps)}{(1013.25)}$$

= 0.899 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 11.55 m/s

(ii) Average of post-sampling velocities: 11.85 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 11.70 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 = 2.21 m^3/s (stack conditions)

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

Qstd = 1.5 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 =	0.4	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	400	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.023	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	23	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

EMISSION MONITORING RESULTS, DRYER 2
NCIA
1-Nov-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:		
Stack internal diameter at test location	490 mm	
Stack gas temperature (average)	105.8 °C	379.0 K
Stack pressure (average)	1011 hPa	
Stack gas velocity (average, stack conditions)	12 m/s	
Stack gas flowrate (stack conditions)	2.2 m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	1.5 m^3/s	
Fine Particulate (PM10) Testing		
Test Period	11:42 -	12:24
Fine Particulate (PM10) Mass	0.4 mg	
Gas Volume Sampled	0.444 m^3	
Fine Particulate (PM10) Emission*1	0.9 mg/m^3	
Fine Particulate (PM10) Mass Emission Rate*2	1.4 mg/s	
Regulatory Limit	NA	
Total Particulate Testing		
Test Period	11:42 -	12:24
Total Particulate Mass	1.1 mg	
Gas Volume Sampled	0.511 m^3	
Total Particulate Emission*1	2.2 mg/m^3	
Total Particulate Mass Emission Rate*2	3.3 mg/s	
Regulatory Limit	20 mg/m^3	
Moisture Content (%)	5.1	
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.

NCIA

AECOM's Project Number: 60305580

Emission Source: Glazeline

Date Sampled: 30-Oct-13

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

Observations made during testing period:

Sampling Performed By:

Nic Baldwin

Colin Clarke

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Glazeline
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

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) = 4 No. Diameters = 4.0 Type of Upstream Disturbance: Fan Downstream (m) = 20 No. Diameters = 20.0 Type of Down Stream Disturbance: Stack Exit	Total No. of sampling points = 16 PM2.5/10= 12 No. of sampling traverses/ports sampled = 2 PM2.5/10= 2 No. of sampling points on each traverse/port = 8 PM2.5/10= 6
Position of each sampling point, for each traverse:	Exclusion of any sample point numbers - comments:

	A	B	PM10/2.5 A	PM2.5/10 B
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot distances
1	33	3	44	14
2	105	75	146	116
3	194	164	296	266
4	323	293	704	674
5	677	647	854	824
6	806	776	956	926
7	895	865		
8	967	937		
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Glazeline
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	11:30	Sampling port No.:	0	
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): 0.97
Moisture percentage (M2): 3.50 %

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:	76.3 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.2 %,(wet)
H_2O:	3.50 %(=M2)		
Therefore, stack gas density (GD) =	1.27 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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STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Glazeline
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	12:42	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:42	0	20.9	0.0
2	12:43	0	20.9	0.0
3	12:44	0	20.9	0.0
4	12:45	0	20.9	0.0
5	12:46	0	20.9	0.0
6	12:47	0	20.9	0.0
7	12:48	0	20.9	0.0
8	12:49	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.19 %

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:	1.19 %(=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)	

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Glazeline

Test 2:Total Particulate

Time :	10:45	Barometric Pressure :	1014	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	3	0.135	29.0	302.2	12.9
1/2	75	0.125	29.0	302.2	12.4
1/3	164	0.143	29.0	302.2	13.3
1/4	293	0.157	29.0	302.2	13.9
1/5	647	0.175	30.0	303.2	14.7
1/6	776	0.172	30.0	303.2	14.5
1/7	865	0.147	30.0	303.2	13.5
1/8	937	0.146	30.0	303.2	13.4
2/1	3	0.182	30.0	303.2	15.0
2/2	75	0.181	30.0	303.2	14.9
2/3	164	0.160	30.0	303.2	14.0
2/4	293	0.157	30.0	303.2	13.9
2/5	647	0.181	30.0	303.2	14.9
2/6	776	0.147	30.0	303.2	13.5
2/7	865	0.142	30.0	303.2	13.2
2/8	937	0.095	30.0	303.2	10.8
Average			29.8	303.0	13.7

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -3.8 mm
Absolute pressure in stack (hPa) : 1013.63 hPa

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STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Glazeline
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.73 x $10^{-5}m^2$
Thimble No: T128
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 172.6655 Meter finish: 172.6655
Time start: 11:32 Time finish: 11:33

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 173.6790 Meter finish: 173.6790
Time start: 13:01 Time finish: 13:02

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 172.6680 Time start: 11:37
Meter correction factor (GMf) : 0.9932

Sampling Position No.	Stopwatch Time at Sampling Position	Distance from far wall (mm)	Isokinetic Flowrate (L/min)	Meter Inlet Temp. (°C)	Meter Outlet Temp. (°C)	Impinger Train Outlet Temp (°C)	Flowrate Attained (Y/N)
1/1	0:06:15	44	12.6	29.0	21.0		Yes
1/2	0:06:00	146	12.6	29.0	21.0		Yes
1/3	0:06:15	296	12.6	30.0	21.0		Yes
1/4	0:06:30	704	12.6	30.0	21.0		Yes
1/5	0:07:00	854	12.6	30.0	21.0		Yes
1/6	0:07:00	956	12.6	30.0	21.0		Yes
2/1	0:07:15	44	12.6	31.0	22.0		Yes
2/2	0:07:00	146	12.6	31.0	22.0		Yes
2/3	0:06:45	296	12.6	31.0	22.0		Yes
2/4	0:06:30	704	12.6	31.0	22.0		Yes
2/5	0:07:00	854	12.6	31.0	22.0		Yes
2/6	0:06:30	956	12.6	31.0	22.0		Yes
Averages				30.3	21.5	no result	

Meter Finish: 173.6762 Time Finish: 13:00
Total Condensate collected: 0 ml Silica gel No(s) used: Z16

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STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Glazeline
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.26 x 10^{-5} m^2
Thimble No: T134
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 284.1067 Meter finish: 284.1067
Time start: 11:33 Time finish: 11:34

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 284.9434 Meter finish: 284.9434
Time start: 13:02 Time finish: 13:03

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1014 hPa (start); 1014 hPa (finish)
Meter start: 284.1081 Time start: 11:37
Meter correction factor (GMf) 0.9981

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	33	9.3	22.0	22.0		Yes
1/2	0:10:00	105	9.0	22.0	22.0		Yes
1/3	0:15:00	194	9.6	23.0	22.0		Yes
1/4	0:20:00	323	10.1	23.0	22.0		Yes
1/5	0:25:00	677	10.6	24.0	22.0		Yes
1/6	0:30:00	806	10.5	24.0	22.0		Yes
1/7	0:35:00	895	9.7	25.0	23.0		Yes
1/8	0:40:00	967	9.7	25.0	23.0		Yes
2/1	0:45:00	33	10.8	25.0	23.0		Yes
2/2	0:50:00	105	10.8	26.0	24.0		Yes
2/3	0:55:00	194	10.1	26.0	24.0		Yes
2/4	1:00:00	323	10.0	26.0	24.0		Yes
2/5	1:05:00	677	10.8	25.0	24.0		Yes
2/6	1:10:00	806	9.7	25.0	24.0		Yes
2/7	1:15:00	895	9.5	25.0	24.0		Yes
2/8	1:20:00	967	7.8	25.0	24.0		Yes
Averages				24.4	23.1	no result	

Meter Finish: 284.9411 Time Finish: 13:00
Total Condensate collected: 0 ml Silica gel No(s) used: Z6

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 30-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Glazeline

Test 2:Total Particulate

Time :	13:05	Barometric Pressure :		1014	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.28	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)
Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.129	30.0	303.2	12.5
1/2	75	0.124	30.0	303.2	12.3
1/3	164	0.154	30.0	303.2	13.7
1/4	293	0.168	30.0	303.2	14.3
1/5	647	0.168	30.0	303.2	14.3
1/6	776	0.180	30.0	303.2	14.8
1/7	865	0.139	30.0	303.2	13.0
1/8	937	0.146	30.0	303.2	13.4
2/1	3	0.174	30.0	303.2	14.6
2/2	75	0.175	30.0	303.2	14.6
2/3	164	0.173	30.0	303.2	14.5
2/4	293	0.168	30.0	303.2	14.3
2/5	647	0.159	30.0	303.2	13.9
2/6	776	0.165	30.0	303.2	14.2
2/7	865	0.156	30.0	303.2	13.8
2/8	937	0.109	30.0	303.2	11.5
Average			30.0	303.2	13.7

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -4.5 mm
Absolute pressure in stack (hPa) : 1013.56 hPa

STACK ANALYSIS - PM10 CALCULATIONS

AECOM

Date:	30-Oct-13	Client:	NCIA
AECOM's Project No:	60305580	Stack/Duct Description:	Glazeline

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)	28.46

3. Absolute Stack Pressure

	Pascals	In. Hg
Barometric Pressure (Pbar)	101400	29.93
Stack Static Pressure (Pg)	101356	29.92
Absolute Stack Pressure		29.92

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	30.0	86.0
Average Meter Temperature:	25.9	
Stack Gas Viscosity		184.8

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.46	0.0162	16.24	0.27

6. Nozzle Velocity, Rmin and Rmax

Nozzle Number	Nozzle Diameter	Nozzle Velocity		Rmin	Rmax	Vmin	Vmin	Vmax	Vmax
	(inches)	ft/sec	m/s	[-]	[-]	ft/sec	m/s	ft/sec	m/s
0	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1	0.131	82.28	27.08	0.759	1.228	62.45	20.49	101.08	33.16
2	0.159	55.84	18.38	0.724	1.250	40.44	13.27	69.81	22.90
3	0.165	51.41	16.92	0.713	1.257	36.67	12.03	64.60	21.19
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.185	41.05	13.51	0.674	1.278	27.66	9.07	52.48	17.22
6	0.216	30.09	9.90	0.577	1.321	17.35	5.69	39.76	13.04
7	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	0.267	19.67	6.47	#NUM!	1.417	9.84	3.23	27.87	9.14
9	0.306	15.06	4.96	#NUM!	1.507	7.53	2.47	22.59	7.41
10	0.339	12.26	4.04	#NUM!	1.599	6.13	2.01	18.39	6.03
11	0.431	7.58	2.49	#NUM!	1.906	3.79	1.24	11.37	3.73

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
5	0.185	0.005	0.000017	13.6

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STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 30-Oct-13 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Glazeline

7.Sampling Time Total Run Time 80 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
126.51	0.52	0.72	6.0
123.61	0.50	0.70	5.8
154.02	0.62	0.79	6.5
167.75	0.67	0.82	6.8
167.75	0.67	0.82	6.8
179.52	0.72	0.85	7.0
173.64	0.70	0.83	6.9
174.62	0.70	0.84	7.0
172.66	0.69	0.83	6.9
167.75	0.67	0.82	6.8
158.92	0.64	0.80	6.6
164.81	0.66	0.81	6.8
	Average	0.80	80.00
	Square	0.64	

Total time min	Full hours	Full minutes	Seconds
6.3	0	6	15
12.3	0	12	15
18.5	0	18	30
25.0	0	25	0
32.0	0	32	0
39.0	0	39	0
46.3	0	46	15
53.3	0	53	15
60.0	1	0	0
66.5	1	6	30
73.5	1	13	30
80.0	1	20	0

Aerodynamic Cut Size (u_{cvc})
185.5

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0120

Actual D_{50}
10.6

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STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 30-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Glazeline

(A) Sample gas volume at standard conditions

Metered volume (MV_3):	1.0013	m^3	Average barometric pressure (P_{BARO})	1014 hPa
Average gas meter temp. ($T_{M,2}$):	25.9	°C		
	299.1	K	Average pressure at meter ($P_{M,2}$)	1014.00 hPa
Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure):	0.9153	m^3		

(B) PM10 concentration at standard conditions

Blank thimble No.: N/A Blank weight: g

Thimble No. used: T128 PM10 Weight <0.0002 g

Final PM10 Weight (Mp1): <0.0002 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ <0.00022 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = <0.22 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ <0.00022 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = <0.22 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ <0.031 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = <31 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z16

V_v = 8.2 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 ($V_{wsg(std)}$) = 0.0109

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

B_{ws} = 1.18 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

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Fine Particulate (PM10)

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.25 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 $\frac{(Ps)}{(1013.25)}$

= 1.127 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.99 m/s

(ii) Average of post-sampling velocities: 14.00 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 14.00 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 = 11.00 m^3/s (stack conditions)

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

Qstd = 9.8 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm = C_{1a} x Qstd = <0.0022 g/s (0°C, dry gas, 1 atm pressure)
= <2.2 mg/s (0°C, dry gas, 1 atm pressure)

C_{1a} x Qstd = <0.0022 g/s (0°C, dry gas, 1 atm pressure 12% CO_2)
= <2.2 mg/s (0°C, dry gas, 1 atm pressure 12% CO_2)

C_{1a} x Qstd = <0.3 g/s (0°C, dry gas, 1 atm pressure 7% O_2)
= <300 mg/s (0°C, dry gas, 1 atm pressure 7% O_2)

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STACK ANALYSIS - FINAL CALCULATIONS

Total Particulate

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

Date: 30-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Glazeline

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.8314 m^3

Average gas meter temp. ($T_{M,2}$): 23.8 °C

297.0 K

Average barometric pressure (P_{BARO}) 1014 hPa

Average pressure at meter ($P_{M,2}$) 1014.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.7653 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T134

Blank weight: g

Total Particulate Weight 0.0004 g

Final Total Particulate Weight (Mp1): 0.00040 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.00052 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.52 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00052 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.52 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.073 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 73 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z6

V_v = 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 ($V_{wsg(std)}$) = 0.0093

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

B_{ws} = 1.21 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

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

(i) Initial gas density for sampling: 1.27 kg/m^3 (from Laboratory Form 107)

(ii) Re-calculated gas density based on moisture content in (c): 1.25 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 $\frac{(Ps)}{(1013.25)}$

= 1.127 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 13.68 m/s

(ii) Average of post-sampling velocities: 13.73 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 13.70 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 = 10.76 m^3/s (stack conditions)

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

Qstd = 9.6 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.005	g/s (0°C, dry gas, 1 atm pressure)		
	=	5	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 =	0.7	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	700	mg/s (0°C, dry gas, 1 atm pressure	7%	O_2)

EMISSION MONITORING RESULTS, GLAZELINE
NCIA
30-Oct-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:			
Stack internal diameter at test location	1000 mm		
Stack gas temperature (average)	29.9 °C		303.1 K
Stack pressure (average)	1014 hPa		
Stack gas velocity (average, stack conditions)	14 m/s		
Stack gas flowrate (stack conditions)	11 m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	9.7 m^3/s		
Fine Particulate (PM10) Testing			
Test Period	11:37	-	13:00
Fine Particulate (PM10) Mass	<0.2 mg		
Gas Volume Sampled	0.915 m^3		
Fine Particulate (PM10) Emission*1	<0.22 mg/m^3		
Fine Particulate (PM10) Mass Emission Rate*2	<2.2 mg/s		
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	11:37	-	13:00
Total Particulate Mass	0.4 mg		
Gas Volume Sampled	0.765 m^3		
Total Particulate Emission*1	0.52 mg/m^3		
Total Particulate Mass Emission Rate*2	5 mg/s		
Regulatory Limit	20 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.

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NCIA

AECOM's Project Number: 60305580

Emission Source: Hot Air Cooler 1

Date Sampled: 28-Oct-13

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

Observations made during testing period:

Sampling Performed By:

for Chris Burns

Nic Baldwin

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STACK ANALYSIS - PRE-SAMPLING

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

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

Total No. of sampling points = 16
PM2.5/10= 12
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 8
PM2.5/10= 6

Position of each sampling point, for each traverse:

Exclusion of any sample point numbers - comments:

	A	B	PM10/2.5 A	PM2.5/10 B
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot distances
1	33	3	44	14
2	105	75	146	116
3	194	164	296	266
4	323	293	704	674
5	677	647	854	824
6	806	776	956	926
7	895	865		
8	967	937		
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

AECOM

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start:	11:00	Sampling port No.:	0	
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	11:00	0	20.9	0.0
2	11:01	0	20.9	0.0
3	11:02	0	20.9	0.0
4	11:03	0	20.9	0.0
5	11:04	0	20.9	0.0
6	11:05	0	20.9	0.0
7	11:06	0	20.9	0.0
8	11:07	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

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

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	77.8 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.60 %(=M2)		
Therefore, stack gas density (GD) =	1.28 kg/m^3	(0^oC, wet, 1 atm pressure)	
Therefore, stack gas density (GD) =	1.29 kg/m^3	(0^oC, dry, 1 atm pressure)	

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STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 1
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start: 12:31		Sampling port No.: 0		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:31	0	20.9	0.0
2	12:32	0	20.9	0.0
3	12:33	0	20.9	0.0
4	12:34	0	20.9	0.0
5	12:35	0	20.9	0.0
6	12:36	0	20.9	0.0
7	12:37	0	20.9	0.0
8	12:38	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
Moisture percentage (M2): 1.65 %

Measurements

CO:	0.0000 %,(dry)	N_2:	79.1 %,(dry)
CO_2:	0.0 %,(dry)	O_2:	20.9 %,(dry)
Gas Compositions converted to wet basis:			
CO:	0.0000 %,(wet)	N_2:	77.8 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.6 %,(wet)
H_2O:	1.65 %(=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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Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 1

Test 2:Total Particulate

Time :	10:45	Barometric Pressure :		1013	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.28	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.265	70.0	343.2	19.2
1/2	75	0.412	78.0	351.2	24.2
1/3	164	0.481	82.0	355.2	26.3
1/4	293	0.441	81.0	354.2	25.1
1/5	647	0.441	84.0	357.2	25.3
1/6	776	0.481	85.0	358.2	26.4
1/7	865	0.451	84.0	357.2	25.5
1/8	937	0.275	82.0	355.2	19.9
2/1	3	0.402	83.0	356.2	24.1
2/2	75	0.451	86.0	359.2	25.6
2/3	164	0.422	89.0	362.2	24.9
2/4	293	0.412	89.0	362.2	24.6
2/5	647	0.363	89.0	362.2	23.1
2/6	776	0.383	88.0	361.2	23.6
2/7	865	0.343	88.0	361.2	22.4
2/8	937	0.353	88.0	361.2	22.7
Average			84.1	357.3	23.9

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -20 mm
Absolute pressure in stack (hPa) : 1011.04 hPa

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STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Hot Air Cooler 1
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 1.73 x $10^{-5}m^2$
Thimble No: T116
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 59.9520 Meter finish: 59.9520
Time start: 11:20 Time finish: 11:21

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 61.2144 Meter finish: 61.2144
Time start: 12:48 Time finish: 12:49

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1013 hPa (start); 1013 hPa (finish)
Meter start: 59.9540 Time start: 11:25
Meter correction factor (GMf) : 1.0159

Sampling Position No.	Stopwatch Time at Sampling Position	Distance from far wall (mm)	Isokinetic Flowrate (L/min)	Meter Inlet Temp. (°C)	Meter Outlet Temp. (°C)	Impinger Train Outlet Temp (°C)	Flowrate Attained (Y/N)
1/1	0:06:00	44	13.8	34.0	30.0		Yes
1/2	0:07:00	146	13.8	34.0	30.0		Yes
1/3	0:06:30	296	13.8	34.0	30.0		Yes
1/4	0:07:00	704	13.8	35.0	30.0		Yes
1/5	0:07:15	854	13.8	35.0	31.0		Yes
1/6	0:06:15	956	13.8	35.0	31.0		Yes
2/1	0:06:15	44	13.8	36.0	31.0		Yes
2/2	0:07:00	146	13.8	36.0	31.0		Yes
2/3	0:07:00	296	13.8	36.0	31.0		Yes
2/4	0:06:45	704	13.8	36.0	31.0		Yes
2/5	0:06:30	854	13.8	36.0	32.0		Yes
2/6	0:06:15	956	13.8	36.0	32.0		Yes
Averages				35.3	30.8	no result	

Meter Finish: 61.2100 Time Finish: 12:46
Total Condensate collected: 0 ml Silica gel No(s) used: Z3

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STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Hot Air Cooler 1
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.26 x 10^{-5} m^2
Thimble No: T115
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 279.0281 Meter finish: 279.0281
Time start: 11:21 Time finish: 11:22

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 280.3370 Meter finish: 280.3370
Time start: 12:50 Time finish: 12:51

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1013 hPa (start); 1013 hPa (finish)
Meter start: 279.0293 Time start: 11:25
Meter correction factor (GMf) : 0.9981

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	33	12.6	34.0	30.0		Yes
1/2	0:10:00	105	15.5	34.0	30.0		Yes
1/3	0:15:00	194	16.6	34.0	30.0		Yes
1/4	0:20:00	323	15.9	34.0	30.0		Yes
1/5	0:25:00	677	15.9	34.0	31.0		Yes
1/6	0:30:00	806	16.6	35.0	32.0		Yes
1/7	0:35:00	895	16.0	35.0	32.0		Yes
1/8	0:40:00	967	12.6	35.0	32.0		Yes
2/1	0:45:00	33	15.2	36.0	34.0		Yes
2/2	0:50:00	105	16.0	36.0	34.0		Yes
2/3	0:55:00	194	15.4	36.0	35.0		Yes
2/4	1:00:00	323	15.3	36.0	35.0		Yes
2/5	1:05:00	677	14.3	36.0	35.0		Yes
2/6	1:10:00	806	14.7	36.0	36.0		Yes
2/7	1:15:00	895	13.9	36.0	36.0		Yes
2/8	1:20:00	967	14.1	36.0	36.0		Yes
Averages				35.2	33.0	no result	

Meter Finish: 280.3338 Time Finish: 12:46
Total Condensate collected: 0 ml Silica gel No(s) used: M99

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 1

Test 2:Total Particulate

Time :	12:15	Barometric Pressure :		1013	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No:	1 to 2	Stack Gas Density:		1.28	kg/m^3
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)

Sampling Position No.	Distance from far wall (mm)	Max. Differential Pressure ΔP, kilo Pascals	Max Temp. °C	Max Temp. (Ts) K	Corrected Velocity (Vs) m/s
1/1	3	0.400	74.0	347.2	23.7
1/2	75	0.471	76.0	349.2	25.8
1/3	164	0.475	77.0	350.2	25.9
1/4	293	0.440	80.0	353.2	25.1
1/5	647	0.442	82.0	355.2	25.2
1/6	776	0.424	82.0	355.2	24.7
1/7	865	0.419	84.0	357.2	24.6
1/8	937	0.287	84.0	357.2	20.4
2/1	3	0.257	94.0	367.2	19.5
2/2	75	0.334	100.0	373.2	22.4
2/3	164	0.296	104.0	377.2	21.3
2/4	293	0.384	104.0	377.2	24.2
2/5	647	0.404	104.0	377.2	24.8
2/6	776	0.339	107.0	380.2	22.8
2/7	865	0.295	100.0	373.2	21.1
2/8	937	0.273	99.0	372.2	20.3
Average			90.7	363.9	23.2

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -23 mm
Absolute pressure in stack (hPa) : 1010.74 hPa

STACK ANALYSIS - PM10 CALCULATIONS

AECOM

Date: 28-Oct-13 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Hot Air Cooler 1

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)	28.66

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	101300	29.91
Stack Static Pressure (Pg)	101074	29.84
Absolute Stack Pressure		29.84

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	91.0	195.8
Average Meter Temperature:	33.0	
Stack Gas Viscosity		213.5

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.56	0.0198	19.78	0.33

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	0.131	100.18	32.97	0.761	1.227	76.25	25.02	122.92	40.33
2	0.159	67.99	22.38	0.728	1.248	49.52	16.25	84.83	27.83
3	0.165	62.60	20.60	0.718	1.254	44.95	14.75	78.48	25.75
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.185	49.99	16.45	0.681	1.274	34.04	11.17	63.70	20.90
6	0.216	36.63	12.06	0.592	1.315	21.67	7.11	48.19	15.81
7	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	0.267	23.95	7.88	#NUM!	1.407	11.97	3.93	33.69	11.05
9	0.306	18.34	6.04	#NUM!	1.494	9.17	3.01	27.39	8.99
10	0.339	14.93	4.91	#NUM!	1.561	7.46	2.45	22.39	7.35
11	0.431	9.23	3.04	#NUM!	1.879	4.61	1.51	13.84	4.54

	Nozzle Diameter	Nozzle Diameter	Nozzle Area	Sample Rate
Selected Nozzle	(inches)	(m)	(m^2)	(L/min)
5	0.185	0.005	0.000017	14.2

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STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 28-Oct-13 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Hot Air Cooler 1

7.Sampling Time Total Run Time 80 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
444.39	1.78	1.34	7.0
505.22	2.03	1.42	7.5
393.38	1.58	1.26	6.6
415.94	1.67	1.29	6.8
484.61	1.94	1.39	7.4
451.26	1.81	1.35	7.1
341.39	1.37	1.17	6.2
386.51	1.55	1.25	6.6
361.99	1.45	1.21	6.4
376.70	1.51	1.23	6.5
399.27	1.60	1.27	6.7
252.12	1.01	1.01	5.3
	Average	1.26	80.00
	Square	1.60	

Total time min	Full hours	Full minutes	Seconds
6.0	0	6	0
13.0	0	13	0
19.5	0	19	30
26.5	0	26	30
33.8	0	33	45
40.0	0	40	0
46.3	0	46	15
53.3	0	53	15
60.3	1	0	15
67.0	1	7	0
73.5	1	13	30
79.8	1	19	45

Aerodynamic Cut Size (u_{cyc})
212.9

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0179

Actual D_{50}
9.2

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STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 28-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Hot Air Cooler 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.2760 m^3

Average gas meter temp. ($T_{M,2}$): 33.0 °C

306.2 K

Average barometric pressure (P_{BARO}) 1013 hPa

Average pressure at meter ($P_{M,2}$) 1013.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.1382 m^3

(B) PM10 concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T116

Blank weight: g

PM10 Weight 0.0004 g

Final PM10 Weight (Mp1): 0.00040 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ 0.00035 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.35 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00035 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.35 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.049 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 49 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z3

V_v = 14.6 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 ($V_{wsg(std)}$) = 0.0195

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

B_{ws} = 1.68 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Fine Particulate (PM10)

AECOM

(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 $\frac{(Ps)}{(1013.25)}$

= 0.966 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 24.03 m/s

(ii) Average of post-sampling velocities: 24.19 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 24.11 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 = 18.94 m^3/s (stack conditions)

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

Qstd = 14.1 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0049	g/s (0°C, dry gas, 1 atm pressure)		
	=	4.9	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0049	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	4.9	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.69	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	690	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: 28-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Hot Air Cooler 1

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.3020 m^3

Average gas meter temp. ($T_{M,2}$): 34.1 °C

307.3 K

Average barometric pressure (P_{BARO}) 1013 hPa

Average pressure at meter ($P_{M,2}$) 1013.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.1572 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T115

Blank weight: g

Total Particulate Weight 0.0007 g

Final Total Particulate Weight (Mp1): 0.00070 g

Total Particulate 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: M99

V_v = 14.3 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 ($V_{wsg(std)}$) = 0.0191

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

B_{ws} = 1.62 %

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

Total Particulate

AECOM

(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 $\frac{(Ps)}{(1013.25)}$

= 0.968 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 23.93 m/s

(ii) Average of post-sampling velocities: 23.24 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 23.58 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 = 18.52 m^3/s (stack conditions)

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

Qstd = 13.8 m^3/s (0^oC, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0083	g/s (0^oC, dry gas, 1 atm pressure)		
	=	8.3	mg/s (0^oC, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0083	g/s (0^oC, dry gas, 1 atm pressure	12%	CO_2)
	=	8.3	mg/s (0^oC, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	1.2	g/s (0^oC, dry gas, 1 atm pressure	7%	O_2)
	=	1200	mg/s (0^oC, dry gas, 1 atm pressure	7%	O_2)

EMISSION MONITORING RESULTS, HOT AIR COOLER 1
NCIA
28-Oct-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:			
Stack internal diameter at test location	1000	mm	
Stack gas temperature (average)	87.7	°C	360.9 K
Stack pressure (average)	1011	hPa	
Stack gas velocity (average, stack conditions)	24	m/s	
Stack gas flowrate (stack conditions)	19	m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	14	m^3/s	
Fine Particulate (PM10) Testing			
Test Period	11:25	-	12:46
Fine Particulate (PM10) Mass	0.4	mg	
Gas Volume Sampled	1.14	m^3	
Fine Particulate (PM10) Emission*1	0.35	mg/m^3	
Fine Particulate (PM10) Mass Emission Rate*2	4.9	mg/s	
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	11:25	-	12:46
Total Particulate Mass	0.7	mg	
Gas Volume Sampled	1.16	m^3	
Total Particulate Emission*1	0.6	mg/m^3	
Total Particulate Mass Emission Rate*2	8.3	mg/s	
Regulatory Limit	5	mg/m^3	
Moisture Content (%)	1.6		
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.

NCIA

AECOM's Project Number: 60305580

Emission Source: Hot Air Cooler 2

Date Sampled: 28-Oct-13

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

Observations made during testing period:

Sampling Performed By:

fs Chris Burns

Nic Baldwin

AECOM

STACK ANALYSIS - PRE-SAMPLING

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Measurement/Observations

Stack Internal Dimensions:

Diameter 1200 mm
OR Length Width
Length/Width (mm)
Equivalent Diameter N/A mm

Cross Sectional Area 1.13 m^2

Minimum No. of sampling points= 12

Distance from sampling plane to nearest disturbances:

Upstream (m) = 5
No. Diameters = 4.2
Type of Upstream Disturbance: fan
Downstream (m) = 5
No. Diameters = 4.2
Type of Down Stream Disturbance: Stack exit

Total No. of sampling points = 16
PM2.5/10= 12
No. of sampling traverses/ports sampled = 2
PM2.5/10= 2
No. of sampling points on each traverse/port = 8
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	40	10	53	23
2	126	96	175	145
3	233	203	355	325
4	388	358	845	815
5	**812**	**782**	**1025**	**995**
6	967	937	1147	1117
7	1074	1044		
8	1160	1130		
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: .....

STACK ANALYSIS - GAS COMPOSITION AND DENSITY PRE-SAMPLING

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start: 12:05		Sampling port No.: 0		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	12:05	0	20.9	0.0
2	12:06	0	20.9	0.0
3	12:07	0	20.9	0.0
4	12:08	0	20.9	0.0
5	12:09	0	20.9	0.0
6	12:10	0	20.9	0.0
7	12:11	0	20.9	0.0
8	12:12	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.98
Moisture percentage (M2): 2.00 %

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:	77.5 %,(wet)
CO_2:	0.0 %,(wet)	O_2:	20.5 %,(wet)
H_2O:	2.00 %(=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

STACK ANALYSIS - GAS COMPOSITION AND DENSITY POST-SAMPLING

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 2
Test 1: Fine Particulate (PM10)
Test 2: Total Particulate

Sampling time start: 14:10		Sampling port No.: 0		
Measurement No.	Time sampled	CO (ppm). (dry)	O_2 (%), (dry)	CO_2 (%), (dry)
1	14:10	0	20.9	0.0
2	14:11	0	20.9	0.0
3	14:12	0	20.9	0.0
4	14:13	0	20.9	0.0
5	14:14	0	20.9	0.0
6	14:15	0	20.9	0.0
7	14:16	0	20.9	0.0
8	14:17	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %

Moisture content (M3): 0.99
Moisture percentage (M2): 1.20 %

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:	1.20 %(=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)	

Stack Analysis - Pre Sampling Pitot Tube and Temperature Traverses

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 2

Test 2:Total Particulate

Time :	11:47	Barometric Pressure :		1013	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	10	0.242	88.0	361.2	18.8
1/2	96	0.262	92.0	365.2	19.7
1/3	203	0.296	94.0	367.2	21.0
1/4	358	0.245	94.0	367.2	19.1
1/5	782	0.256	94.0	367.2	19.5
1/6	937	0.207	93.0	366.2	17.5
1/7	1044	0.174	92.0	365.2	16.0
1/8	1130	0.158	91.0	364.2	15.3
2/1	10	0.200	92.0	365.2	17.2
2/2	96	0.257	93.0	366.2	19.5
2/3	203	0.194	94.0	367.2	17.0
2/4	358	0.229	95.0	368.2	18.5
2/5	782	0.234	96.0	369.2	18.7
2/6	937	0.276	98.0	371.2	20.4
2/7	1044	0.273	97.0	370.2	20.2
2/8	1130	0.186	95.0	368.2	16.7
Average			93.6	366.8	18.4

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -15 mm
Absolute pressure in stack (hPa) : 1011.53 hPa

AECOM

STACK ANALYSIS

SAMPLING OF FINE PARTICULATE (PM10)

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Hot Air Cooler 2
Sample Nozzle No.: fine5
Sampling Port No.: 1 to 2
Page No: 1 of 1

Sample Nozzle Area (An): 1.73 x 10^{-5} m^2
Thimble No: T109
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 61.2174 Meter finish: 61.2174
Time start: 12:57 Time finish: 12:58

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 62.5838 Meter finish: 62.5838
Time start: 14:26 Time finish: 14:27

Therefore, leakage rate = no leak L/min

(>0.1 l/min. is unacceptable)

Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1013 hPa (start); 1013 hPa (finish)
Meter start: 61.2228 Time start: 13:00
Meter correction factor (GMf) : 1.0159

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	53	13.9	36.0	33.0		Yes
1/2	0:07:15	175	13.9	36.0	33.0		Yes
1/3	0:06:15	355	13.9	36.0	33.0		Yes
1/4	0:07:00	845	13.9	36.0	34.0		Yes
1/5	0:06:15	1025	13.9	36.0	34.0		Yes
1/6	0:05:45	1147	13.9	36.0	34.0		Yes
2/1	0:06:15	53	13.9	37.0	34.0		Yes
2/2	0:06:30	175	13.9	37.0	35.0		Yes
2/3	0:06:15	355	13.9	37.0	35.0		Yes
2/4	0:07:00	845	13.9	37.0	35.0		Yes
2/5	0:07:15	1025	13.9	37.0	35.0		Yes
2/6	0:06:45	1147	13.9	37.0	35.0		Yes
Averages				36.5	34.2	no result	

Meter Finish: 62.5830 Time Finish: 14:22
Total Condensate collected: -2 ml Silica gel No(s) used: GARY

AECOM

STACK ANALYSIS

SAMPLING OF TOTAL PARTICULATE

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack Description No.: Hot Air Cooler 2
Sample Nozzle No.: s2
Sampling Port No.: 1 to 2
Page No: 1 of 1
Sample Nozzle Area (An): 1.26 x $10^{-5}m^2$
Thimble No: T112
Blank thimble No: N/A

Leak Check (Pre-Sampling)
Meter start: 280.3395 Meter finish: 280.3395
Time start: 12:56 Time finish: 12:57
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Leak Check (Post Sampling)
Meter start: 281.2582 Meter finish: 281.2582
Time start: 14:27 Time finish: 14:28
Therefore, leakage rate = no leak L/min
(>0.1 l/min. is unacceptable)
Repeat:
Comments:

Sampling Record Table

Barometric Pressure: 1013 hPa (start); 1013 hPa (finish)
Meter start: 280.3410 Time start: 13:00
Meter correction factor (GMf) : 0.9981

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	40	11.7	36.0	34.0		Yes
1/2	0:10:00	126	12.2	36.0	34.0		Yes
1/3	0:15:00	233	12.9	36.0	34.0		Yes
1/4	0:20:00	388	11.7	36.0	34.0		Yes
1/5	0:25:00	812	12.0	36.0	34.0		Yes
1/6	0:30:00	967	10.8	36.0	34.0		Yes
1/7	0:35:00	1074	9.9	37.0	36.0		Yes
1/8	0:40:00	1160	9.5	37.0	36.0		Yes
2/1	0:45:00	40	10.6	37.0	36.0		Yes
2/2	0:50:00	126	12.0	38.0	36.0		Yes
2/3	0:55:00	233	10.5	38.0	36.0		Yes
2/4	1:00:00	388	11.3	38.0	37.0		Yes
2/5	1:05:00	812	11.4	38.0	37.0		Yes
2/6	1:10:00	967	12.4	38.0	37.0		Yes
2/7	1:15:00	1074	12.3	38.0	37.0		Yes
2/8	1:20:00	1160	10.2	38.0	37.0		Yes
Averages				37.1	35.6	no result	

Meter Finish: 281.2570 Time Finish: 14:22
Total Condensate collected: -2 ml Silica gel No(s) used: Z12

Stack Analysis - Post Sampling Pitot Tube and Temperature Traverses

AECOM

Date: 28-Oct-13
Client: NCIA
AECOM's Project No: 60305580
Stack/Duct Description: Hot Air Cooler 2

Test 2:Total Particulate

Time :	14:01	Barometric Pressure :	1013	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	10	0.261	79.0	352.2	19.3
1/2	96	0.282	80.0	353.2	20.0
1/3	203	0.307	82.0	355.2	21.0
1/4	358	0.212	82.0	355.2	17.4
1/5	782	0.178	80.0	353.2	15.9
1/6	937	0.213	80.0	353.2	17.4
1/7	1044	0.227	80.0	353.2	18.0
1/8	1130	0.160	77.0	350.2	15.0
2/1	10	0.221	85.0	358.2	17.9
2/2	96	0.208	88.0	361.2	17.4
2/3	203	0.249	90.0	363.2	19.1
2/4	358	0.234	95.0	368.2	18.7
2/5	782	0.248	95.0	368.2	19.2
2/6	937	0.290	96.0	369.2	20.8
2/7	1044	0.255	96.0	369.2	19.5
2/8	1130	0.268	91.0	364.2	19.8
Average			86.0	359.2	18.5

Static Pressure (Dwyer) (Pa): kPa
Static Pressure (U-tube, if required) : -10 mm
Absolute pressure in stack (hPa) : 1012.02 hPa

STACK ANALYSIS - PM10 CALCULATIONS

AECOM

Date:	28-Oct-13	Client:	NCIA
AECOM's Project No:	60305580	Stack/Duct Description:	Hot Air Cooler 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)	28.62

3. Absolute Stack Pressure

	Pascals	in. Hg
Barometric Pressure (Pbar)	101300	29.91
Stack Static Pressure (Pg)	101202	29.88
Absolute Stack Pressure		29.88

4. Viscosity of Stack Gas

	°C	°F
Average Stack Temp.	86.4	187.6
Average Meter Temperature:	35.3	
Stack Gas Viscosity		211.7

5. Cyclone Flow Rate

	ft^3/min	m^3/min	L/min	L/s
Cyclone Flow Rate	0.55	0.0195	19.54	0.33

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	0.131	98.97	32.58	0.761	1.227	75.32	24.71	121.44	39.84
2	0.159	67.17	22.11	0.728	1.248	48.91	16.05	83.81	27.50
3	0.165	61.84	20.36	0.718	1.254	44.39	14.56	77.54	25.44
4	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.185	49.38	16.25	0.681	1.275	33.61	11.03	62.94	20.65
6	0.216	36.19	11.91	0.591	1.316	21.38	7.01	47.62	15.62
7	0.000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	0.267	23.66	7.79	#NUM!	1.408	11.83	3.88	33.30	10.93
9	0.306	18.11	5.96	#NUM!	1.495	9.06	2.97	27.08	8.88
10	0.339	14.75	4.85	#NUM!	1.583	7.37	2.42	22.12	7.26
11	0.431	9.11	3.00	#NUM!	1.880	4.56	1.50	13.67	4.49

Selected Nozzle	Nozzle Diameter (inches)	Nozzle Diameter (m)	Nozzle Area (m^2)	Sample Rate (L/min)
5	0.185	0.005	0.000017	14.5

AECOM

STACK ANALYSIS - PM10 CALCULATIONS CONTINUED

Date: 28-Oct-13 Client: NCIA
AECOM's Project No: 60305580 Stack/Duct Description: Hot Air Cooler 2

7.Sampling Time Total Run Time 80 Number of points 12

Velocity Head (pitot) Pa	Vel Head in H20	Sqr Root	Dwell time mins
311.96	1.25	1.12	7.5
249.17	1.00	1.00	6.7
257.02	1.03	1.02	6.8
212.88	0.85	0.92	6.2
224.65	0.90	0.95	6.4
218.76	0.88	0.94	6.3
211.90	0.85	0.92	6.2
195.22	0.78	0.89	6.0
275.66	1.11	1.05	7.1
311.96	1.25	1.12	7.5
273.70	1.10	1.05	7.1
209.93	0.84	0.92	6.2
	Average	0.99	80.00
	Square	0.98	

Total time min	Full hours	Full minutes	Seconds
7.5	0	7	30
14.8	0	14	45
21.0	0	21	0
28.0	0	28	0
34.3	0	34	15
40.0	0	40	0
46.3	0	46	15
52.8	0	52	45
59.0	0	59	0
66.0	1	6	0
73.3	1	13	15
80.0	1	20	0

Aerodynamic Cut Size (u_{cyc})
210.4

PM_{10} Flow rate at actual cyclone conditions (Q_a)
0.0192

Actual D_{50}
8.7

AECOM

STACK ANALYSIS - FINAL CALCULATIONS

Fine Particulate (PM10)

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

Date: 28-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Hot Air Cooler 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 1.3818 m^3

Average gas meter temp. ($T_{M,2}$): 35.3 °C

308.5 K

Average barometric pressure (P_{BARO}) 1013 hPa

Average pressure at meter ($P_{M,2}$) 1013.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 1.2234 m^3

(B) PM10 concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T109

Blank weight: g

PM10 Weight 0.0003 g

Final PM10 Weight (Mp1): 0.00030 g

PM10 Concentration (C1): $=M_{p1}/MV_4=$ 0.00025 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.25 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.00025 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.25 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.035 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 35 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: GARY

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

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

B_{ws} = 1.14 %

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): 1.27 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 $\frac{(Ps)}{(1013.25)}$

= 0.954 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 18.95 m/s

(ii) Average of post-sampling velocities: 18.84 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 18.90 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 = 21.38 m^3/s (stack conditions)

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

Qstd = 15.9 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.004	g/s (0°C, dry gas, 1 atm pressure)		
	=	4	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.004	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	4	mg/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	C_{1a} x Qstd =	0.56	g/s (0°C, dry gas, 1 atm pressure	7%	O_2)
	=	560	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: 28-Oct-13 Client: NCIA

AECOM's Project No: 60305580 Stack/Duct Description: Hot Air Cooler 2

(A) Sample gas volume at standard conditions

Metered volume (MV_3): 0.9143 m^3

Average gas meter temp. ($T_{M,2}$): 36.3 °C

309.5 K

Average barometric pressure (P_{BARO}) 1013 hPa

Average pressure at meter ($P_{M,2}$) 1013.00 hPa

Sample gas volume (MV_4); (0°C, dry gas, 1 atm pressure): 0.8069 m^3

(B) Total Particulate concentration at standard conditions

Blank thimble No.: N/A

Thimble No. used: T112

Blank weight: g

Total Particulate Weight 0.0004 g

Final Total Particulate Weight (Mp1): 0.00040 g

Total Particulate Concentration (C1): $=M_{p1}/MV_4=$ 0.0005 g/m^3 (0°C, dry gas, 1atm pressure)

;and C_2 = 0.5 mg/m^3 (0°C, dry gas, 1atm pressure)

CO_2 Basis 12 %

Average CO_2%: 0.0 %

Therefore, C_c: $= C_a \times 12/CO_2\% =$ 0.0005 g/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

;and C_{c1} = 0.5 mg/m^3 (0°C, dry gas, 1atm pressure, 12% CO_2)

O_2 Basis 7 %

Average O_2%: 20.9 %

Therefore, C_b: $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 0.07 g/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

;and C_{b1} = 70 mg/m^3 (0°C, dry gas, 1atm pressure, 7% O_2)

(C) Moisture content

Silica Gel Number: Z12

V_v = 9.7 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 ($V_{wsg(std)}$) = 0.0129

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

Total Particulate

AECOM

(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 $\frac{(Ps)}{(1013.25)}$

= 0.954 kg/m^3 (stack conditions, wet)

(E) Gas Velocities

(i) Average of pre-sampling velocities: 18.44 m/s

(ii) Average of post-sampling velocities: 18.53 m/s

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

(iv) Overall average of pre-sampling and post-sampling velocities (Vs): 18.48 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 = 20.90 m^3/s (stack conditions)

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

Qstd = 15.5 m^3/s (0°C, dry gas, 1 atm pressure)

(G) Mass Emission Rate

Rm =	C_{1a} x Qstd =	0.0078	g/s (0°C, dry gas, 1 atm pressure)		
	=	7.8	mg/s (0°C, dry gas, 1 atm pressure)		
	C_{1a} x Qstd =	0.0078	g/s (0°C, dry gas, 1 atm pressure	12%	CO_2)
	=	7.8	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)

EMISSION MONITORING RESULTS, HOT AIR COOLER 2
NCIA
28-Oct-13
FINE PARTICULATE (PM10)
TOTAL PARTICULATE

Sampling Conditions:			
Stack internal diameter at test location	1200	mm	
Stack gas temperature (average)	90.0	°C	363.2 K
Stack pressure (average)	1012	hPa	
Stack gas velocity (average, stack conditions)	19	m/s	
Stack gas flowrate (stack conditions)	21	m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	16	m^3/s	
Fine Particulate (PM10) Testing			
Test Period	13:00	-	14:22
Fine Particulate (PM10) Mass	0.3	mg	
Gas Volume Sampled	1.22	m^3	
Fine Particulate (PM10) Emission*1	0.25	mg/m^3	
Fine Particulate (PM10) Mass Emission Rate*2	4	mg/s	
Regulatory Limit	N/A		
Total Particulate Testing			
Test Period	13:00	-	14:22
Total Particulate Mass	0.4	mg	
Gas Volume Sampled	0.807	m^3	
Total Particulate Emission*1	0.5	mg/m^3	
Total Particulate Mass Emission Rate*2	7.8	mg/s	
Regulatory Limit	5	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.

Appendix B

Laboratory Analytical Reports (30 pages)

Appendix B Laboratory Analytical Reports (30 pages)

Steel River Testing

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

STACK EMISSION - MOISTURE REPORT

Origin: AECOM - Newcastle
Project: **60305580**
Report : 5399-0-M

Description : Stack Emission Samples
Received: 06-Nov-13
Date : 11-Nov-13

Report To : Colin Clarke
17 Warabrook Blvd, Warabrook NSW 2304
Copy to: FILE

Jar ID	Moisture (g)
B66	6.3
F24	8.6
FA6	9.6
GARY	12.6
M99	14.3
P22	8.9
P27	7.7
P38	11.5
P40	9.6
P6	8.3
Z12	9.7
Z13	7.9
Z15	7.3
Z16	8.2
Z18	6.7
Z2	8.7

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

ACCREDITED FOR TECHNICAL COMPETENCE

Reported By:
Belinda Evans

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: **60305580**

Report : 5399-0-M

Description : Stack Emission Samples
Received: 06-Nov-13

Date : 11-Nov-13

Report To : Colin Clarke
17 Warabrook Blvd, Warabrook NSW 2304

Copy to: FILE

Jar ID	Moisture (g)
Z3	14.6
Z6	7.0

Reported By: _____
Belinda Evans

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
Project: **60305580**

Report : 5399-0-P

Description : Stack Emission Samples
Received: 06-Nov-13

Date : 11-Nov-13

Report To : Colin Clarke
17 Warabrook Blvd, Warabrook NSW 2304

Copy to: FILE

Thimble ID		Volume (mL)	Total Particulate Matter (g)
T104	Filter	-	0.0083
T106	Filter	-	0.0043
T109	Filter	-	0.0003
T110	Filter	-	0.0027
T112	Filter	-	0.0004
T115	Filter	-	0.0007
T116	Filter	-	0.0004
T117	Filter	-	0.0006
T118	Filter	-	0.0085
T119	Filter	-	0.0005
T127	Filter	-	0.0004
T128	Filter	-	<0.0002
T131	Filter	-	0.0004
T132	Filter	-	0.0008
T134	Filter	-	0.0004
T136	Filter	-	0.0011

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

Note : 1. Sampled by Client

Reported By: Belinda Evans

Determined in Accordance With:
Particulate matter - total in stack gases by gravimetric using in-house M300

Steel River Testing

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

STACK EMISSION - PARTICULATES REPORT

Origin: AECOM - Newcastle
Project: **60305580**

Report : 5399-0-P

Description : Stack Emission Samples
Received: 06-Nov-13

Date : 11-Nov-13

Report To : Colin Clarke
17 Warabrook Blvd, Warabrook NSW 2304

Copy to: FILE

Thimble ID		Volume (mL)	Total Particulate Matter (g)
T137	Filter	-	0.0004
T138	Filter	-	0.0010

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

Note : 1. Sampled by Client

Reported By: Belinda Evans

Determined in Accordance With:
Particulate matter - total in stack gases by gravimetric using in-house M300

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	**EN1400365**	Page	1 of 4
Client	**AECOM Australia Pty Ltd**	Laboratory	Environmental Division Newcastle
Contact	MR JAMES MCINTYRE	Contact	Peter Keyte
Address	17 WARABROOK BOULEVARDE WARABROOK NSW, AUSTRALIA 2304	Address	5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	james.mcintyre@aecom.com	E-mail	peter.keyte@als.com.au
Telephone	+61 02 4911 4900	Telephone	61-2-4968-9433
Facsimile	+61 02 4911 4999	Facsimile	+61-2-4968 0349
Project	60305580 1 9	QC Level	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	----		
C-O-C number	154842	Date Samples Received	: 04-FEB-2014
Sampler	CB, CC	Issue Date	11-FEB-2014
Site	----		
		No. of samples received	9
Quote number	EN/004/13	No. of samples analysed	: 9

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics

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

Analytical Results

Sub-Matrix: IMPINGER SOLUTION (Matrix: AIR)

Compound	CAS Number	LOR	Unit	Client sample ID	KILN 1 SOX IPA	KILN 2 SOX IPA	IPA BLANK	KILN 2 SOX H2O2	KILN 1 SOX H2O2
				Client sampling date / time	30-JAN-2014 15:00	31-JAN-2014 15:00	31-JAN-2014 15:00	31-JAN-2014 15:00	30-JAN-2014 15:00
					EN1400365-001	EN1400365-002	EN1400365-003	EN1400365-004	EN1400365-005
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	----	1	mL		198	288	493	----	----
Sulfuric Acid as SO3	----	2	mg/sample		<2	242	<2	----	----
Volume - Impinger	----	1	mL		----	----	----	252	323
Sulfur Dioxide as SO3	----	10	mg/sample		----	----	----	10	20

Analytical Results

Sub-Matrix: **IMPINGER SOLUTION** (Matrix: **AIR**)

Compound	CAS Number	LOR	Unit	Client sample ID	H2O2 BLANK	KILN 1 TF	KILN 2 TF	TF BLANK	----
				Client sampling date / time	31-JAN-2014 15:00	30-JAN-2014 15:00	31-JAN-2014 15:00	31-JAN-2014 15:00	----
					EN1400365-006	EN1400365-007	EN1400365-008	EN1400365-009	----
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	----	1	mL		**470**	----	----	----	----
Sulfur Dioxide as SO3	----	10	mg/sample		<10	----	----	----	----
EA144C: Gaseous and Particulate Fluorides									
Fluoride (as HF)	----	0.1	mg/sample		----	**3.6**	**0.6**	<0.1	----
Volume - Impinger	----	1	mL		----	**293**	**262**	**435**	----

Steel River Testing

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

STACK EMISSION - MOISTURE REPORT

Origin: AECOM - Newcastle
Project: **60305580**

Report : 5930-0-M

Description : Stack Emission Samples
Received: 04-Feb-14

Date : 07-Feb-14

Report To : Chad Whitburn
17 Warabrook Blvd, Warabrook NSW 2304

Copy to: FILE

Jar ID	Moisture (g)
F99	12.2
FA1	13.1
P30	16.5
P31	17.1
P36	12.3
T2	11.5
Z11	18.7
Z13	16.6
Z16	10.6
Z8	5.8

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
Project: **60305580**

Report : 5930-0-P

Description : Stack Emission Samples
Received: 04-Feb-14

Date : 07-Feb-14

Report To : Chad Whitburn
17 Warabrook Blvd, Warabrook NSW 2304

Copy to: FILE

Thimble ID		Volume (mL)	Total Particulate Matter (g)
T14	Thimble	-	0.0087
T19	Thimble	-	0.0032
T23	Thimble	-	0.0137
T9	Thimble	-	0.0131

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

A.B.N. 44 000 964 278
3 - 5, 18 Redland Drive
Mitcham, Vic, 3132
Telephone: (03) 9874 1988
Fax: (03) 9874 1933

Chartered Chemists

10-Feb-2014

REPORT NUMBER: M140192
Site/Client Ref: 60305580 1.9
Order No: 60305580 1.9

AECOM
17 Warabrook Bvde
Warabrook

NSW 2304
Attention: Chris Burns

CERTIFICATE OF ANALYSIS

SAMPLES:	Eighteen samples were received for analysis
DATE RECEIVED:	**5-Feb-2014**
DATE COMMENCED:	**5-Feb-2014**
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
Chemist

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory Number: 14429

Accredited for compliance with ISO/IEC 17025.

(I) RESULTS

Report N°: M140192

Matrix: Filter

Method: USEPA M29 (Analysis only) - MA-1400.FL.M29.02

Sample units are expressed in µg total

	Leeder ID	2014001197	2014001198	2014001199	2014001200
	Client ID	KILN 1 No.1	KILN 2 No.1	Metals No.12	Method
Analyte Name	PQL				Blank
Sb	0.5	nd	nd	nd	nd
As	0.5	0.9	2.5	nd	nd
Be	0.5	nd	nd	nd	nd
Cd	0.5	6.0	4.7	nd	nd
Cr	0.5	6.3	8.7	0.9	nd
Co	0.5	nd	nd	nd	nd
Cu	0.5	0.5	0.9	0.6	nd
Pb	0.5	16	42	nd	nd
Mg	5	92	170	120	nd
Mn	0.5	1.3	2.2	0.7	nd
Hg	0.5	nd	nd	nd	nd
Ni	0.5	0.9	0.7	nd	nd
Se	0.5	2.1	1.0	nd	nd
Tl	0.5	nd	2.3	nd	nd
Sn	0.5	nd	5.6	nd	nd
V	0.5	2.0	2.4	2.0	nd
Zn	0.5	990	2600	1200	nd

(I) RESULTS

Report N°: M140192

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

	Leeder ID	2014001201
	Client ID	KILN1 No.3
Analyte Name	**PQL**	
Sb	0.1	0.2
As	0.1	1.3
Be	0.1	nd
Cd	0.1	9.1
Cr	0.1	11
Co	0.1	nd
Cu	0.1	15
Pb	0.1	3.2
Mg	1	8
Mn	0.1	8.6
Hg	0.1	nd
Ni	0.1	1.1
Se	0.1	0.2
Tl	0.1	0.1
Sn	0.1	0.6
V	0.1	nd
Zn	0.1	45
Sample Volume (ml)		100

(I) RESULTS

Report N°: M140192

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

	Leeder ID	2014001202	2014001203	2014001204
	Client ID	KILN2 No.3	KILN1 No.4	KILN2 No.4
Analyte Name	**PQL**			
Sb	0.1	0.5	2.9	1.2
As	0.1	12	0.9	1.5
Be	0.1	nd	nd	nd
Cd	0.1	16	9.8	6.1
Cr	0.1	14	0.4	4.9
Co	0.1	nd	nd	nd
Cu	0.1	3.7	0.6	0.8
Pb	0.1	18	0.4	16
Mg	1	21	8	10
Mn	0.1	11	6.3	3.7
Hg	0.1	1.0	nd	2.3
Ni	0.1	1.7	0.4	nd
Se	0.1	7.3	15	2.4
Tl	0.1	1.7	nd	1.7
Sn	0.1	0.9	2.3	0.6
V	0.1	nd	nd	nd
Zn	0.1	340	5.7	270
Sample Volume (ml)		95	320	330

(I) RESULTS

Report N°: M140192

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

	Leeder ID	2014001209	2014001211
	Client ID	Metals No.8A	Metals No.9
Analyte Name	**PQL**		
Sb	0.1	nd	0.6
As	0.1	nd	nd
Be	0.1	nd	nd
Cd	0.1	nd	nd
Cr	0.1	nd	nd
Co	0.1	nd	nd
Cu	0.1	0.6	nd
Pb	0.1	nd	nd
Mg	1	3	4
Mn	0.1	3.1	4.0
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	2.0	0.8
Sample Volume (ml)		310	200

(I) RESULTS

Report N°: M140192

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

	Leeder ID	2014001213
	Client ID	Method
Analyte Name	**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	1	nd
Mn	0.1	nd
Hg	0.1	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

(I) RESULTS

Report N°: M140192

Matrix: Impinger Solution

Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)

Sample units are expressed in µg total

	Leeder ID	2014001210
	Client ID	Metals No.8B
Analyte Name	**PQL**	
Hg	0.5	nd
Sample Volume (ml)		50

Matrix: Impinger Solution

Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)

Sample units are expressed in µg total

	Leeder ID	2014001212
	Client ID	Metals No.11
Analyte Name	PQL	
Hg	0.5	nd
Sample Volume (ml)		250

(I) RESULTS

Report N°: M140192

Matrix: KMnO4

Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)

Sample units are expressed in µg total

	Leeder ID	2014001205	2014001206
	Client ID	KILN1 No.5A	KILN2 No.5A
Analyte Name	**PQL**		
Hg	0.5	nd	nd
Sample Volume (ml)		100	95

Matrix: KMnO4

Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)

Sample units are expressed in µg total

	Leeder ID	2014001207	2014001208
	Client ID	KILN1 No.5C	KILN2 No.5C
Analyte Name	**PQL**		
Hg	0.5	nd	nd
Sample Volume (ml)		190	240

(I) RESULTS

Report N°: M140192

Matrix: KMnO4

Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)

Sample units are expressed in µg total

	Leeder ID	2014001214	2014001215	2014001216
	Client ID	KILN1 No.5B	KILN2 No.5B	Metals No.10
Analyte Name	**PQL**			
Hg	0.5	nd	4.9	nd
Sample Volume (ml)		400	400	100

Matrix: KMnO4

Method: USEPA M29 (Analysis only) - MA-1400.IMP.M29.04 Mercury in Impingers (ug total)

Sample units are expressed in µg total

	Leeder ID	2014001217
	Client ID	Method
Analyte Name	**PQL**	Blank
Hg	0.5	nd

(II) QUALITY CONTROL

Report N°: M140192

Matrix: Filter

Method: USEPA M29 (Analysis only) - MA-1400.FL.M29.02

Quality Control Results are expressed in Percent Recovery of expected result

	Leeder ID	2014001218	2014001219
	Client ID	Matrix	Matrix
Analyte Name	**PQL**	Spike	Spike Dup
Sb		116	114
As		111	111
Be		120	117
Cd		113	112
Cr		116	117
Co		112	114
Cu		114	113
Pb		108	109
Mg		94	96
Mn		111	111
Hg		102	104
Ni		112	111
Se		107	109
Tl		102	101
Sn		114	113
V		120	119
Zn		89	93

(II) QUALITY CONTROL

Report N°: M140192

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

	Leeder ID	2014001220	2014001221
	Client ID	Method	Method
Analyte Name	**PQL**	Spike	Spike Dup
Sb		94	116
As		109	109
Be		124	121
Cd		113	115
Cr		129	118
Co		108	112
Cu		127	116
Pb		109	116
Mg		103	96
Mn		110	109
Hg		110	111
Ni		111	111
Se		107	108
Tl		99	108
Sn		112	112
V		112	113
Zn		99	99

(II) QUALITY CONTROL

Report N°: M140192

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

	Leeder ID	2014001222
	Client ID	Method
Analyte Name	PQL	Spike
Hg		98

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

	Leeder ID	2014001223
	Client ID	Method
Analyte Name	PQL	Spike Dup
Hg		102

QUALIFIERS / NOTES FOR REPORTED RESULTS

PQL	Practical Quantitation Limit
is	Insufficient Sample to perform this analysis.
T	Tentative identification based on computer library search of mass spectra.
ND	Not Detected – The analyte was not detected above the reported PQL.
NC	Not calculated, Results below PQL
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.
C2	These compounds co-elute.
CT	Elevated concentration. Results reported from carbon tube analysis
**	Sample shows non-petroleum hydrocarbon profile

APPENDIX ONE.

CHAIN OF CUSTODY DOCUMENT

Chain of Custody Record - 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

Sheet 1 of 2

CLIENT NAME: AECOM (CONS-SUBS)

CLIENT ADDRESS: 17 Warabrook Blvd Warabrook NSW 2304

CONTACT: (CHRIS BURNS)

SAMPLED BY: CB, CC

PROJECT REF. / ORDER No: 60305580 109

CONTACT PHONE No: 02 4911 4900

CONTACT FAX No: 02 4911 4999

RESULTS REQUIRED BY:

EMAIL REPORT TO: Ntlair.Labs@aecom.com

LAB QUOTE NUMBER:

Sample Disposal (Please X) After: 4 Weeks ( ) 6 Weeks ( )

Client Sample ID	Date Sampled	Matrix: Soil	Water	Other	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	01-1L (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 (13 elements)	1,4-D
KILN 1 No.1															✓	
" 2 No.1															✓	
" 1 No.3															✓	
" 2 No.3															✓	
" 1 No.4															✓	
" 2 No.4															✓	
" 1 No.5A																✓
" 2 No.5A																✓
" 1 No.5B																✓
" 2 No 5B																✓
" 1 No.5C																✓
" 2 No. 5C																✓
----------	Totals:															

CHAIN OF CUSTODY RECORD

RELEASED BY: (Name) CHRIS BURNS (Signature) (Date / Time) 4/2/14

RECEIVED BY: (Name) V.PALAMARA (Signature) (Date / Time) 5/2/14 10.30am

Custody Seals Intact? (Yes) / No

Samples Received Chilled? (Yes) / No

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)

Chain of Custody Record - 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

Sheet 2 of 2

CLIENT NAME: AECOM

CLIENT ADDRESS: 17 Warabrook Blvd Warabrook NSW 2304 (CONS-SUBS)

CONTACT: (CHRIS BURNS)

SAMPLED BY: C.B, CC

PROJECT REF. / ORDER No: 60305580 HG

CONTACT PHONE No: 02 4911 4900

CONTACT FAX No: 02 4911 4999

RESULTS REQUIRED BY:

EMAIL REPORT TO: Ntlair.Labs@aecom.com

LAB QUOTE NUMBER:

Sample Disposal (Please X) After: 4 Weeks ( ) 6 Weeks ( )

Client Sample ID	Date Sampled	Matrix: Soil	Matrix: Water	Matrix: Other	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	01-1L (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, HG	HG
Metals No. 8A															✓	
" No 8B															✓	✓
" No. 9															✓	✓
" No. 10															✓	✓
" No 11															✓	✓
" No. 12															✓	✓
	Totals:															

CHAIN OF CUSTODY RECORD

	(Name)	(Signature)	(Date / Time)
RELEASED BY:	CHRIS BURNS	C	4/2/14
RECEIVED BY:	V. PALAMARA		5/2/12 10.30am

Custody Seals Intact? (Yes) / No

Samples Received Chilled? (Yes) / No

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)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1401194**	Page	: 1 of 3
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR JAMES LANG	Contact	: Peter Keyte
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW, AUSTRALIA 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: james.lang@aecom.com	E-mail	: peter.keyte@als.com.au
Telephone	: +61 02 4911 4900	Telephone	: 61-2-4968-9433
Facsimile	: +61 02 4911 4999	Facsimile	: +61-2-4968 0349
Project	: 60305580 TASK 1 9	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 60305580 TASK 1.9		
C-O-C number	: 154845	Date Samples Received	: 08-APR-2014
Sampler	: J LANG	Issue Date	: 15-APR-2014
Site	: ---		
Quote number	: EN/004/13	No. of samples received	: 4
		No. of samples analysed	: 4

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED **ACCREDITATION**

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics

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

- **Particular samples required dilution prior to analysis due to matrix interferences. LOR values have been adjusted accordingly.**

Analytical Results

Sub-Matrix: **IMPINGER SOLUTION** (Matrix: **AIR**)

Compound	CAS Number	LOR	Unit	Client sample ID	KILN 2 - H2SO4 AS SO3	KILN 2 - SO2 AS SO3	BLANK - H2SO4 AS SO3	BLANK - SO2 AS SO3	---
				Client sampling date / time	03-APR-2014 15:00	03-APR-2014 15:00	03-APR-2014 15:00	03-APR-2014 15:00	---
					EN1401194-001	EN1401194-002	EN1401194-003	EN1401194-004	---
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	---	1	mL		**330**	---	**162**	---	---
Sulfuric Acid as SO3	---	2	mg/sample		**26**	---	<2	---	---
Volume - Impinger	---	1	mL		---	**263**	---	**154**	---
Sulfur Dioxide as SO3	---	10	mg/sample		---	**210**	---	<10	---

Steel River Testing

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

STACK EMISSION - MOISTURE REPORT

Origin: AECOM - Newcastle
Project: **60305580 / 1.9**

Description : Stack Emission Samples
Received: 08-Apr-14

Report To : Chad Whitburn
17 Warabrook Blvd, Warabrook NSW 2304

Report : 6326-0-M

Date : 10-Apr-14

Copy to: FILE

Jar ID	Moisture (g)
F27	13.3

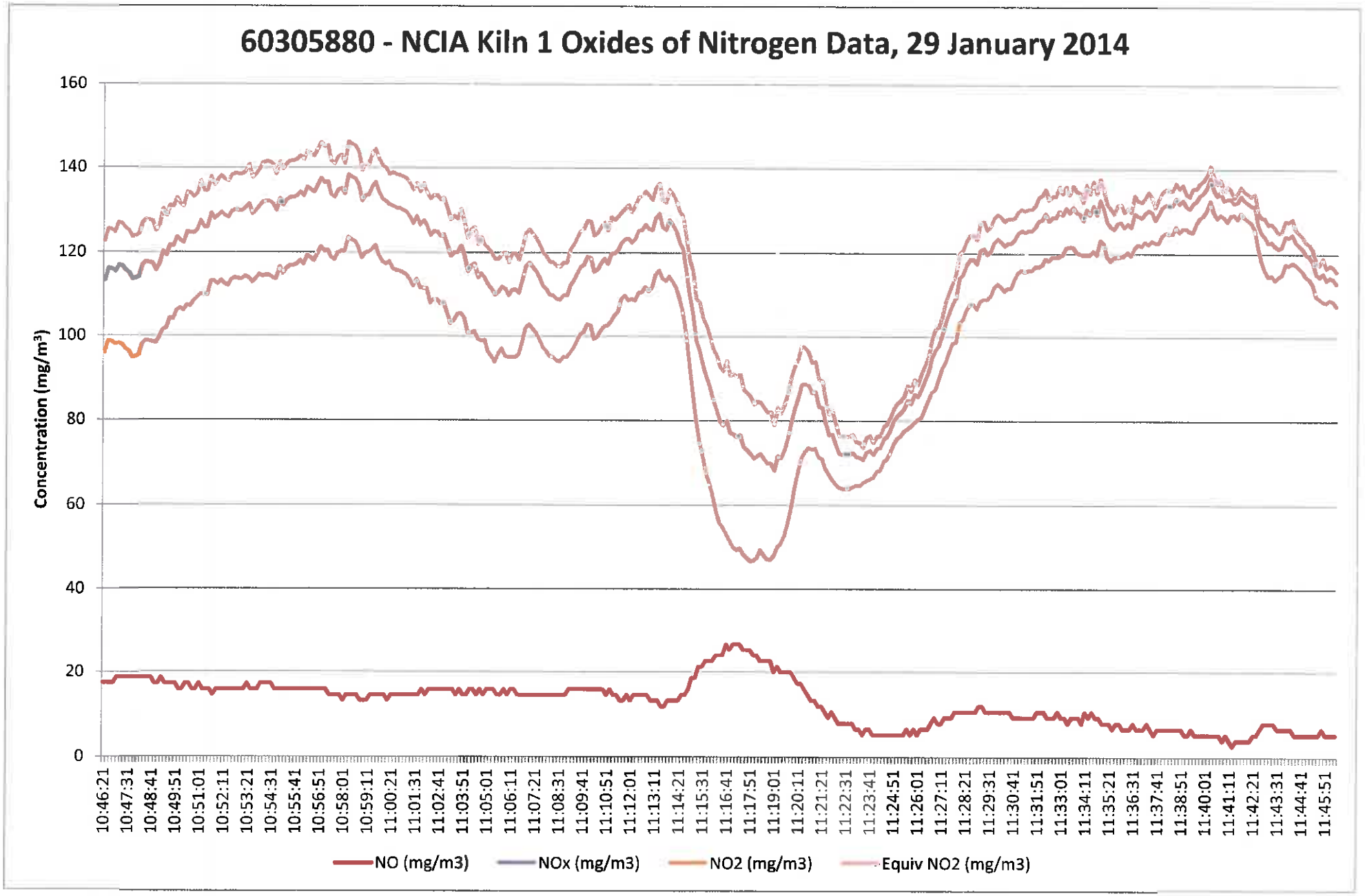
Reported By: Belinda Evans

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

Appendix C

Raw and Calculated Gas Data (12 pages)

Appendix C Raw and Calculated Gas Data (12 pages)


60305880 - NCIA Kiln 1 Oxides of Nitrogen Data, 29 January 2014
Concentration (mg/m³)
160
140
120
100
80
60
40
20
0
10:46:21
10:47:31
10:48:41
10:49:51
10:51:01
10:52:11
10:53:21
10:54:31
10:55:41
10:56:51
10:58:01
10:59:11
11:00:21
11:01:31
11:02:41
11:03:51
11:05:01
11:06:11
11:07:21
11:08:31
11:09:41
11:10:51
11:12:01
11:13:11
11:14:21
11:15:31
11:16:41
11:17:51
11:19:01
11:20:11
11:21:21
11:22:31
11:23:41
11:24:51
11:26:01
11:27:11
11:28:21
11:29:31
11:30:41
11:31:51
11:33:01
11:34:11
11:35:21
11:36:31
11:37:41
11:38:51
11:40:01
11:41:11
11:42:21
11:43:31
11:44:41
11:45:51
NO (mg/m3)
NOx (mg/m3)
NO2 (mg/m3)
Equiv NO2 (mg/m3)

60305580 Kiln 1 Oxides of Nitrogen Results, 29 January 2014

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)
29-Jan-14	10:46:21	13	17	44	113	46.7	96	67	123
29-Jan-14	10:46:31	13	17	46	116	48.1	99	68	125
29-Jan-14	10:46:41	13	17	49	116	48.0	99	68	125
29-Jan-14	10:46:51	13	17	50	115	47.7	98	68	125
29-Jan-14	10:47:01	14	19	50	117	47.8	98	69	127
29-Jan-14	10:47:11	14	19	50	117	47.7	98	69	127
29-Jan-14	10:47:21	14	19	50	116	47.2	97	69	126
29-Jan-14	10:47:31	14	19	51	115	46.9	96	68	125
29-Jan-14	10:47:41	14	19	52	114	46.2	95	68	124
29-Jan-14	10:47:51	14	19	52	114	46.3	95	68	124
29-Jan-14	10:48:01	14	19	53	114	46.5	95	68	124
29-Jan-14	10:48:11	14	19	54	117	47.8	98	69	127
29-Jan-14	10:48:21	14	19	54	118	48.2	99	70	128
29-Jan-14	10:48:31	14	19	54	118	48.1	99	70	128
29-Jan-14	10:48:41	14	19	54	117	48.0	99	69	127
29-Jan-14	10:48:51	13	17	54	116	47.9	98	68	125
29-Jan-14	10:49:01	13	17	55	117	48.6	100	69	127
29-Jan-14	10:49:11	14	19	55	120	49.4	101	71	130
29-Jan-14	10:49:21	13	17	55	119	49.6	102	70	129
29-Jan-14	10:49:31	13	17	55	122	50.8	104	71	131
29-Jan-14	10:49:41	13	17	55	122	50.7	104	71	131
29-Jan-14	10:49:51	13	17	56	124	51.7	106	72	133
29-Jan-14	10:50:01	12	16	56	123	52.0	107	70	131
29-Jan-14	10:50:11	12	16	56	122	51.7	106	70	131
29-Jan-14	10:50:21	13	17	55	125	52.3	107	72	134
29-Jan-14	10:50:31	13	17	56	125	52.2	107	72	134
29-Jan-14	10:50:41	12	16	56	125	52.8	108	71	133
29-Jan-14	10:50:51	12	16	55	125	53.2	109	72	134
29-Jan-14	10:51:01	13	17	55	127	53.6	110	74	137
29-Jan-14	10:51:11	12	16	55	126	53.5	110	72	135
29-Jan-14	10:51:21	12	16	55	126	53.5	110	72	135
29-Jan-14	10:51:31	12	16	56	129	55.1	113	74	138
29-Jan-14	10:51:41	11	15	57	128	55.1	113	72	136
29-Jan-14	10:51:51	12	16	56	129	54.8	113	73	137
29-Jan-14	10:52:01	12	16	57	129	55.2	113	74	138
29-Jan-14	10:52:11	12	16	56	129	54.8	113	73	137
29-Jan-14	10:52:21	12	16	56	128	54.6	112	73	137
29-Jan-14	10:52:31	12	16	56	130	55.3	114	74	138
29-Jan-14	10:52:41	12	16	57	130	55.5	114	74	139
29-Jan-14	10:52:51	12	16	57	130	55.4	114	74	138
29-Jan-14	10:53:01	12	16	57	130	55.4	114	74	138
29-Jan-14	10:53:11	12	16	57	130	55.7	114	74	139
29-Jan-14	10:53:21	13	17	57	131	55.5	114	75	141
29-Jan-14	10:53:31	12	16	57	129	55.0	113	73	138
29-Jan-14	10:53:41	12	16	57	130	55.4	114	74	138
29-Jan-14	10:53:51	12	16	58	131	55.9	115	74	139
29-Jan-14	10:54:01	13	17	58	132	55.7	114	76	141
29-Jan-14	10:54:11	13	17	58	132	55.8	115	76	141
29-Jan-14	10:54:21	13	17	58	132	55.8	115	76	141
29-Jan-14	10:54:31	13	17	58	131	55.5	114	75	141
29-Jan-14	10:54:41	12	16	59	130	55.4	114	74	138
29-Jan-14	10:54:51	12	16	60	133	56.8	117	75	141
29-Jan-14	10:55:01	12	16	59	131	56.0	115	74	140
29-Jan-14	10:55:11	12	16	59	132	56.6	116	75	141
29-Jan-14	10:55:21	12	16	59	133	56.9	117	75	141
29-Jan-14	10:55:31	12	16	59	133	56.9	117	75	141
29-Jan-14	10:55:41	12	16	60	133	57.1	117	76	142
29-Jan-14	10:55:51	12	16	60	134	57.5	118	76	143
29-Jan-14	10:56:01	12	16	60	133	57.1	117	76	142
29-Jan-14	10:56:11	12	16	60	135	58.1	119	77	144
29-Jan-14	10:56:21	12	16	60	135	57.8	119	76	143
29-Jan-14	10:56:31	12	16	60	134	57.5	118	76	143
29-Jan-14	10:56:41	12	16	60	136	58.3	120	77	144
29-Jan-14	10:56:51	12	16	61	137	59.1	121	78	146
29-Jan-14	10:57:01	12	16	61	136	58.6	120	77	145
29-Jan-14	10:57:11	12	16	61	137	58.7	121	77	145
29-Jan-14	10:57:21	11	15	60	134	57.9	119	75	141
29-Jan-14	10:57:31	11	15	61	133	57.6	118	74	141
29-Jan-14	10:57:41	11	15	62	135	58.4	120	75	143
29-Jan-14	10:57:51	11	15	62	135	58.6	120	75	143
29-Jan-14	10:58:01	10	13	62	134	58.6	120	74	141
29-Jan-14	10:58:11	11	15	61	138	60.2	124	77	146
29-Jan-14	10:58:21	11	15	62	138	59.9	123	77	146
29-Jan-14	10:58:31	11	15	61	137	59.7	123	77	145
29-Jan-14	10:58:41	11	15	62	136	59.0	121	76	144
29-Jan-14	10:58:51	10	13	62	132	57.8	119	73	139
29-Jan-14	10:59:01	10	13	62	133	58.4	120	74	140

60305580 Kiln 1 Oxides of Nitrogen Results, 29 January 2014

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)
29-Jan-14	10:59:11	10	13	62	134	58.5	120	74	141
29-Jan-14	10:59:21	11	15	63	135	58.8	121	76	143
29-Jan-14	10:59:31	11	15	62	137	59.3	122	76	144
29-Jan-14	10:59:41	11	15	63	134	58.1	119	75	142
29-Jan-14	10:59:51	11	15	63	133	57.4	118	74	140
29-Jan-14	11:00:01	11	15	64	132	57.1	117	74	140
29-Jan-14	11:00:11	10	13	64	131	57.4	118	73	138
29-Jan-14	11:00:21	11	15	64	131	56.6	116	73	139
29-Jan-14	11:00:31	11	15	64	131	56.4	116	73	138
29-Jan-14	11:00:41	11	15	64	130	56.3	116	73	138
29-Jan-14	11:00:51	11	15	65	130	56.1	115	73	138
29-Jan-14	11:01:01	11	15	65	130	55.9	115	73	137
29-Jan-14	11:01:11	11	15	64	128	55.3	114	72	136
29-Jan-14	11:01:21	11	15	64	127	54.6	112	71	135
29-Jan-14	11:01:31	11	15	64	129	55.4	114	72	136
29-Jan-14	11:01:41	11	15	64	126	54.4	112	71	134
29-Jan-14	11:01:51	12	16	63	128	54.3	112	73	136
29-Jan-14	11:02:01	11	15	63	126	54.3	112	71	134
29-Jan-14	11:02:11	12	16	62	124	52.6	108	71	133
29-Jan-14	11:02:21	12	16	62	125	53.0	109	71	133
29-Jan-14	11:02:31	12	16	61	125	53.0	109	71	133
29-Jan-14	11:02:41	12	16	62	124	52.5	108	71	132
29-Jan-14	11:02:51	12	16	61	124	52.7	108	71	133
29-Jan-14	11:03:01	12	16	61	122	51.5	106	70	130
29-Jan-14	11:03:11	12	16	61	119	50.2	103	69	128
29-Jan-14	11:03:21	12	16	61	120	50.6	104	69	129
29-Jan-14	11:03:31	11	15	62	120	51.3	105	68	128
29-Jan-14	11:03:41	12	16	61	122	51.4	106	70	130
29-Jan-14	11:03:51	11	15	62	119	50.9	105	68	127
29-Jan-14	11:04:01	11	15	63	116	49.1	101	66	123
29-Jan-14	11:04:11	12	16	64	117	49.1	101	68	125
29-Jan-14	11:04:21	12	16	65	117	49.3	101	68	126
29-Jan-14	11:04:31	11	15	65	114	48.4	99	65	122
29-Jan-14	11:04:41	12	16	65	115	48.2	99	67	124
29-Jan-14	11:04:51	11	15	65	114	48.3	99	65	122
29-Jan-14	11:05:01	12	16	65	112	46.9	96	65	121
29-Jan-14	11:05:11	12	16	66	111	46.4	95	65	120
29-Jan-14	11:05:21	12	16	66	110	45.7	94	64	118
29-Jan-14	11:05:31	11	15	66	111	46.7	96	64	118
29-Jan-14	11:05:41	11	15	67	112	47.3	97	64	120
29-Jan-14	11:05:51	12	16	66	111	46.4	95	65	120
29-Jan-14	11:06:01	11	15	67	110	46.3	95	63	118
29-Jan-14	11:06:11	12	16	67	111	46.3	95	65	120
29-Jan-14	11:06:21	12	16	66	111	46.3	95	65	120
29-Jan-14	11:06:31	11	15	68	110	46.6	96	63	118
29-Jan-14	11:06:41	11	15	68	114	48.1	99	65	121
29-Jan-14	11:06:51	11	15	68	117	49.7	102	67	125
29-Jan-14	11:07:01	11	15	68	118	50.1	103	67	125
29-Jan-14	11:07:11	11	15	68	117	49.6	102	66	124
29-Jan-14	11:07:21	11	15	68	116	49.1	101	66	123
29-Jan-14	11:07:31	11	15	69	114	48.4	99	65	122
29-Jan-14	11:07:41	11	15	69	112	47.4	97	64	120
29-Jan-14	11:07:51	11	15	70	111	47.0	97	64	119
29-Jan-14	11:08:01	11	15	70	110	46.4	95	63	118
29-Jan-14	11:08:11	11	15	69	110	46.3	95	63	118
29-Jan-14	11:08:21	11	15	70	109	45.9	94	63	117
29-Jan-14	11:08:31	11	15	70	109	45.8	94	63	117
29-Jan-14	11:08:41	11	15	70	110	46.3	95	63	118
29-Jan-14	11:08:51	11	15	70	110	46.3	95	63	118
29-Jan-14	11:09:01	12	16	71	112	46.8	96	65	121
29-Jan-14	11:09:11	12	16	70	113	47.4	97	66	122
29-Jan-14	11:09:21	12	16	71	115	48.2	99	67	124
29-Jan-14	11:09:31	12	16	71	117	49.0	101	67	125
29-Jan-14	11:09:41	12	16	71	117	49.2	101	68	126
29-Jan-14	11:09:51	12	16	71	119	50.1	103	69	128
29-Jan-14	11:10:01	12	16	71	119	50.0	103	68	127
29-Jan-14	11:10:11	12	16	72	115	48.4	99	67	124
29-Jan-14	11:10:21	12	16	72	116	48.7	100	67	125
29-Jan-14	11:10:31	12	16	72	118	49.4	101	68	126
29-Jan-14	11:10:41	12	16	72	119	49.9	102	68	127
29-Jan-14	11:10:51	11	15	72	117	50.0	103	67	125
29-Jan-14	11:11:01	12	16	72	120	50.5	104	69	128
29-Jan-14	11:11:11	11	15	73	120	51.2	105	68	128
29-Jan-14	11:11:21	11	15	72	121	51.6	106	68	129
29-Jan-14	11:11:31	10	13	69	122	53.1	109	68	130
29-Jan-14	11:11:41	10	13	67	123	53.5	110	69	130
29-Jan-14	11:11:51	11	15	73	123	52.9	109	70	131

60305580 Kiln 1 Oxides of Nitrogen Results, 29 January 2014

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)
29-Jan-14	11:12:01	10	13	74	122	53.1	109	68	130
29-Jan-14	11:12:11	11	15	75	123	52.9	109	70	131
29-Jan-14	11:12:21	11	15	74	125	53.8	110	71	133
29-Jan-14	11:12:31	11	15	74	125	53.9	111	71	133
29-Jan-14	11:12:41	11	15	74	127	54.5	112	71	135
29-Jan-14	11:12:51	11	15	73	126	54.0	111	71	133
29-Jan-14	11:13:01	10	13	72	125	54.5	112	70	132
29-Jan-14	11:13:11	10	13	70	128	55.9	115	71	135
29-Jan-14	11:13:21	10	13	69	129	56.4	116	72	136
29-Jan-14	11:13:31	9	12	69	126	55.5	114	69	132
29-Jan-14	11:13:41	9	12	68	125	55.2	113	69	132
29-Jan-14	11:13:51	10	13	68	128	55.7	114	71	135
29-Jan-14	11:14:01	10	13	67	127	55.1	113	70	134
29-Jan-14	11:14:11	10	13	67	125	54.4	112	70	132
29-Jan-14	11:14:21	10	13	67	122	53.1	109	68	130
29-Jan-14	11:14:31	11	15	65	121	51.6	106	68	129
29-Jan-14	11:14:41	11	15	61	115	49.0	101	66	123
29-Jan-14	11:14:51	12	16	54	110	45.6	94	64	118
29-Jan-14	11:15:01	14	19	46	106	42.4	87	64	116
29-Jan-14	11:15:11	14	19	39	99	39.1	80	61	109
29-Jan-14	11:15:21	16	21	37	97	36.7	75	61	108
29-Jan-14	11:15:31	16	21	39	93	34.9	72	59	105
29-Jan-14	11:15:41	17	23	34	91	33.0	68	59	103
29-Jan-14	11:15:51	17	23	30	88	31.8	65	58	100
29-Jan-14	11:16:01	17	23	40	85	30.3	62	56	97
29-Jan-14	11:16:11	18	24	52	83	28.5	59	56	95
29-Jan-14	11:16:21	18	24	55	80	27.2	56	55	93
29-Jan-14	11:16:31	18	24	49	79	26.7	55	54	92
29-Jan-14	11:16:41	20	27	43	80	25.9	53	57	94
29-Jan-14	11:16:51	19	25	39	77	25.2	52	54	91
29-Jan-14	11:17:01	20	27	46	77	24.4	50	55	91
29-Jan-14	11:17:11	20	27	57	76	24.1	49	55	91
29-Jan-14	11:17:21	20	27	60	77	24.3	50	55	91
29-Jan-14	11:17:31	19	25	60	74	23.6	48	53	87
29-Jan-14	11:17:41	19	25	61	73	23.2	48	52	87
29-Jan-14	11:17:51	19	25	61	72	22.8	47	52	86
29-Jan-14	11:18:01	18	24	61	71	22.9	47	51	84
29-Jan-14	11:18:11	18	24	60	72	23.2	48	51	85
29-Jan-14	11:18:21	17	23	60	72	24.1	49	50	84
29-Jan-14	11:18:31	17	23	59	71	23.5	48	50	83
29-Jan-14	11:18:41	17	23	59	70	23.0	47	49	82
29-Jan-14	11:18:51	17	23	58	70	23.0	47	49	82
29-Jan-14	11:19:01	15	20	58	68	23.5	48	47	79
29-Jan-14	11:19:11	16	21	58	72	24.5	50	49	83
29-Jan-14	11:19:21	15	20	56	71	24.9	51	48	82
29-Jan-14	11:19:31	15	20	56	73	25.8	53	49	84
29-Jan-14	11:19:41	15	20	58	76	27.2	56	50	87
29-Jan-14	11:19:51	15	20	57	80	29.1	60	52	91
29-Jan-14	11:20:01	14	19	57	83	31.3	64	53	93
29-Jan-14	11:20:11	13	17	57	85	33.1	68	53	95
29-Jan-14	11:20:21	13	17	57	89	34.7	71	55	98
29-Jan-14	11:20:31	12	16	57	89	35.4	73	54	97
29-Jan-14	11:20:41	11	15	56	88	35.9	74	53	96
29-Jan-14	11:20:51	10	13	55	87	35.7	73	51	94
29-Jan-14	11:21:01	10	13	54	87	35.8	74	51	94
29-Jan-14	11:21:11	9	12	53	84	34.8	71	49	90
29-Jan-14	11:21:21	9	12	51	83	34.6	71	48	90
29-Jan-14	11:21:31	8	11	49	80	33.5	69	46	85
29-Jan-14	11:21:41	7	9	46	77	32.8	67	44	82
29-Jan-14	11:21:51	8	11	44	77	32.2	66	44	83
29-Jan-14	11:22:01	7	9	43	74	31.7	65	42	79
29-Jan-14	11:22:11	6	8	42	72	31.3	64	41	77
29-Jan-14	11:22:21	6	8	41	72	31.2	64	40	76
29-Jan-14	11:22:31	6	8	40	72	31.2	64	40	76
29-Jan-14	11:22:41	6	8	40	72	31.2	64	40	76
29-Jan-14	11:22:51	6	8	40	73	31.4	64	41	77
29-Jan-14	11:23:01	5	7	40	72	31.6	65	39	75
29-Jan-14	11:23:11	5	7	39	71	31.5	65	39	75
29-Jan-14	11:23:21	4	5	39	71	31.9	66	38	74
29-Jan-14	11:23:31	5	7	38	73	32.1	66	40	76
29-Jan-14	11:23:41	5	7	37	73	32.3	66	40	77
29-Jan-14	11:23:51	4	5	37	72	32.5	67	39	75
29-Jan-14	11:24:01	4	5	37	74	33.2	68	39	76
29-Jan-14	11:24:11	4	5	37	74	33.3	68	39	77
29-Jan-14	11:24:21	4	5	37	76	34.3	70	40	79
29-Jan-14	11:24:31	4	5	35	76	34.6	71	41	79
29-Jan-14	11:24:41	4	5	35	78	35.4	73	42	81

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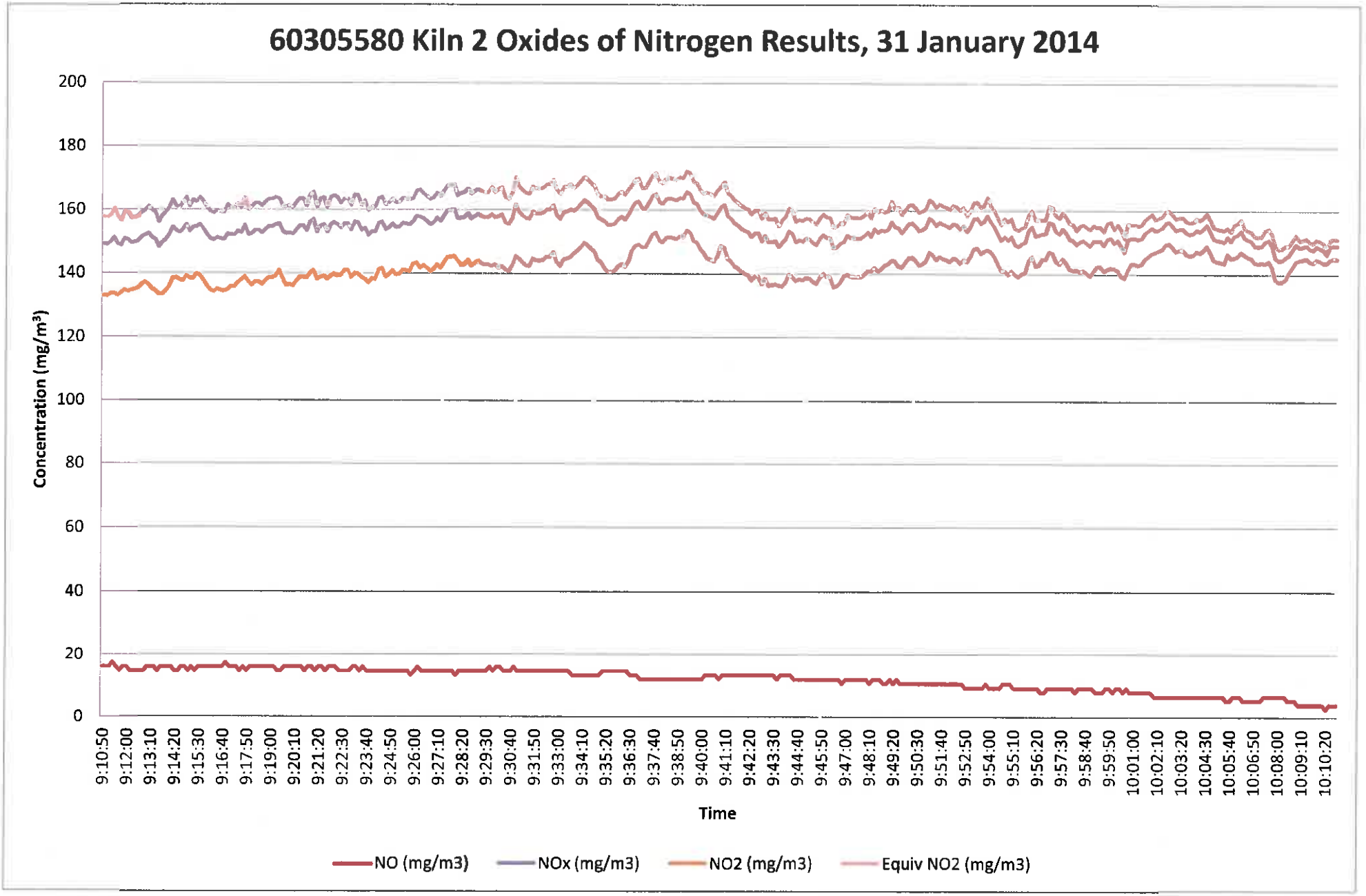
Date	Time	NO (ppm)	NO (mg/m^3)	NOx (ppm)	NOx (mg/m^3)	NO_2 (ppm)	NO_2 (mg/m^3)	Equiv NO_2 (ppm)	Equiv NO_2 (mg/m^3)
29-Jan-14	11:24:51	4	5	34	80	36.4	75	43	83
29-Jan-14	11:25:01	4	5	34	81	37.0	76	43	84
29-Jan-14	11:25:11	4	5	33	82	37.3	77	43	85
29-Jan-14	11:25:21	4	5	33	83	37.8	78	44	86
29-Jan-14	11:25:31	5	7	32	85	38.1	78	46	89
29-Jan-14	11:25:41	4	5	32	84	38.4	79	45	87
29-Jan-14	11:25:51	5	7	31	86	38.8	80	46	90
29-Jan-14	11:26:01	4	5	30	86	39.2	81	45	89
29-Jan-14	11:26:11	5	7	30	88	39.4	81	47	91
29-Jan-14	11:26:21	5	7	31	90	40.4	83	48	93
29-Jan-14	11:26:31	5	7	31	92	41.4	85	49	95
29-Jan-14	11:26:41	6	8	31	95	42.3	87	52	99
29-Jan-14	11:26:51	7	9	31	97	42.6	87	53	102
29-Jan-14	11:27:01	6	8	31	98	43.8	90	53	102
29-Jan-14	11:27:11	6	8	30	100	45.0	92	54	105
29-Jan-14	11:27:21	7	9	29	103	45.8	94	57	108
29-Jan-14	11:27:31	7	9	29	106	46.9	96	58	111
29-Jan-14	11:27:41	7	9	28	108	48.0	99	59	113
29-Jan-14	11:27:51	8	11	27	109	48.1	99	60	115
29-Jan-14	11:28:01	8	11	27	114	50.4	104	63	120
29-Jan-14	11:28:11	8	11	26	115	50.8	104	63	121
29-Jan-14	11:28:21	8	11	25	117	51.9	107	64	123
29-Jan-14	11:28:31	8	11	24	119	52.5	108	65	124
29-Jan-14	11:28:41	8	11	24	119	52.5	108	65	124
29-Jan-14	11:28:51	8	11	24	118	52.0	107	64	123
29-Jan-14	11:29:01	9	12	23	121	52.9	109	67	127
29-Jan-14	11:29:11	9	12	23	121	53.1	109	67	128
29-Jan-14	11:29:21	8	11	23	120	53.1	109	65	125
29-Jan-14	11:29:31	8	11	22	121	53.5	110	66	126
29-Jan-14	11:29:41	8	11	22	123	54.5	112	67	128
29-Jan-14	11:29:51	8	11	22	123	54.9	113	67	129
29-Jan-14	11:30:01	8	11	22	123	54.6	112	67	129
29-Jan-14	11:30:11	8	11	22	122	54.1	111	66	128
29-Jan-14	11:30:21	8	11	22	122	54.4	112	67	128
29-Jan-14	11:30:31	8	11	22	122	54.4	112	67	128
29-Jan-14	11:30:41	7	9	21	123	55.5	114	66	128
29-Jan-14	11:30:51	7	9	22	125	56.2	115	67	130
29-Jan-14	11:31:01	7	9	21	125	56.5	116	67	130
29-Jan-14	11:31:11	7	9	21	125	56.3	116	67	130
29-Jan-14	11:31:21	7	9	21	125	56.5	116	67	130
29-Jan-14	11:31:31	7	9	21	125	56.5	116	67	130
29-Jan-14	11:31:41	7	9	21	126	56.9	117	68	131
29-Jan-14	11:31:51	8	11	21	128	56.9	117	69	133
29-Jan-14	11:32:01	8	11	20	128	57.1	117	69	134
29-Jan-14	11:32:11	8	11	21	129	57.8	119	70	135
29-Jan-14	11:32:21	7	9	20	128	57.6	118	68	133
29-Jan-14	11:32:31	7	9	20	128	58.0	119	69	133
29-Jan-14	11:32:41	7	9	20	128	58.0	119	69	133
29-Jan-14	11:32:51	8	11	19	130	58.1	119	70	136
29-Jan-14	11:33:01	7	9	19	129	58.3	120	69	134
29-Jan-14	11:33:11	7	9	19	131	59.1	121	70	136
29-Jan-14	11:33:21	6	8	19	130	59.2	122	68	134
29-Jan-14	11:33:31	7	9	19	131	59.2	122	70	136
29-Jan-14	11:33:41	7	9	19	130	58.6	120	69	135
29-Jan-14	11:33:51	7	9	19	129	58.4	120	69	134
29-Jan-14	11:34:01	6	8	19	128	58.3	120	68	132
29-Jan-14	11:34:11	8	11	20	130	58.3	120	71	136
29-Jan-14	11:34:21	7	9	19	129	58.3	120	69	134
29-Jan-14	11:34:31	8	11	19	131	58.7	121	71	137
29-Jan-14	11:34:41	7	9	19	129	58.3	120	69	134
29-Jan-14	11:34:51	7	9	19	133	60.0	123	71	138
29-Jan-14	11:35:01	6	8	19	130	59.6	122	69	135
29-Jan-14	11:35:11	6	8	19	127	58.1	119	67	132
29-Jan-14	11:35:21	6	8	19	126	57.6	118	67	131
29-Jan-14	11:35:31	5	7	20	126	58.0	119	66	129
29-Jan-14	11:35:41	6	8	19	127	58.0	119	67	131
29-Jan-14	11:35:51	6	8	19	127	58.1	119	67	132
29-Jan-14	11:36:01	5	7	19	126	58.2	120	66	130
29-Jan-14	11:36:11	5	7	19	127	58.6	120	66	131
29-Jan-14	11:36:21	5	7	19	126	58.2	120	66	130
29-Jan-14	11:36:31	6	8	19	129	59.1	121	68	134
29-Jan-14	11:36:41	5	7	18	129	59.5	122	67	132
29-Jan-14	11:36:51	5	7	19	128	59.3	122	67	132
29-Jan-14	11:37:01	5	7	18	130	59.8	123	67	133
29-Jan-14	11:37:11	6	8	19	130	59.5	122	69	135
29-Jan-14	11:37:21	5	7	18	130	59.9	123	68	133
29-Jan-14	11:37:31	4	5	19	128	59.7	123	66	131

60305580 Kiln 1 Oxides of Nitrogen Results, 29 January 2014

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)
29-Jan-14	11:37:41	5	7	18	129	59.7	123	67	133
29-Jan-14	11:37:51	5	7	18	131	60.5	124	68	135
29-Jan-14	11:38:01	5	7	19	132	60.8	125	68	135
29-Jan-14	11:38:11	5	7	19	131	60.7	125	68	135
29-Jan-14	11:38:21	5	7	19	131	60.7	125	68	135
29-Jan-14	11:38:31	5	7	18	133	61.5	126	69	137
29-Jan-14	11:38:41	5	7	18	132	60.9	125	69	135
29-Jan-14	11:38:51	5	7	18	133	61.3	126	69	136
29-Jan-14	11:39:01	4	5	18	131	61.3	126	67	134
29-Jan-14	11:39:11	4	5	18	131	61.0	125	67	133
29-Jan-14	11:39:21	5	7	18	132	60.9	125	69	135
29-Jan-14	11:39:31	4	5	18	132	61.9	127	68	135
29-Jan-14	11:39:41	4	5	18	134	62.5	128	69	137
29-Jan-14	11:39:51	4	5	19	134	62.8	129	69	137
29-Jan-14	11:40:01	4	5	18	136	63.4	130	70	138
29-Jan-14	11:40:11	4	5	19	138	64.5	132	71	141
29-Jan-14	11:40:21	4	5	19	135	63.2	130	69	138
29-Jan-14	11:40:31	4	5	19	134	62.5	128	69	137
29-Jan-14	11:40:41	4	5	19	135	62.9	129	69	137
29-Jan-14	11:40:51	3	4	19	133	62.6	129	67	135
29-Jan-14	11:41:01	4	5	18	133	62.1	128	68	136
29-Jan-14	11:41:11	3	4	19	133	62.8	129	67	135
29-Jan-14	11:41:21	2	3	18	132	62.9	129	66	133
29-Jan-14	11:41:31	3	4	19	132	62.4	128	67	134
29-Jan-14	11:41:41	3	4	19	134	63.1	130	68	136
29-Jan-14	11:41:51	3	4	19	133	62.6	129	67	135
29-Jan-14	11:42:01	3	4	19	132	62.3	128	67	134
29-Jan-14	11:42:11	3	4	18	131	62.0	127	67	133
29-Jan-14	11:42:21	4	5	19	131	61.3	126	67	134
29-Jan-14	11:42:31	4	5	18	127	59.2	122	65	130
29-Jan-14	11:42:41	5	7	18	125	57.6	118	65	129
29-Jan-14	11:42:51	6	8	18	124	56.5	116	66	128
29-Jan-14	11:43:01	6	8	18	123	55.8	115	65	127
29-Jan-14	11:43:11	6	8	18	123	55.9	115	65	127
29-Jan-14	11:43:21	6	8	17	122	55.4	114	65	126
29-Jan-14	11:43:31	5	7	17	121	55.8	115	63	125
29-Jan-14	11:43:41	5	7	17	122	56.0	115	64	125
29-Jan-14	11:43:51	5	7	17	124	57.2	117	65	128
29-Jan-14	11:44:01	5	7	17	124	57.1	117	65	128
29-Jan-14	11:44:11	5	7	17	125	57.4	118	65	128
29-Jan-14	11:44:21	4	5	18	123	57.2	117	63	126
29-Jan-14	11:44:31	4	5	17	122	56.8	117	63	125
29-Jan-14	11:44:41	4	5	18	121	56.4	116	63	124
29-Jan-14	11:44:51	4	5	18	120	55.8	115	62	123
29-Jan-14	11:45:01	4	5	18	119	55.5	114	62	122
29-Jan-14	11:45:11	4	5	19	118	54.9	113	61	121
29-Jan-14	11:45:21	4	5	20	115	53.5	110	60	118
29-Jan-14	11:45:31	4	5	20	115	53.2	109	59	117
29-Jan-14	11:45:41	5	7	22	115	52.9	109	61	119
29-Jan-14	11:45:51	4	5	22	114	52.8	108	59	117
29-Jan-14	11:46:01	4	5	23	114	53.1	109	59	117
29-Jan-14	11:46:11	4	5	24	114	52.9	109	59	117
29-Jan-14	11:46:21	4	5	24	113	52.4	108	59	116
Average		**10**	**13**	**45**	**115**	**50**	**102**	**65**	**122**
Maximum		**20**	**27**	**75**	**138**	**65**	**132**	**78**	**146**
Minimum		**2**	**3**	**17**	**68**	**23**	**47**	**38**	**74**
Corrected to 18% O2		**6**	**8**	**28**	**70**	**30**	**63**	**39**	**75**


60305580 Kiln 2 Oxides of Nitrogen Results, 31 January 2014
Concentration (mg/m³)
200
180
160
140
120
100
80
60
40
20
0
9:10:50
9:12:00
9:13:10
9:14:20
9:15:30
9:16:40
9:17:50
9:19:00
9:20:10
9:21:20
9:22:30
9:23:40
9:24:50
9:26:00
9:27:10
9:28:20
9:29:30
9:30:40
9:31:50
9:33:00
9:34:10
9:35:20
9:36:30
9:37:40
9:38:50
9:40:00
9:41:10
9:42:20
9:43:30
9:44:40
9:45:50
9:47:00
9:48:10
9:49:20
9:50:30
9:51:40
9:52:50
9:54:00
9:55:10
9:56:20
9:57:30
9:58:40
9:59:50
10:01:00
10:02:10
10:03:20
10:04:30
10:05:40
10:06:50
10:08:00
10:09:10
10:10:20
Time
NO (mg/m3)
NOx (mg/m3)
NO2 (mg/m3)
Equiv NO2 (mg/m3)

60305580 Kiln 2 Oxides of Nitrogen Results, 31 January 2014

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)
31-Jan-14	9:10:50	12	16	77	149	64.8	133	83	158
31-Jan-14	9:11:00	12	16	77	149	64.7	133	83	158
31-Jan-14	9:11:10	12	16	77	150	65.1	134	84	158
31-Jan-14	9:11:20	13	17	78	151	65.1	134	85	160
31-Jan-14	9:11:30	12	16	77	149	64.8	133	83	158
31-Jan-14	9:11:40	11	15	77	149	65.2	134	82	156
31-Jan-14	9:11:50	12	16	77	151	65.6	135	84	159
31-Jan-14	9:12:00	12	16	77	150	65.4	134	84	159
31-Jan-14	9:12:10	11	15	77	149	65.6	135	82	157
31-Jan-14	9:12:20	11	15	77	150	65.7	135	83	158
31-Jan-14	9:12:30	11	15	77	150	65.9	135	83	158
31-Jan-14	9:12:40	11	15	78	151	66.5	137	83	159
31-Jan-14	9:12:50	11	15	78	152	66.8	137	84	160
31-Jan-14	9:13:00	12	16	78	152	66.4	136	85	161
31-Jan-14	9:13:10	12	16	78	151	65.8	135	84	160
31-Jan-14	9:13:20	12	16	77	151	65.5	135	84	159
31-Jan-14	9:13:30	11	15	76	148	65.0	133	82	156
31-Jan-14	9:13:40	12	16	77	150	65.0	133	83	158
31-Jan-14	9:13:50	12	16	77	151	65.5	135	84	159
31-Jan-14	9:14:00	12	16	78	152	66.2	136	85	161
31-Jan-14	9:14:10	12	16	79	154	67.4	138	86	163
31-Jan-14	9:14:20	11	15	79	153	67.5	139	84	161
31-Jan-14	9:14:30	11	15	79	153	67.2	138	84	161
31-Jan-14	9:14:40	12	16	79	154	67.0	138	85	162
31-Jan-14	9:14:50	12	16	80	155	67.8	139	86	164
31-Jan-14	9:15:00	11	15	79	153	67.4	138	84	161
31-Jan-14	9:15:10	12	16	79	154	67.4	138	86	163
31-Jan-14	9:15:20	11	15	80	155	68.1	140	85	162
31-Jan-14	9:15:30	12	16	80	155	67.8	139	86	164
31-Jan-14	9:15:40	12	16	79	154	67.1	138	86	162
31-Jan-14	9:15:50	12	16	78	152	66.3	136	85	161
31-Jan-14	9:16:00	12	16	77	151	65.6	135	84	159
31-Jan-14	9:16:10	12	16	77	150	65.4	134	84	159
31-Jan-14	9:16:20	12	16	77	151	65.8	135	84	160
31-Jan-14	9:16:30	12	16	78	151	65.6	135	84	159
31-Jan-14	9:16:40	12	16	78	151	65.5	135	84	159
31-Jan-14	9:16:50	13	17	78	152	65.7	135	86	162
31-Jan-14	9:17:00	12	16	78	152	66.2	136	85	161
31-Jan-14	9:17:10	12	16	78	152	66.2	136	85	161
31-Jan-14	9:17:20	12	16	79	153	66.8	137	85	162
31-Jan-14	9:17:30	11	15	78	153	67.2	138	84	161
31-Jan-14	9:17:40	12	16	79	155	67.7	139	86	164
31-Jan-14	9:17:50	11	15	78	152	66.9	137	84	160
31-Jan-14	9:18:00	12	16	78	152	66.4	136	85	161
31-Jan-14	9:18:10	12	16	78	153	66.9	137	85	162
31-Jan-14	9:18:20	12	16	79	153	66.9	137	85	162
31-Jan-14	9:18:30	12	16	78	153	66.5	137	85	161
31-Jan-14	9:18:40	12	16	79	154	67.1	138	86	162
31-Jan-14	9:18:50	12	16	79	155	67.5	139	86	163
31-Jan-14	9:19:00	12	16	79	155	67.5	139	86	163
31-Jan-14	9:19:10	12	16	79	155	67.8	139	86	164
31-Jan-14	9:19:20	11	15	80	156	68.6	141	85	163
31-Jan-14	9:19:30	11	15	79	153	67.4	138	84	161
31-Jan-14	9:19:40	12	16	78	152	66.4	136	85	161
31-Jan-14	9:19:50	12	16	78	153	66.5	137	85	161
31-Jan-14	9:20:00	12	16	78	152	66.3	136	85	161
31-Jan-14	9:20:10	12	16	79	154	67.0	138	85	162
31-Jan-14	9:20:20	12	16	80	155	67.6	139	86	163
31-Jan-14	9:20:30	12	16	79	155	67.6	139	86	163
31-Jan-14	9:20:40	11	15	79	153	67.5	139	84	161
31-Jan-14	9:20:50	12	16	80	156	68.2	140	87	165
31-Jan-14	9:21:00	12	16	80	157	68.6	141	87	166
31-Jan-14	9:21:10	11	15	79	153	67.3	138	84	161
31-Jan-14	9:21:20	12	16	79	155	67.6	139	86	163
31-Jan-14	9:21:30	12	16	79	155	67.8	139	86	164
31-Jan-14	9:21:40	11	15	79	153	67.3	138	84	161
31-Jan-14	9:21:50	12	16	79	155	67.8	139	86	164
31-Jan-14	9:22:00	12	16	80	156	68.1	140	87	164
31-Jan-14	9:22:10	12	16	79	155	67.8	139	86	164
31-Jan-14	9:22:20	11	15	79	154	67.9	139	85	162
31-Jan-14	9:22:30	11	15	80	156	68.6	141	85	163
31-Jan-14	9:22:40	11	15	80	156	68.6	141	85	163
31-Jan-14	9:22:50	11	15	79	154	67.6	139	84	161
31-Jan-14	9:23:00	12	16	80	156	68.2	140	87	165
31-Jan-14	9:23:10	12	16	80	156	68.1	140	87	164
31-Jan-14	9:23:20	11	15	79	154	67.6	139	84	161
31-Jan-14	9:23:30	12	16	79	154	67.3	138	86	163

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)
31-Jan-14	9:23:40	11	15	78	152	66.8	137	84	160
31-Jan-14	9:23:50	11	15	79	153	67.4	138	84	161
31-Jan-14	9:24:00	11	15	78	153	67.3	138	84	161
31-Jan-14	9:24:10	11	15	80	156	68.7	141	86	164
31-Jan-14	9:24:20	11	15	80	156	68.9	141	86	164
31-Jan-14	9:24:30	11	15	79	154	67.7	139	85	162
31-Jan-14	9:24:40	11	15	79	154	68.0	140	85	162
31-Jan-14	9:24:50	11	15	80	156	68.6	141	85	163
31-Jan-14	9:25:00	11	15	79	154	68.0	140	85	162
31-Jan-14	9:25:10	11	15	79	155	68.1	140	85	162
31-Jan-14	9:25:20	11	15	80	156	68.7	141	86	164
31-Jan-14	9:25:30	11	15	79	156	68.6	141	85	163
31-Jan-14	9:25:40	11	15	79	155	68.5	141	85	163
31-Jan-14	9:25:50	10	13	80	156	69.6	143	85	163
31-Jan-14	9:26:00	11	15	81	158	69.8	143	87	166
31-Jan-14	9:26:10	12	16	81	158	69.0	142	87	166
31-Jan-14	9:26:20	11	15	81	157	69.4	143	86	165
31-Jan-14	9:26:30	11	15	80	156	69.0	142	86	164
31-Jan-14	9:26:40	11	15	80	155	68.5	141	85	163
31-Jan-14	9:26:50	11	15	80	156	68.8	141	86	164
31-Jan-14	9:27:00	11	15	81	157	69.5	143	86	165
31-Jan-14	9:27:10	11	15	80	156	69.0	142	86	164
31-Jan-14	9:27:20	11	15	81	158	69.8	143	87	166
31-Jan-14	9:27:30	11	15	81	160	70.6	145	87	168
31-Jan-14	9:27:40	11	15	82	160	70.7	145	88	168
31-Jan-14	9:27:50	11	15	81	160	70.8	145	88	168
31-Jan-14	9:28:00	10	13	80	157	70.1	144	85	164
31-Jan-14	9:28:10	11	15	80	157	69.5	143	86	165
31-Jan-14	9:28:20	11	15	81	158	69.6	143	86	166
31-Jan-14	9:28:30	11	15	81	159	70.2	144	87	167
31-Jan-14	9:28:40	11	15	80	157	69.4	143	86	165
31-Jan-14	9:28:50	11	15	81	158	69.8	143	87	166
31-Jan-14	9:29:00	11	15	81	159	70.1	144	87	167
31-Jan-14	9:29:10	11	15	81	158	69.8	143	87	166
31-Jan-14	9:29:20	11	15	80	158	69.6	143	86	166
31-Jan-14	9:29:30	11	15	81	158	69.6	143	86	166
31-Jan-14	9:29:40	12	16	81	159	69.4	143	88	167
31-Jan-14	9:29:50	11	15	81	158	69.6	143	86	166
31-Jan-14	9:30:00	12	16	81	158	69.1	142	88	167
31-Jan-14	9:30:10	12	16	81	159	69.4	143	88	167
31-Jan-14	9:30:20	11	15	80	156	68.8	141	86	164
31-Jan-14	9:30:30	11	15	80	156	68.6	141	85	163
31-Jan-14	9:30:40	11	15	81	157	69.5	143	86	165
31-Jan-14	9:30:50	12	16	83	162	70.9	146	89	170
31-Jan-14	9:31:00	11	15	82	160	70.5	145	87	167
31-Jan-14	9:31:10	11	15	81	158	69.9	144	87	166
31-Jan-14	9:31:20	11	15	80	157	69.5	143	86	165
31-Jan-14	9:31:30	11	15	81	157	69.4	143	86	165
31-Jan-14	9:31:40	11	15	82	160	70.5	145	87	167
31-Jan-14	9:31:50	11	15	81	159	70.2	144	87	167
31-Jan-14	9:32:00	11	15	81	159	70.2	144	87	167
31-Jan-14	9:32:10	11	15	81	159	70.3	144	87	167
31-Jan-14	9:32:20	11	15	82	160	70.8	145	88	168
31-Jan-14	9:32:30	11	15	82	160	70.8	145	88	168
31-Jan-14	9:32:40	11	15	82	162	71.5	147	88	169
31-Jan-14	9:32:50	11	15	81	158	70.0	144	87	166
31-Jan-14	9:33:00	11	15	80	157	69.4	143	86	165
31-Jan-14	9:33:10	11	15	81	159	70.4	145	87	167
31-Jan-14	9:33:20	11	15	82	160	70.5	145	87	167
31-Jan-14	9:33:30	11	15	81	160	70.8	145	88	168
31-Jan-14	9:33:40	10	13	82	160	71.3	146	87	167
31-Jan-14	9:33:50	10	13	82	161	71.7	147	87	168
31-Jan-14	9:34:00	10	13	82	162	72.3	148	88	169
31-Jan-14	9:34:10	10	13	83	163	72.9	150	88	170
31-Jan-14	9:34:20	10	13	83	162	72.6	149	88	170
31-Jan-14	9:34:30	10	13	83	161	72.0	148	87	168
31-Jan-14	9:34:40	10	13	82	160	71.6	147	87	168
31-Jan-14	9:34:50	10	13	81	158	70.3	144	86	165
31-Jan-14	9:35:00	10	13	80	157	70.0	144	85	164
31-Jan-14	9:35:10	11	15	80	156	69.0	142	86	164
31-Jan-14	9:35:20	11	15	80	155	68.5	141	85	163
31-Jan-14	9:35:30	11	15	80	155	68.5	141	85	163
31-Jan-14	9:35:40	11	15	80	156	68.7	141	86	164
31-Jan-14	9:35:50	11	15	80	157	69.4	143	86	165
31-Jan-14	9:36:00	11	15	80	158	69.7	143	87	166
31-Jan-14	9:36:10	11	15	80	157	69.3	142	86	165
31-Jan-14	9:36:20	11	15	81	159	70.1	144	87	167

60305580 Kiln 2 Oxides of Nitrogen Results, 31 January 2014

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)
31-Jan-14	9:36:30	10	13	82	161	71.7	147	87	168
31-Jan-14	9:36:40	10	13	83	162	72.5	149	88	169
31-Jan-14	9:36:50	10	13	82	163	72.7	149	88	170
31-Jan-14	9:37:00	9	12	82	161	72.3	148	86	167
31-Jan-14	9:37:10	9	12	81	161	72.3	148	86	167
31-Jan-14	9:37:20	9	12	82	162	73.2	150	87	169
31-Jan-14	9:37:30	9	12	83	164	74.2	152	88	171
31-Jan-14	9:37:40	9	12	84	165	74.5	153	88	171
31-Jan-14	9:37:50	9	12	82	163	73.3	151	87	169
31-Jan-14	9:38:00	9	12	82	162	73.0	150	87	168
31-Jan-14	9:38:10	9	12	83	163	73.7	151	88	170
31-Jan-14	9:38:20	9	12	83	164	73.8	152	88	170
31-Jan-14	9:38:30	9	12	83	163	73.7	151	88	170
31-Jan-14	9:38:40	9	12	82	163	73.5	151	87	169
31-Jan-14	9:38:50	9	12	83	164	73.9	152	88	170
31-Jan-14	9:39:00	9	12	83	164	73.8	152	88	170
31-Jan-14	9:39:10	9	12	84	166	74.8	154	89	172
31-Jan-14	9:39:20	9	12	83	165	74.5	153	88	171
31-Jan-14	9:39:30	9	12	82	162	73.2	150	87	169
31-Jan-14	9:39:40	9	12	82	162	73.0	150	87	168
31-Jan-14	9:39:50	9	12	81	160	72.0	148	86	166
31-Jan-14	9:40:00	9	12	81	159	71.4	147	85	165
31-Jan-14	9:40:10	10	13	80	158	70.6	145	86	166
31-Jan-14	9:40:20	10	13	81	158	70.4	145	86	165
31-Jan-14	9:40:30	10	13	80	157	70.1	144	85	164
31-Jan-14	9:40:40	10	13	81	159	70.9	146	86	166
31-Jan-14	9:40:50	9	12	82	161	72.5	149	86	167
31-Jan-14	9:41:00	10	13	82	162	72.2	148	88	169
31-Jan-14	9:41:10	10	13	80	158	70.5	145	86	165
31-Jan-14	9:41:20	10	13	80	157	70.1	144	85	164
31-Jan-14	9:41:30	10	13	79	156	69.4	143	85	163
31-Jan-14	9:41:40	10	13	79	155	69.1	142	84	162
31-Jan-14	9:41:50	10	13	79	154	68.6	141	84	161
31-Jan-14	9:42:00	10	13	79	154	68.3	140	84	161
31-Jan-14	9:42:10	10	13	78	153	68.1	140	83	160
31-Jan-14	9:42:20	10	13	78	152	67.3	138	83	159
31-Jan-14	9:42:30	10	13	78	153	67.9	139	83	160
31-Jan-14	9:42:40	10	13	78	153	67.9	139	83	160
31-Jan-14	9:42:50	10	13	76	150	66.7	137	82	158
31-Jan-14	9:43:00	10	13	77	152	67.5	139	83	159
31-Jan-14	9:43:10	10	13	77	150	66.5	137	82	157
31-Jan-14	9:43:20	10	13	76	150	66.6	137	82	157
31-Jan-14	9:43:30	10	13	76	150	66.7	137	82	158
31-Jan-14	9:43:40	9	12	76	149	66.5	137	80	155
31-Jan-14	9:43:50	10	13	76	150	66.4	136	82	157
31-Jan-14	9:44:00	10	13	77	151	67.0	138	82	158
31-Jan-14	9:44:10	10	13	78	153	68.2	140	84	161
31-Jan-14	9:44:20	10	13	77	153	67.8	139	83	160
31-Jan-14	9:44:30	9	12	77	150	67.2	138	81	156
31-Jan-14	9:44:40	9	12	77	151	67.5	139	81	157
31-Jan-14	9:44:50	9	12	76	150	67.3	138	81	157
31-Jan-14	9:45:00	9	12	77	151	67.7	139	82	158
31-Jan-14	9:45:10	9	12	76	151	67.6	139	81	157
31-Jan-14	9:45:20	9	12	76	150	67.1	138	81	156
31-Jan-14	9:45:30	9	12	76	149	66.8	137	81	156
31-Jan-14	9:45:40	9	12	77	151	67.7	139	82	158
31-Jan-14	9:45:50	9	12	77	152	68.3	140	82	159
31-Jan-14	9:46:00	9	12	77	151	67.9	139	82	158
31-Jan-14	9:46:10	9	12	77	151	67.8	139	82	158
31-Jan-14	9:46:20	9	12	76	148	66.3	136	80	155
31-Jan-14	9:46:30	9	12	76	149	66.5	137	80	155
31-Jan-14	9:46:40	9	12	76	150	67.0	138	81	156
31-Jan-14	9:46:50	8	11	76	150	67.9	139	80	156
31-Jan-14	9:47:00	9	12	77	152	68.2	140	82	159
31-Jan-14	9:47:10	9	12	77	151	67.9	139	82	158
31-Jan-14	9:47:20	9	12	77	151	67.8	139	82	158
31-Jan-14	9:47:30	9	12	77	151	67.8	139	82	158
31-Jan-14	9:47:40	9	12	77	151	67.8	139	82	158
31-Jan-14	9:47:50	9	12	77	152	68.2	140	82	159
31-Jan-14	9:48:00	9	12	77	153	68.7	141	83	160
31-Jan-14	9:48:10	8	11	77	152	68.7	141	81	158
31-Jan-14	9:48:20	9	12	78	154	69.2	142	83	161
31-Jan-14	9:48:30	9	12	78	153	68.7	141	83	160
31-Jan-14	9:48:40	9	12	78	154	69.0	142	83	160
31-Jan-14	9:48:50	8	11	78	154	69.6	143	82	159
31-Jan-14	9:49:00	8	11	78	154	69.8	143	82	160
31-Jan-14	9:49:10	9	12	79	156	70.3	144	84	163

60305580 Kiln 2 Oxides of Nitrogen Results, 31 January 2014

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)
31-Jan-14	9:49:20	8	11	79	155	70.2	144	82	161
31-Jan-14	9:49:30	9	12	78	155	69.4	143	83	161
31-Jan-14	9:49:40	8	11	78	153	69.3	142	82	159
31-Jan-14	9:49:50	8	11	78	154	70.0	144	82	160
31-Jan-14	9:50:00	8	11	79	156	70.7	145	83	162
31-Jan-14	9:50:10	8	11	79	156	70.8	145	83	162
31-Jan-14	9:50:20	8	11	78	155	70.3	144	83	161
31-Jan-14	9:50:30	8	11	78	154	69.6	143	82	159
31-Jan-14	9:50:40	8	11	78	154	69.8	143	82	160
31-Jan-14	9:50:50	8	11	78	155	70.2	144	82	161
31-Jan-14	9:51:00	8	11	80	158	71.5	147	84	163
31-Jan-14	9:51:10	8	11	79	157	71.2	146	83	163
31-Jan-14	9:51:20	8	11	78	155	70.4	145	83	161
31-Jan-14	9:51:30	8	11	79	156	70.9	146	83	162
31-Jan-14	9:51:40	8	11	79	156	70.6	145	83	161
31-Jan-14	9:51:50	8	11	78	155	70.4	145	83	161
31-Jan-14	9:52:00	8	11	78	155	70.1	144	82	160
31-Jan-14	9:52:10	8	11	78	156	70.7	145	83	162
31-Jan-14	9:52:20	8	11	78	155	70.5	145	83	161
31-Jan-14	9:52:30	8	11	78	154	69.9	144	82	160
31-Jan-14	9:52:40	8	11	78	155	70.4	145	83	161
31-Jan-14	9:52:50	7	9	77	153	70.1	144	81	158
31-Jan-14	9:53:00	7	9	78	155	70.9	146	82	160
31-Jan-14	9:53:10	7	9	79	157	72.1	148	83	162
31-Jan-14	9:53:20	7	9	79	158	72.2	148	83	163
31-Jan-14	9:53:30	7	9	78	156	71.4	147	82	161
31-Jan-14	9:53:40	7	9	79	157	71.7	147	82	162
31-Jan-14	9:53:50	8	11	80	158	71.9	148	84	164
31-Jan-14	9:54:00	7	9	79	156	71.6	147	82	161
31-Jan-14	9:54:10	7	9	78	155	70.9	146	82	160
31-Jan-14	9:54:20	7	9	77	153	69.8	143	81	158
31-Jan-14	9:54:30	7	9	76	151	68.8	141	80	156
31-Jan-14	9:54:40	8	11	76	152	68.7	141	81	158
31-Jan-14	9:54:50	8	11	76	151	68.2	140	80	156
31-Jan-14	9:55:00	8	11	76	152	68.7	141	81	158
31-Jan-14	9:55:10	7	9	76	149	68.2	140	79	154
31-Jan-14	9:55:20	7	9	75	149	67.9	139	79	154
31-Jan-14	9:55:30	7	9	75	150	68.3	140	79	155
31-Jan-14	9:55:40	7	9	75	150	68.5	141	79	155
31-Jan-14	9:55:50	7	9	77	154	70.3	144	81	159
31-Jan-14	9:56:00	7	9	78	155	70.9	146	82	160
31-Jan-14	9:56:10	7	9	76	152	69.5	143	80	157
31-Jan-14	9:56:20	7	9	76	152	69.6	143	80	157
31-Jan-14	9:56:30	6	8	77	153	70.5	145	80	157
31-Jan-14	9:56:40	6	8	77	153	70.5	145	80	157
31-Jan-14	9:56:50	7	9	78	156	71.6	147	82	161
31-Jan-14	9:57:00	7	9	78	156	71.4	147	82	161
31-Jan-14	9:57:10	7	9	77	154	70.2	144	81	159
31-Jan-14	9:57:20	7	9	76	153	69.8	143	81	158
31-Jan-14	9:57:30	7	9	77	154	70.6	145	81	159
31-Jan-14	9:57:40	7	9	77	153	69.9	144	81	158
31-Jan-14	9:57:50	7	9	76	151	69.0	142	80	156
31-Jan-14	9:58:00	7	9	76	151	68.8	141	80	156
31-Jan-14	9:58:10	6	8	75	150	68.9	141	78	154
31-Jan-14	9:58:20	7	9	75	150	68.6	141	79	155
31-Jan-14	9:58:30	7	9	76	151	68.8	141	80	156
31-Jan-14	9:58:40	7	9	75	150	68.4	140	79	155
31-Jan-14	9:58:50	7	9	75	149	68.0	140	79	154
31-Jan-14	9:59:00	7	9	76	150	68.7	141	79	155
31-Jan-14	9:59:10	6	8	76	151	69.4	143	79	155
31-Jan-14	9:59:20	6	8	75	151	69.4	143	79	155
31-Jan-14	9:59:30	6	8	75	149	68.7	141	78	153
31-Jan-14	9:59:40	7	9	76	151	69.0	142	80	156
31-Jan-14	9:59:50	7	9	76	151	69.2	142	80	156
31-Jan-14	10:00:00	6	8	75	150	69.1	142	78	154
31-Jan-14	10:00:10	7	9	75	151	68.8	141	80	156
31-Jan-14	10:00:20	7	9	74	149	68.0	140	79	154
31-Jan-14	10:00:30	6	8	74	147	67.7	139	77	151
31-Jan-14	10:00:40	7	9	75	151	68.9	141	80	156
31-Jan-14	10:00:50	6	8	76	151	69.8	143	79	156
31-Jan-14	10:01:00	6	8	76	151	69.8	143	79	156
31-Jan-14	10:01:10	6	8	76	151	69.6	143	79	155
31-Jan-14	10:01:20	6	8	76	151	69.8	143	79	156
31-Jan-14	10:01:30	6	8	76	153	70.6	145	80	157
31-Jan-14	10:01:40	6	8	77	154	71.0	146	80	158
31-Jan-14	10:01:50	6	8	77	155	71.4	147	81	159
31-Jan-14	10:02:00	5	7	77	154	71.6	147	79	157

60305580 Kiln 2 Oxides of Nitrogen Results, 31 January 2014

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)
31-Jan-14	10:02:10	5	7	77	154	71.8	147	79	158
31-Jan-14	10:02:20	5	7	77	155	72.1	148	80	158
31-Jan-14	10:02:30	5	7	78	156	72.8	150	80	160
31-Jan-14	10:02:40	5	7	78	156	72.9	150	81	160
31-Jan-14	10:02:50	5	7	77	155	72.3	148	80	159
31-Jan-14	10:03:00	5	7	76	154	71.7	147	79	158
31-Jan-14	10:03:10	5	7	76	154	71.9	148	80	158
31-Jan-14	10:03:20	5	7	77	154	71.9	148	80	158
31-Jan-14	10:03:30	5	7	76	153	71.3	146	79	157
31-Jan-14	10:03:40	5	7	76	153	71.1	146	79	156
31-Jan-14	10:03:50	5	7	76	153	71.2	146	79	156
31-Jan-14	10:04:00	5	7	76	154	71.7	147	79	158
31-Jan-14	10:04:10	5	7	76	154	71.5	147	79	157
31-Jan-14	10:04:20	5	7	77	154	71.9	148	80	158
31-Jan-14	10:04:30	5	7	77	156	72.5	149	80	159
31-Jan-14	10:04:40	5	7	76	154	71.5	147	79	157
31-Jan-14	10:04:50	5	7	75	151	70.4	145	78	155
31-Jan-14	10:05:00	5	7	75	151	70.2	144	78	154
31-Jan-14	10:05:10	5	7	75	151	70.1	144	78	154
31-Jan-14	10:05:20	5	7	75	150	69.9	144	78	154
31-Jan-14	10:05:30	4	5	76	152	71.3	146	77	155
31-Jan-14	10:05:40	4	5	75	151	70.7	145	77	153
31-Jan-14	10:05:50	5	7	75	152	70.8	145	78	156
31-Jan-14	10:06:00	5	7	76	153	71.0	146	79	156
31-Jan-14	10:06:10	5	7	76	154	71.6	147	79	157
31-Jan-14	10:06:20	4	5	75	152	71.2	146	77	154
31-Jan-14	10:06:30	4	5	75	151	70.9	146	77	154
31-Jan-14	10:06:40	4	5	75	151	70.7	145	77	153
31-Jan-14	10:06:50	4	5	74	149	70.0	144	76	152
31-Jan-14	10:07:00	4	5	74	149	69.9	144	76	152
31-Jan-14	10:07:10	4	5	74	149	70.0	144	76	152
31-Jan-14	10:07:20	5	7	74	150	69.9	144	78	154
31-Jan-14	10:07:30	5	7	75	151	70.2	144	78	154
31-Jan-14	10:07:40	5	7	74	149	69.4	143	77	153
31-Jan-14	10:07:50	5	7	73	145	67.5	139	75	149
31-Jan-14	10:08:00	5	7	72	144	67.1	138	75	148
31-Jan-14	10:08:10	5	7	72	145	67.2	138	75	148
31-Jan-14	10:08:20	5	7	72	146	67.6	139	75	149
31-Jan-14	10:08:30	4	5	73	146	68.6	141	75	149
31-Jan-14	10:08:40	4	5	73	148	69.4	143	76	151
31-Jan-14	10:08:50	4	5	74	150	70.2	144	76	152
31-Jan-14	10:09:00	3	4	74	149	70.4	145	75	151
31-Jan-14	10:09:10	3	4	74	149	70.5	145	75	151
31-Jan-14	10:09:20	3	4	73	149	70.7	145	75	151
31-Jan-14	10:09:30	3	4	73	148	70.2	144	75	150
31-Jan-14	10:09:40	3	4	73	148	70.0	144	75	150
31-Jan-14	10:09:50	3	4	73	149	70.5	145	75	151
31-Jan-14	10:10:00	3	4	73	148	70.3	144	75	151
31-Jan-14	10:10:10	3	4	73	148	70.0	144	75	150
31-Jan-14	10:10:20	2	3	72	146	70.0	144	73	148
31-Jan-14	10:10:30	3	4	73	149	70.5	145	75	151
31-Jan-14	10:10:40	3	4	73	149	70.7	145	75	151
31-Jan-14	10:10:50	3	4	73	149	70.6	145	75	151
Average		**9**	**12**	**78**	**154**	**69**	**142**	**83**	**161**
Maximum		**13**	**17**	**84**	**166**	**75**	**154**	**89**	**172**
Minimum		**2**	**3**	**72**	**144**	**65**	**133**	**73**	**148**
Corrected to 18% O2		**5**	**7**	**43**	**84**	**38**	**78**	**45**	**88**

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This is the end of the Report