

RivCott 2016 RivCott Pty Ltd 22-Jan-2016 Doc No. 60480321\_1.1\_RPT

## RivCott Carrathool Cotton Gin Emissions Monitoring

January 2016





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## RivCott Carrathool Cotton Gin Emissions Monitoring

January 2016

Client: RivCott Pty Ltd

ABN: 14165446837

Prepared by

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Job No.: 60480321\_1.1

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## **Quality Information**

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Prepared by	Dylan Turnbull	NII AL
Reviewed by	Chad Whitburn	AECOM Approved Signatory

### **Revision History**

Revision Revision		Detaile	Authorised		
Revision	Date	Details	Name/Position	Signature	
0	22-Jan-16	Final Report for Issue	Chad Whitburn Associate Director - Air Quality		

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## 1.0 Introduction

AECOM was appointed by RivCott Pty Ltd to conduct air emissions testing of the Unloading Fan: 1A-1 Cyclone (EPL Point 1) and the Feeder Dust cyclone (EPL Point 14) at the Carrathool, NSW site. The testing is a requirement of their Environmental Protection Licence, number 20717.

Testing was conducted from 5-6 January 2016 to investigate emission concentrations for the following parameters:

- Total Particulate.

Laboratory analysis was conducted by the following laboratory for the specified tests:

Steel River Testing NATA accreditation number 18079, performed the following analysis detailed in report numbers 10418-0-M and 10418-0-P:

- Total Solid Particulates; and
- Moisture.

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## 2.0 Sampling Plane Requirements

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

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

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

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

- a) The gas flow is basically in the same direction at all points along each sampling traverse;
- b) The gas velocity at all sampling points is greater than 3 m/s;
- c) The gas flow profile at the sampling plane shall be steady, evenly distributed and not have a cyclonic component which exceeds an angle of 15° 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.

All sampling point locations were in compliance with AS4323.1.

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## 3.0 Methodology

## 3.1 NATA Endorsed Methods

The following methods are accredited with the National Association of Testing Authorities (NATA) (accreditation number 2778(14391)) and are approved for the sampling and analysis of gases. All sampling and analysis is conducted according to the methods in **Table 2**.

NSW EPA Approved Methods	USEPA Methods	Method Title
AS4323.1 (NSW EPA TM-1)	USEPA (2000) Method 1	Selection of sampling positions
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)
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-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 TM-32	USEPA (1996) Method 10	Determination of Carbon Monoxide emissions from stationary sources
NSW EPA TM-25	USEPA (1990) Method 3A	Determination of Oxygen concentrations from stationary sources

Table 2 AECOM NATA	Endorsed Methods

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## 4.0 Sampling Location

## 4.1 Sampling Location Summary

Table 3 provides a summary of the locations sampled by AECOM on 5-6 January 2016.

#### Table 3 Sampling Location Summary

Discharge Description	Unloading Fan: 1A-1 Cyclone	Feeder Dust Cyclone
Duct Shape	Circular	Circular
Construction Material	Metal	Metal
Duct Diameter (mm)	705	705
Minimum No. Sampling Points	12	12
Sampling Ports	2	2
Min. Points/Traverse	6	6
Disturbance	Yes	Yes
Distance from Upstream Disturbance	5.5	5.5
Type of Disturbance	Bend	Bend
Distance from Downstream Disturbance	5.5	5.5
Type of Disturbance	Bend	Bend
Ideal Sampling Location	Yes	Yes
Correction Factors Applied	No	No
Total No. Points Sampled	12	12
Points/Traverse	6	6
Sampling Performed to Standard <sup>1</sup>	Yes	Yes

<sup>1</sup>AS 4323.1 Stationary source emissions Method 1 – Selection of sampling positions

D = Diameters

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## 5.0 Equipment Calibration

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

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## 6.0 Results

A summary of results obtained from emissions testing performed on 5-6 January 2016 is provided in **Table 4**. Detailed results along with gas stream properties during the testing period can be found in **Tables 5-10**.

All emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atmosphere pressure for comparison with appropriate guideline levels.

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** and analytical laboratory results are provided in **Appendix B**.

Parameter	Units	EPL Point 1		EPL Point 14				
Stack ID		Unloading Fan: 1A-1 Feeder Dust		EPL Limit				
Round		1	2	3	1 2 3		3	
Total Particulates	mg/m <sup>3</sup>	6.8	9.0	5.6	12	15	18	50

#### Table 4 Summary of Results, January 2016

#### Table 5 Unloading Fan: 1A-1 Cyclone (EPL Point 1), Round 1, Total Particulate Results, 5 January 2016

Sampling Conditions:			
Stack internal diameter at test location	705	mm	
Stack gas temperature (average)	47.9	°C	321.1 K
Stack pressure (average)	1011	hPa	
Stack gas velocity (average, stack conditions)	16	m/s	
Stack gas flowrate (stack conditions)	6.3	m <sup>3</sup> /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	5.2	m <sup>3</sup> /s	
Total Particulate Testing			
Test Period	8:27	-	9:28
Total Particulate Mass	4.8	mg	
Gas Volume Sampled	0.711	m <sup>3</sup>	
Total Particulate Emission*1	6.8	mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate* <sup>2</sup>	36	mg/s	
Regulatory Limit	50	mg/m <sup>3</sup>	
Moisture Content (%)	2.3		
Gas Density (dry at 1 atmosphere)	1.29	kg/m <sup>3</sup>	
Dry Molecular Weight	28.8	g/g-mole	

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

\*2 Mass emission rate determined from pre and post-test sampling flow measurements and the respective test moisture content. See Q<sub>std</sub> in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Table 6	Unloading Fan: 1A-1 Cyclone (EPL Point 1), Round 2, Total Particulate Results, 5 January 2016	
---------	---	--

Sampling Conditions:			
Stack internal diameter at test location	705	mm	
Stack gas temperature (average)	49.6	°C	322.8 K
Stack pressure (average)	1011	hPa	
Stack gas velocity (average, stack conditions)	16	m/s	
Stack gas flowrate (stack conditions)	6.2	m <sup>3</sup> /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	5.2	m <sup>3</sup> /s	
Total Particulate Testing			
Test Period	9:49	-	10:50
Total Particulate Mass	6.4	mg	
Gas Volume Sampled	0.708	m <sup>3</sup>	
Total Particulate Emission*1	9.0	mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate*2	47	mg/s	
Regulatory Limit	50	mg/m <sup>3</sup>	
Moisture Content (%)	1.2		
Gas Density (dry at 1 atmosphere)	1.29	kg/m <sup>3</sup>	
Dry Molecular Weight	28.8	g/g-mole	

Stack pressure (average)

**Total Particulate Testing** 

**Total Particulate Mass** 

Gas Volume Sampled Total Particulate Emission\*1

**Moisture Content (%)** 

**Regulatory Limit** 

Test Period

Stack gas velocity (average, stack conditions)

Stack gas flowrate (0°C, dry gas, 1 atm pressure)

Stack gas flowrate (stack conditions)

Total Particulate Mass Emission Rate\*2

1011 hPa

15 m/s 5.9 m<sup>3</sup>/s

4.9 m<sup>3</sup>/s

-

mg

5.6 mg/m<sup>3</sup>

mg/s

mg/m<sup>3</sup>

11:01

3.7

0.662 m<sup>3</sup>

27

50

2.7

Sampling Conditions:				
Stack internal diameter at test location	705	mm		
Stack gas temperature (average)	50.2	°C	323.4	ιĸ

#### Table 7 Unloading Fan: 1A-1 Cyclone (EPL Point 1), Round 3, Total Particulate Results, 5 January 2016

Gas Density (dry at 1 atmosphere) kg/m<sup>3</sup> 1.29 **Dry Molecular Weight** 28.8 g/g-mole Notes \*1 Emission concentration at Standard conditions of 0°C, 1 atm, dry gas

\*2 Mass emission rate determined from pre and post-test sampling flow measurements and the respective test moisture content. See Q<sub>std</sub> in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

12:02

#### Table 8 Feeder Dust Cyclone (EPL Point 14), Round 1, Total Particulate Results, 6 January 2016

Sampling Conditions:			
Stack internal diameter at test location	705	mm	
Stack gas temperature (average)	31.0	°C	304.2 K
Stack pressure (average)	1011	hPa	
Stack gas velocity (average, stack conditions)	12	m/s	
Stack gas flowrate (stack conditions)	4.6	m <sup>3</sup> /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	4	m <sup>3</sup> /s	
Total Particulate Testing			
Test Period	9:30	-	10:31
Total Particulate Mass	7.1	mg	
Gas Volume Sampled	0.574	m <sup>3</sup>	
Total Particulate Emission*1	12	mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate*2	48	mg/s	
Regulatory Limit	50	mg/m <sup>3</sup>	
Moisture Content (%)	2.3		
Gas Density (dry at 1 atmosphere)	1.29	kg/m <sup>3</sup>	
Dry Molecular Weight	28.8	g/g-mole	

#### Table 9 Feeder Dust Cyclone (EPL Point 14), Round 2, Total Particulate Results, 6 January 2016

Sampling Conditions:			
Stack internal diameter at test location	705	mm	
Stack gas temperature (average)	33.1	°C	306.3 K
Stack pressure (average)	1011	hPa	
Stack gas velocity (average, stack conditions)	12	m/s	
Stack gas flowrate (stack conditions)	4.6	m <sup>3</sup> /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	4	m <sup>3</sup> /s	
Total Particulate Testing			
Test Period	10:49	-	11:51
Total Particulate Mass	8.3	mg	
Gas Volume Sampled	0.537	m <sup>3</sup>	
Total Particulate Emission*1	15	mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate*2	60	mg/s	
Regulatory Limit	50	mg/m <sup>3</sup>	
Moisture Content (%)	2.5		
Gas Density (dry at 1 atmosphere)	1.29	kg/m <sup>3</sup>	
Dry Molecular Weight	28.8	g/g-mole	

#### Table 10 Feeder Dust Cyclone (EPL Point 14), Round 3, Total Particulate Results, 6 January 2016

Sampling Conditions:			
Stack internal diameter at test location	705	mm	
Stack gas temperature (average)	34.0	°C	307.2 K
Stack pressure (average)	1010	hPa	
Stack gas velocity (average, stack conditions)	12	m/s	
Stack gas flowrate (stack conditions)	4.7	m <sup>3</sup> /s	
Stack gas flowrate (0°C, dry gas, 1 atm pressure)	4	m <sup>3</sup> /s	
Total Particulate Testing			
Test Period	12:08	-	13:10
Total Particulate Mass	9.8	mg	
Gas Volume Sampled	0.559	m <sup>3</sup>	
Total Particulate Emission*1	18	mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate*2	72	mg/s	
Regulatory Limit	50	mg/m <sup>3</sup>	
Moisture Content (%)	3.0		
Gas Density (dry at 1 atmosphere)	1.29	kg/m <sup>3</sup>	
Dry Molecular Weight	28.8	g/g-mole	

## Appendix A

# Field Sheets (60 pages)

A-1

Appendix A Field Sheets (60 pages)

Q4AN(EV)-332-FM31

AECOM's Project Number: 60480321

5-Jan-16

Unloading Fan: 1A-1 Round 1

Emission Source:

Date Sampled:

ANALYTE(S)

#### METHOD

**Total Particulate** 

NSW EPA TM - 15

Observations made during testing period:

Sampling Performed By:

James Lang

Dylan Turnbull

Q4AN(EV)-332-FM31

ATCO

### **STACK ANALYSIS - PRE-SAMPLING**

Date:5-Jan-16Client:RivCottAECOM's Project No:60480321Stack/Duct Description:Unloading Fan: 1A-1 Round 1Test 1:Total Particulate

Measurement/Observations					
Stack Inter	nal Dimensions:				
Diameter	705	mm M/: -the	Cross Sectional Area	: 0.39 m <sup>2</sup>	
OR	Length	Width			
Length/wid	ath (mm)		Minimum No. of	10	
Equivalent	Diameter N/A	mm	sampling points=	12	
Distance fr nearest dis	om sampling plane to turbances:		Total No. of sampling	points = 12 PM2.5/10= NA	
			No. of sampling trave	rses/ports	
Upstream (	(m) = 5.5		sampled =	2	
No. Diamet	ters = 7.8			PM2.5/10= NA	
Type of Up	stream Disturbance:	Bend	No. of sampling points	s on each	
Downstrea	m (m) = 5.5		traverse/port =	6	
No. Diamet	ters = 7.8			PM2.5/10= NA	
Type of Do	wn Stream Disturbance:	Bend			
			Exclusion of any sam	ple point	
Position of	each sampling point, for	each traverse:	numbers - comments:		
	А	В	PM10/2.5 A	PM2.5/10 B	
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot distances	
1	31	1			
2	103	73			
3	209	179			
4	496	466			
5	602	572			
6	674	644			
7					
8					
a					
10			Check of total points :	against	
11			minimum (ves/no) - c	ommente:	
12	ter and the second s		1	ommenta.	
12					
14			4		
15			-	~	
16			4		
17					
10		110-11 (Made 1/	- /	/	
10			Conorol Commontes	/	
19	· · · · · · · · · · · · · · · · · · ·				
20	<u></u>				
Signed: ≶	Hur?		Checked:		

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

Q4AN(EV)-332-FM31

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

1.50 %

Date:5-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Unloading Fan: 1A-1 Round 1

Sampling time start:	8:00	Sampling port No.:	:	1			
Measurement No.	Time sampled	CO (ppm). (dry)	02	2 (%), (dry)		CO <sub>2</sub> (%), (dry)	
1	8:00	0		20.9		0.0	
2	8:01	0		20.9		0.0	
3	8:02	0		20.9		0.0	
4	8:03	0		20.9		0.0	
5	8:04	0	10	20.9		0.0	
6	8:05	0		20.9		0.0	
7	8:06	0	_	20.9		0.0	
8	8:07	0		20.9		0.0	
	Averages:	0.0 p	opm	20.9	%	0.0	%
Moisture content (M3)	0.99						

Moisture percentage (M2):

Measurements

CO:	0.0000 %,(dry)		N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)		O <sub>2</sub> :	20.9 %,(dry)	
Gas Compo	ositions converted to wet basis:	-			
CO:	0.0000 %,(wet)		N <sub>2</sub> :	77.9 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	1	O <sub>2</sub> :	20.6 %,(wet)	
H <sub>2</sub> O:	1.50 %(=M2)				
Therefore,	stack gas density (GD) =	1.28	kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore,	stack gas density (GD) =	1.29	kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	



Q4AN(EV)-332-FM31

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

2.33 %

Date:5-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Unloading Fan: 1A-1 Round 1

Sampling time start:	9:30	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (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 ppn	n 20.9 %	0.0 %
Moisture content (M3)	): 0.98			

Moisture percentage (M2):

#### Measurements

CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	
Gas Com	positions converted to wet basis:	1071		
CO:	0.0000 %,(wet)	N <sub>2</sub> :	77.3 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	O <sub>2</sub> :	20.4 %,(wet)	
H <sub>2</sub> O:	2.33 %(=M2)			
Therefore	e, stack gas density (GD) =	1.28 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore	e, stack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	



Q4AN(EV)-332-FM31

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

 Date:
 5-Jan-16

 Client:
 RivCott

 AECOM's Project No:
 Stack/Duct Description:

 Stack/Duct Description:
 U

 Test 1:Total Particulate
 U

60480321 Unloading Fan: 1A-1 Round 1

Timo	8.00	Baromotric Pr	OSCUTO :	1010	hPa
Page No. 1	1 of 1	Datometric Fi	essure .	0.84	in a
Compling Dort No.	1 to 2	Steek Cos Do	and actor .	1.29	ka/m <sup>3</sup>
Sampling Port No.	1102	Slack Gas De	ensity.	1.20	(0°C )Mat 1 Atra)
Pitot Tube Type :	5			,	(U C, Wet, I Atm)
- 20	Distance	Max.			
Sampling Position	Distance	Differential	Max Temp.	Max Temp. (Ts)	Corrected Velocity
No.	from far wall	Pressure	°C	К	(Vs) m/s
	((((((((	AP, KIO			
1/1	1	0 1/0	45.0	318.2	13.8
1/2	73	0.175	45.0	318.2	15.0
1/3	179	0.175	46.0	319.2	15.0
1/4	466	0.190	46.0	319.2	15.7
1/5	572	0.195	47.0	320.2	15.9
1/6	644	0.096	47.0	320.2	11.2
2/1	1	0.135	46.0	319.2	13.2
2/2	73	0.224	47.0	320.2	17.0
2/3	179	0.238	47.0	320.2	17.6
2/4	466	0.255	47.0	320.2	18.2
2/5	572	0.275	48.0	321.2	18.9
2/6	644	0.232	48.0	321.2	17.3
		•			
				-0	
	1.1				
	<u></u>				
			·		
-					
			······		
Average			46.6	319.8	15.7

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 15 mm 1011.47 hPa



Q4AN(EV)-332-FM31

#### STACK ANALYSIS

## SAMPLING OF TOTAL PARTICULATE

Date: 5-Jan-16						
Client: RivCott						
AECOM's Project No:		60480321				
Stack Description No.:	Unloading Fan:	1A-1 Round	1			
Sample Nozzle No.:	S2		Sample Nozzle Area	a (An):	1.42	x 10 <sup>-5</sup> m <sup>2</sup>
Sampling Port No .:	1 to 2		Thimble No:		T18	
Page No:	1 of 1		Blank thimble No:		0	
Leak Check (Pre-Sampling	g)		Leak Check (Post	Sampling	1)	
Meter start: 384.5522	Meter finish:	384.5522	Meter start:	385.3248	Meter finish:	385.3248
Time start: 8:26	Time finish:	8:26	Time start:	9:30	Time finish:	9:31
Therefore, leakage rate =	no leak L	/min	Therefore, leakage	rate =	no leak	L/min

(>0.1 l/min. is unacceptable)

(>0.1 l/min. is unacceptable)

Repeat: Comments: Repeat: Comments:

#### Sampling Record Table

Barometric Pressure:	1010 hPa (s	1010 hPa (finish)	
Meter start:	384.5569	Time start:	8:27
Meter correction factor (GMf) :		1.0100	

	Stopwatch						
	Time at	Distance	Isokinetic			Impinger	Flowrate
Sampling	Sampling	from far wall	Flowrate	Meter Inlet	Meter Outlet	Train Outlet	Attained
Position No.	Position	(mm)	(L/min)	Temp. (°C)	Temp. (°C)	Temp (°C)	(Y/N)
1/1	0:05:00	31	11.1	21.0	19.0		Yes
1/2	0:10:00	103	12.0	23.0	20.0		Yes
1/3	0:15:00	209	12.0	24.0	21.0		Yes
1/4	0:20:00	496	12.6	24.0	22.0		Yes
1/5	0:25:00	602	12.7	25.0	22.0		Yes
1/6	0:30:00	674	8.9	25.0	22.0		Yes
2/1	0:35:00	31	10.6	26.0	23.0		Yes
2/2	0:40:00	103	13.6	26.0	23.0		Yes
2/3	0:45:00	209	14.0	27.0	24.0		Yes
2/4	0:50:00	496	14.5	27.0	24.0		Yes
2/5	0:55:00	602	15.0	27.0	24.0		Yes
2/6	1:00:00	674	13.7	28.0	25.0		Yes
				×			
							warm of anything in
				-			
					-		
	-						
10.00			14				
Averages				25.3	22.4	no result	
Meter Finish	<u>.</u>	385 3242		Time Finish		9:28	
Total Condens	sate collected:	3	ml	Silica gel No(s)	) used:	F24	

ISO-1 Emission Measurement Calculations Spreadsheet (Q4AN(EV)-332-FM31) Revision 2 May 28, 2015



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STACK	ANALYSIS	- FINAL	CALCULATIONS

#### **Total Particulate**

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

Date: 5 AECOM's Projec	5-Jan-16 t No:	60480321	Client: Stack/Duct	RivCott Description:	Unloading	Fan: 1A-1 Round 1
(A) Sample gas v	volume at standard o	onditions				
Metered volume	(MV <sub>3</sub> ):	0.7750	m <sup>3</sup>	Average baron	netric	
Average gas met	er temp. (1 <sub>M,2</sub> ).	23.8	к	Average press meter ( $P_{M,2}$ )	sure at	1010.00 hPa
Sample gas volu gas, 1 atm press	me (MV₄); (0ºC, dry ure):	0.7106	m <sup>3</sup>			
(B) Total Particul Blank thimble No Thimble No. used Final Total Partic Total Particulate	ate concentration at .: d: T18 ulate Weight (Mp1): Concentration (C1):	standard condii 0 0.00480	g =M <sub>p1</sub> /MV <sub>4</sub> =	Blank weight: Total Particula	te Weight 0.0068	g 0.0048 g g/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
CO <sub>2</sub> Basis Average CO <sub>2</sub> %:	12 %	0.0 %	;and C <sub>2</sub> =		6.8	mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
Therefore, C <sub>c</sub> :		= C <sub>a</sub> x 12/0	CO <sub>2</sub> % =	0.0068	g/m <sup>3</sup> (0°C, pressure, 2	dry gas, 1atm 12% CO <sub>2</sub> )
			;and $C_{c1}$ =	6.8	3 mg/m <sup>3</sup> (0°0 pressure, 7	C, dry gas, 1atm 12% CO <sub>2</sub> )
O <sub>2</sub> Basis	7 %					
Average O <sub>2</sub> %:	2	20.9 %				
Therefore, C <sub>b</sub> :	=C <sub>a</sub> x (21 -	- O <sub>2ref</sub> %)/(21 - C	0 <sub>2mea</sub> %)	0.95	5 g/m <sup>3</sup> (0°C, 7%	dry gas, 1atm pressure, O <sub>2</sub> )
			;and C <sub>b1</sub> =	950	0°0 mg/m <sup>3</sup> (0°0 7%	C, dry gas, 1atm pressure, O <sub>2</sub> )
(C) Moisture cont Silica Gel Number	tent er: F24					
$V_v$ = Volume of Water Volume of Water Therefore, $B_{ws}$ =	9.7 g (from labe Vapour Condensed Vapour Condensed (Vwc	oratory report) $(V_{wc(std)}) =$ $(V_{wsg(std)}) =$ $(V_{wc(std)} + V_{wsg(std)} + V_{rest})$	0.0040 0.0129 )) n(std))	V <sub>w</sub> =	3	mL (=grams) (recorded on Laboratory Form 108)
B <sub>ws</sub> =	= 2	2.33 %				



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## **Emission Measurement Calculations Spreadsheet**

STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

**Total Particulate** 

ANZ

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

(i) Initial gas density for sampling:

1.28 kg/m<sup>3</sup> (from Laboratory Form 107)

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

1.29 kg/m<sup>3</sup> (0°C, wet, 1 atm pressure) 1.29 kg/m<sup>3</sup> (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

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

1.095 kg/m<sup>3</sup> (stack conditions, wet)

16.19 m/s (stack conditions, wet)

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

15.73 m/s

16.65 m/s

N/A m/s

(E) Gas Velocities

(i) Average of pre-sampling velocities:

(ii) Average of post-sampling velocities:

(iii) Average of while-sampling velocities:

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

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

5.2 m<sup>3</sup>/s (0°C, dry gas, 1 atm pressure)

Qstack =		Vs x A =		6.32 m <sup>3</sup> /s (stack conditions)	
Qstd =	Qstack x	<u>Ps</u> x	<u>(Tstd)</u> x	<u>(100 - B<sub>w</sub>)</u>	
		(Pstd)	(Ts)	100	

=

Qstd =

(G) Mass Emission Rate

Rm =	C <sub>1a</sub> x Qstd = =	0.036 36	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure	) )	
2	C <sub>1a</sub> x Qstd =	0.036	g/s (0°C, dry gas, 1 atm pressure	12%	CO <sub>2</sub> )
	=	36	mg/s (0°C, dry gas, 1 atm pressure	12%	CO <sub>2</sub> )
	C <sub>1a</sub> x Qstd =	5	g/s (0°C, dry gas, 1 atm pressure	7%	O <sub>2</sub> )
	=	5000	mg/s (0°C, dry gas, 1 atm pressure	7%	O <sub>2</sub> )



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EMISSION MONITORING RESULTS, UNLOADING FAN: 1A-1 ROUND 1 RIVCOTT 5-Jan-16 TOTAL PARTICULATE					
Sampling Conditions:					
Stack internal diameter at test location	705 mm				
Stack gas temperature (average)	47.9 °C	321.1 K			
Stack pressure (average)	1011 hPa				
Stack gas velocity (average, stack conditions)	16 m/s				
Stack gas flowrate (stack conditions)	6.3 m <sup>3</sup> /s				
Stack gas flowrate (0ºC, dry gas, 1 atm pressure)	5.2 m <sup>3</sup> /s				
Total Particulate Testing					
Test Period	8:27 -	9:28			
Total Particulate Mass	4.8 mg				
Gas Volume Sampled	0.711 m <sup>3</sup>				
Total Particulate Emission*1	6.8 mg/m <sup>3</sup>				
Total Particulate Mass Emission Rate*2 36 mg/s					
Regulatory Limit	50 mg/m <sup>3</sup>				
Moisture Content (%)	2.3				
Gas Density (dry at 1 atmosphere)	Gas Density (dry at 1 atmosphere) 1.29 kg/m <sup>3</sup>				
Dry Molecular Weight	28.8 g/g-mole				

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

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

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

Date:	5-Jan-	16
Client:	RivCott	
AECOM's Pro	oject No:	60480321
Stack/Duct Description:		Unloading Fan: 1A-1 Round 1
Test 1:Total Particulate		

Time :	9:30	Barometric Pr	essure :	1010	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No	1 to 2	Stack Gas De	ensity:	1.28	ka/m <sup>3</sup>
Pitot Tube Type :	S		, nony.		(0 °C. Wet 1 Atm)
Thot Tube Type .	<u> </u>	Max		1	(0 0, 100, 17, 11)
	Distance	Differential	50-7-252 #2471		
Sampling Position	from far wall	Differential	Max Temp.	Max Temp. (Ts)	Corrected Velocity
No.			°C	K	(Vs) m/s
20 C	(mm)				
1/1	1	0.174	47.0	320.2	15.0
1/1	72	0.174	47.0	320.2	15.0
1/2	170	0.195	40.0	321.2	17.5
1/3	179	0.234	49.0	322.2	17.5
1/4	400	0.231	49.0	322.2	17.4
1/5	572	0.193	50.0	323.2	15.9
1/6	644	0.160	50.0	323.2	14.5
0/4		0.000	40.0	202.0	10.0
2/1	1	0.202	49.0	322.2	16.3
2/2	/3	0.247	49.0	322.2	18.0
2/3	179	0.283	50.0	323.2	19.2
2/4	466	0.277	50.0	323.2	19.0
2/5	572	0.220	50.0	323.2	17.0
2/6	644	0.151	50.0	323.2	14.1
					*
			с.		
			2		
	1.12				
				t0	
			5174201 d. of		
			40.2	202.5	16.7
Average			49.3	322.5	10.7

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 8 mm 1010.78 hPa

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#### RivCott

AECOM's Project Number:

5-Jan-16

60480321

Unloading Fan: 1A-1 Round 2

Emission Source:

Date Sampled:

ANALYTE(S)

#### Total Particulate

## METHOD NSW EPA TM - 15

Observations made during testing period:

Sampling Performed By:

James Lang

Dylan Turnbull



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#### **STACK ANALYSIS - PRE-SAMPLING**

Date:5-Jan-16Client:RivCottAECOM's Project No:60480321Stack/Duct Description:Unloading Fan: 1A-1 Round 2Test 1:Total Particulate

Measurement/Observations						
Stack Inter	nal Dimensions:					
Diameter	705	Cross Sectional Area	· 0.39 m <sup>2</sup>			
OR	Length					
Length/Wid	ith (mm)		Minimum No. of			
Equivalent	Diameter N/A	mm	sampling points=	12		
Distance fro	om sampling plane to		Total No. of sampling	points = 12		
nearest dis	turbances:			PM2.5/10= NA		
			No. of sampling traver	rses/ports		
Upstream (	m) = 5.5		sampled =	2		
No. Diamet	ers = 7.8			PM2.5/10= NA		
Type of Up	stream Disturbance:	Bend	No. of sampling points	s on each		
Downstream	m (m) = 5.5		traverse/port =	6		
No. Diamet	ers = 7.8			PM2.5/10= NA		
Type of Do	wn Stream Disturbance:	Bend				
			Exclusion of any same	ole point		
Position of	each sampling point, for	each traverse:	numbers - comments:			
	;;;;;					
	٨	P	DM10/2 5 A	DM2 5/10 P		
No	Distance from wall	S tuno Pitot distancos	Dictoreo from wall	S Type Bitet distances		
	21		Distance Ironi wali	S-Type Filot distances		
2	102	72				
2	200	170				
3	406	179				
5	602	572				
5	674	512				
7	074	044				
0		· · · · · · · · · · · · · · · · · · ·				
9			Charle of total points a	reinet		
10				against		
10			Thinininum, (yes/no) - c	omments.		
12						
13			4	2		
14			4			
10				//		
10				/		
1/				/		
18				/		
19			General Comments:			
20			$ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $			
0	Sal					
Signed	- uu		Спескеа:	~~~~~		

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


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

1.50 %

Date:5-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Unloading Fan: 1A-1 Round 2

Sampling time start:	9:30	Sampling port No.	.:	1	e l		
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (*	%), (dry)		CO <sub>2</sub> (%), (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)	. 0.99						

Moisture percentage (M2):

Measurements

CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	1 A 1
Gas Compo	ositions converted to wet basis:			
CO:	0.0000 %,(wet)	N <sub>2</sub> :	77.9 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	O <sub>2</sub> :	20.6 %,(wet)	
H <sub>2</sub> O:	1.50 %(=M2)			14
Therefore,	stack gas density (GD) =	1.28 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore, s	stack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	

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

1.25 %

Date:5-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Unloading Fan: 1A-1 Round 2

Sampling time start:	10:55	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (dry)
1	10:55	0	20.9	0.0
2	10:56	0	20.9	0.0
3	10:57	0	20.9	0.0
4	10:58	0	20.9	0.0
5	10:59	0	20.9	0.0
6	11:00	0	20.9	0.0
7	11:01	0	20.9	0.0
8	11:02	0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	0.0 %
Moisture content (M3):	0.99			

Moisture percentage (M2):

Measurements

the second se				
CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	
Gas Compo	sitions converted to wet basis:			
CO:	0.0000 %,(wet)	N <sub>2</sub> :	78.1 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	O <sub>2</sub> :	20.6 %,(wet)	
H <sub>2</sub> O:	1.25 %(=M2)			
Therefore, s	tack gas density (GD) =	1.28 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore, s	tack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	



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

Date: 5-Jan-16 Client: RivCott AECOM's Project No: Stack/Duct Description: Test 1:Total Particulate

60480321 Unloading Fan: 1A-1 Round 2

Time	0.20	Deremetric D		1010	hDe
Dees No. 1	9.30	Darometric Pr	essure .	1010	nra
Page No. :	TOTT	Pilot Correctio	on Factor :	0.84	3
Sampling Port No:	1 to 2	Stack Gas De	ensity:	1.28	kg/m°
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)
	Victoria W	Max.			4
Sampling Position	Distance	Differential	Max Temp	Max Temp (Ts)	Corrected Velocity
No	from far wall	Pressure	°C	K K	
NO.	(mm)	∆P, kilo	C		(\$3)11/3
		Pascals			
1/1	1	0.174	47.0	320.2	15.0
1/2	73	0.195	48.0	321.2	15.9
1/3	179	0.234	49.0	322.2	17.5
1/4	466	0.231	49.0	322.2	17.3
1/5	572	0.193	50.0	323.2	15.9
1/6	644	0.160	50.0	323.2	14.5
2/1	1	0.202	49.0	322.2	16.2
2/2	73	0.247	49.0	322.2	17.9
2/3	179	0.283	50.0	323.2	19.2
2/4	466	0.277	50.0	323.2	19.0
2/5	572	0.220	50.0	323.2	16.9
2/6	644	0.151	50.0	323.2	14.1
				CONTRACTOR AND A CONTRACT OF	
	_				
Average			49.3	322.5	16.6

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 8 mm 1010.78 hPa



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

Date:	5-Jan-	16
Client:	RivCott	
AECOM's Pro	ject No:	60480321
Stack/Duct Description:		Unloading Fan: 1A-1 Round 2
Test 1:Total F	Particulate	

Time :	10:55	Barometric Pressure :		1010	hPa
Page No. :	1 of 1	Pitot Correction	on Factor :	0.84	6 <sup>1</sup> m
Sampling Port No:	1 to 2	Stack Gas De	ensity:	1.28	kg/m <sup>3</sup>
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)
		Max.			
Compling Desition	Distance	Differential	Max Tomp	May Tamp (Ta)	Corrected Valacity
Sampling Position	from far wall	Pressure		Max Temp. (TS)	Corrected velocity
NO.	(mm)	ΔP, kilo	-0	r.	(vs) m/s
		Pascals			
1/1	1	0.158	49.0	322.2	14.3
1/2	73	0.195	49.0	322.2	15.9
1/3	179	0.200	49.0	322.2	16.1
1/4	466	0.215	50.0	323.2	16.7
1/5	572	0.175	50.0	323.2	15.1
1/6	644	0.126	50.0	323.2	12.8
2/1	1	0.174	50.0	323.2	15.1
2/2	73	0.190	50.0	323.2	15.8
2/3	179	0.184	50.0	323.2	15.5
2/4	466	0.204	51.0	324.2	16.3
2/5	572	0.165	51.0	324.2	14.7
2/6	644	0.139	51.0	324.2	13.5
		· · · · · · · · · · · · · · · · · · ·			
				80)	
	E				
Average			50.0	323.2	15.2

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 7.5 mm 1010.74 hPa



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#### STACK ANALYSIS

#### SAMPLING OF TOTAL PARTICULATE

Date: 5-Jan-16	5					
Client: RivCott						
AECOM's Project No:		60480321				
Stack Description No.:	Unloading Far	: 1A-1 Round	2			
Sample Nozzle No.:	S2		Sample Nozzle Are	a (An):	1.42	x 10 <sup>-5</sup> m <sup>2</sup>
Sampling Port No .:	1 to 2		Thimble No:		T11	
Page No:	1 of 1		Blank thimble No:		0	
Leak Check (Pre-Samplin	ng)		Leak Check (Post	Sampling	)	
Meter start: 385.3850	Meter finish:	385.3850	Meter start:	386.1704	Meter finish:	386.1704
Time start: 9:47	7 Time finish:	9:48	Time start:	9:53	Time finish:	9:54
Therefore, leakage rate =	no leak	L/min	Therefore, leakage	rate =	no leak	L/min
(>0.1 l/min. is unacceptable	e)		(>0.1 l/min. is unac	ceptable)		
Repeat:			Repeat:			
Comments:			Comments:			

#### Sampling Record Table

Barometric Pressure:	1010 hPa (s	tart);	1010 hPa (finish)
Meter start:	385.3864	Time start:	9:49
Meter correction factor (GMf) :		1.0100	

	Stopwatch						
	Time at	Distance	Isokinetic	1 192529 25 60-00746 74		Impinger	Flowrate
Sampling	Sampling	from far wall	Flowrate	Meter Inlet	Meter Outlet	Train Outlet	Attained
Position No.	Position	(mm)	(L/min)	Temp. (°C)	Temp. (°C)	Temp (°C)	(Y/N)
1/1	0:05:00	31	11.9	28.0	26.0		Yes
1/2	0:10:00	103	12.6	29.0	26.0		Yes
1/3	0:15:00	209	13.9	30.0	27.0		Yes
1/4	0:20:00	496	13.7	32.0	28.0		Yes
1/5	0:25:00	602	12.5	33.0	30.0		Yes
1/6	0:30:00	674	11.4	34.0	30.0		Yes
2/1	0:35:00	31	12.8	34.0	30.0	-	Yes
2/2	0:40:00	103	14.2	34.0	31.0		Yes
2/3	0:45:00	209	15.2	34.0	31.0		Yes
2/4	0:50:00	496	15.0	35.0	32.0		Yes
2/5	0:55:00	602	13.3	34.0	32.0		Yes
2/6	1:00:00	674	11.1	34.0	32.0	1.41	Yes
							-
							· · · · · · · · · · · · · · · · · · ·
Averages				32.6	20.6	no rocult	
Averages		000 1005		32.0	29.0		L
weter Finish	i.	386.1695	ml	Filian and Na(a)	uaadu	10:50	
I otal Conden	sate collected:	4	mi	SIIICA GEL NO(S)	usea:	гао	



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#### **STACK ANALYSIS - FINAL CALCULATIONS**

#### **Total Particulate**

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

**RivCott** 5-Jan-16 Client: Date: AECOM's Project No: 60480321 Stack/Duct Description: Unloading Fan: 1A-1 Round 2 (A) Sample gas volume at standard conditions  $0.7909 \text{ m}^3$ Average barometric Metered volume (MV<sub>3</sub>): pressure (P<sub>BARO</sub>) 31.1 °C 1010 hPa Average gas meter temp. (T<sub>M.2</sub>): Average pressure at 304.3 K meter (P<sub>M2</sub>) 1010.00 hPa Sample gas volume (MV<sub>4</sub>); (0°C, dry 0.7078 m<sup>3</sup> gas, 1 atm pressure): (B) Total Particulate concentration at standard conditions Blank thimble No .: 0 Blank weight: g **Total Particulate Weight** 0.0064 g Thimble No. used: T11 Final Total Particulate Weight (Mp1): 0.00640 q 0.0090 g/m<sup>3</sup> (0°C, dry gas,  $=M_{p1}/MV_{4}=$ Total Particulate Concentration (C1): 1atm pressure) ;and  $C_2 =$ 9.0 mg/m<sup>3</sup> (0°C, dry gas, 1atm pressure) CO<sub>2</sub> Basis 12 % 0.0 % Average CO<sub>2</sub>%: 0.0090 g/m3 (0°C, dry gas, 1atm = C<sub>a</sub> x 12/CO<sub>2</sub>% = Therefore, C<sub>c</sub>: pressure, 12% CO<sub>2</sub>) ;and C<sub>c1</sub> = 9.0 mg/m3 (0°C, dry gas, 1atm pressure, 12% CO<sub>2</sub>) O<sub>2</sub> Basis 7 % Average O<sub>2</sub>%: 20.9 %  $=C_a \times (21 - O_{2ref}\%)/(21 - O_{2mea}\%)$ 1.3 g/m<sup>3</sup> (0°C, dry gas, 1atm pressure, Therefore, C<sub>b</sub>: 7%  $O_2$ ) ;and Ch1 = 1300 mg/m<sup>3</sup> (0°C, dry gas, 1atm pressure, 7%  $O_2$ ) (C) Moisture content FA8 Silica Gel Number: 4 mL (=grams) V<sub>v</sub> = 2.7 g (from laboratory report)  $V_w =$ (recorded on Volume of Water Vapour Condensed (V<sub>wc(std)</sub>) = 0.0053 Laboratory Form Volume of Water Vapour Condensed (V<sub>wsq(std)</sub>) = 0.0036 108) Therefore, B<sub>ws</sub> = (Vwc(std)+Vwsg(std)) (Vwc(std)+Vwsg(std)+Vm(std)) 1.25 %

B<sub>ws</sub> =



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### STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

**Total Particulate** 

ANZ

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

(i) Initial gas density for sampling:

1.28 kg/m<sup>3</sup> (from Laboratory Form 107)

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

1.28 kg/m<sup>3</sup> (0°C, wet, 1 atm pressure) 1.29 kg/m<sup>3</sup> (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

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

1.081 kg/m<sup>3</sup> (stack conditions, wet)

15.88 m/s (stack conditions, wet)

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

16.62 m/s

15.15 m/s

N/A m/s

(E) Gas Velocities

(i) Average of pre-sampling velocities:

(ii) Average of post-sampling velocities:

(iii) Average of while-sampling velocities:

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

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

=

Qstack =		Vs x A =		6.20 m <sup>3</sup> /s (stack conditions)
Qstd =	Qstack x	<u>Ps</u> x (Pstd)	<u>(Tstd)</u> x (Ts)	<u>(100 - B<sub>w</sub>)</u> 100

Qstd =

= 5.2 m<sup>3</sup>/s (0°C, dry gas, 1 atm pressure)

#### (G) Mass Emission Rate

Rm =	C <sub>1a</sub> x Qstd = =	0.047 47	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure	)	
	C <sub>1a</sub> x Qstd =	0.047	g/s (0°C, dry gas, 1 atm pressure	12%	CO <sub>2</sub> )
	=	47	mg/s (0°C, dry gas, 1 atm pressure	12%	CO <sub>2</sub> )
	C <sub>1a</sub> x Qstd =	6.5	g/s (0°C, dry gas, 1 atm pressure	7%	O <sub>2</sub> )
	=	6500	mg/s (0°C, dry gas, 1 atm pressure	7%	O <sub>2</sub> )



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EMISSION MONITORING RESULTS, UNLOADING FAN: 1A-1 ROUND 2 RIVCOTT 5-Jan-16 TOTAL PARTICULATE				
Sampling Conditions:				
Stack internal diameter at test location	705 mm			
Stack gas temperature (average)	49.6 °C	322.8 K		
Stack pressure (average)	1011 hPa			
Stack gas velocity (average, stack conditions)	16 m/s			
Stack gas flowrate (stack conditions)	6.2 m <sup>3</sup> /s			
Stack gas flowrate (0 <sup>0</sup> C, dry gas, 1 atm pressure)	5.2 m <sup>3</sup> /s			
Total Particulate Testing				
Test Period	9:49 -	10:50		
Total Particulate Mass	6.4 mg			
Gas Volume Sampled	0.708 m <sup>3</sup>			
Total Particulate Emission*1	9.0 mg/m <sup>3</sup>			
Total Particulate Mass Emission Rate*2	47 mg/s			
Regulatory Limit	50 mg/m <sup>3</sup>			
Moisture Content (%)	1.2			
Gas Density (dry at 1 atmosphere)	1.29 kg/m <sup>3</sup>			
Dry Molecular Weight	28.8 g/g-mole			

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

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

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#### **RivCott**

AECOM's Project Number:

60480321

Unloading Fan: 1A-1 Round 3

5-Jan-16

Emission Source:

Date Sampled:

ANALYTE(S)

METHOD

Total Particulate

NSW EPA TM - 15

Observations made during testing period:

Sampling Performed By:

James Lang

Dylan Turnbull



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#### **STACK ANALYSIS - PRE-SAMPLING**

Date:5-Jan-16Client:RivCottAECOM's Project No:60480321Stack/Duct Description:Unloading Fan: 1A-1 Round 3Test 1:Total Particulate

Measurement/Observations						
Stack Inter	nal Dimensions:			Da C Martin		
Diameter	705	mm	Cross Sectional Area	· 0.39 m <sup>2</sup>		
OR	Length	Width				
Length/Wid	dth (mm)		Minimum No. of			
Equivalent	Diameter N/A	mm	sampling points=	12		
Distance fr	om sampling plane to		Total No. of sampling	points = 12		
nearest dis	turbances:			PM2.5/10= NA		
			No. of sampling trave	rses/ports		
Upstream (	(m) = 5.5		sampled =	2		
No. Diamet	ters = 7.8			PM2.5/10= NA		
Type of Up	stream Disturbance:	Bend	No. of sampling points	s on each		
Downstream	m (m) = 5.5		traverse/port =	6		
No. Diamet	ters = 7.8			PM2.5/10= NA		
Type of Do	wn Stream Disturbance:	Bend				
			Exclusion of any sam	nle point		
Position of	each sampling point for	each traverse:	numbers - comments			
	each sampling point, for		indifibers - comments.			
	^	P	DM10/2 5 A	DM2 5/10 D		
No	Distance from well	D S turno Ditat diatanaga	PIVITU/2.5 A	PIVI2.5/10 B		
1	21		Distance from wait	S-Type Pilot distances		
2	103	72				
2	200	170				
3	406	179				
5	602	400 572				
5	674	644				
7	074	044				
°						
10			Check of total points	aginat		
10				against		
10			$\mathbf{T}$	omments:		
12			4			
13			-			
14			-			
15			-			
10			-			
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SamplePts Emission Measurement Calculations Spreadsheet (Q4AN(EV)-332-FM31) Revision 2 May 28, 2015

### AECOM

### ANZ Emission Measurement Calculations Spreadsheet

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

1.50 %

Date:5-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Unloading Fan: 1A-1 Round 3

Sampling time start:	10:55	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (dry)
1	10:55	0	20.9	0.0
2	10:56	0	20.9	0.0
3	10:57	0	20.9	0.0
4	10:58	0	20.9	0.0
5	10:59	0	20.9	0.0
6	11:00	0	20.9	0.0
7	11:01	0	20.9	0.0
8	11:02	0	20.9	0.0
	Averages:	0.0 pp	m 20.9 %	6 0.0 %
Moisture content (M3):	0.99			

Moisture percentage (M2):

#### Measurements

CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	
Gas Com	positions converted to wet basis:			
CO:	0.0000 %,(wet)	N <sub>2</sub> :	77.9 %,(wet)	
CO2:	0.0 %,(wet)	O <sub>2</sub> :	20.6 %,(wet)	
H₂O:	1.50 %(=M2)			
Therefore	e, stack gas density (GD) =	1.28 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore	e, stack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	



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

Date:5-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Unloading Fan: 1A-1 Round 3

Sampling time start:	12:10	Sampling port No.:	1			
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)		CO <sub>2</sub> (%), (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	n 20.9	%	0.0	%
Moisture content (M3)	: 0.97					
Moisture percentage (	M2): 2.67	%				

Measurements

CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	
Gas Compo	ositions converted to wet basis:			
CO:	0.0000 %,(wet)	N <sub>2</sub> :	77.0 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	O <sub>2</sub> :	20.3 %,(wet)	
H <sub>2</sub> O:	2.67 %(=M2)			
Therefore,	stack gas density (GD) =	1.27 kg/m	<sup>3</sup> (0°C, wet, 1 atm pressure)	
Therefore,	stack gas density (GD) =	1.29 kg/m	<sup>3</sup> (0°C, dry, 1 atm pressure)	



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

Date: 5-Jan-16 Client: RivCott AECOM's Project No: Stack/Duct Description: Test 1:Total Particulate

60480321 Unloading Fan: 1A-1 Round 3

Time :	10:55	Barometric Pr	essure :	1010	hPa
Page No. :	1 of 1	Pitot Correction	on Factor :	0.84	
Sampling Port No:	1 to 2	Stack Gas De	ensity:	1.28	kg/m <sup>3</sup>
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)
		Max.			
Sampling Position	Distance	Differential	Max Temp	May Tomp (Te)	Corrected Velocity
No	from far wall	Pressure	°C	K	
140.	(mm)	∆P, kilo	C		(03)11/3
		Pascals			
1/1	1	0.158	49.0	322.2	14.3
1/2	73	0.195	49.0	322.2	15.9
1/3	179	0.200	49.0	322.2	16.1
1/4	466	0.215	50.0	323.2	16.8
1/5	572	0.175	50.0	323.2	15.1
1/6	644	0.126	50.0	323.2	12.8
2/1	1	0.174	50.0	202.0	45.4
2/1	] 72	0.174	50.0	323.2	15.1
2/2	13	0.190	50.0	323.2	15.0
213	179	0.104	50.0	323.2	15.0
2/4	400 570	0.204	51.0	324.2	10.4
2/0	512	0.100	51.0	324.2	14.7
2/0	044	0.159	51.0	324.2	13.3
			() 		
Average			50.0	323.2	15.2

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 7.5 mm 1010.74 hPa

Δ= COM

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#### STACK ANALYSIS

#### SAMPLING OF TOTAL PARTICULATE

Date: 5-Jan-16					
Client: RivCott					
AECOM's Project No:	604	80321			
Stack Description No .:	Unloading Fan: 1A-1 F	Round 3			
Sample Nozzle No.:	S2	Sample Nozzle Area	a (An):	1.42	x 10 <sup>-5</sup> m <sup>2</sup>
Sampling Port No.:	1 to 2	Thimble No:		Т9	
Page No:	1 of 1	Blank thimble No:		0	
Leak Check (Pre-Sampling	g)	Leak Check (Post	Sampling	1)	
Meter start: 386.1744	Meter finish: 386	6.1744 Meter start:	386.9182	Meter finish:	386.9182
Time start: 10:59	Time finish:	11:00 Time start:	12:04	Time finish:	12:05
Therefore, leakage rate =	no leak L/min	Therefore, leakage	rate =	no leak	L/min
(>0.1 l/min. is unacceptable	)	(>0.1 l/min. is unacc	eptable)		
Repeat:		Repeat:			
Comments:		Comments:			

#### Sampling Record Table

Barometric Pressure:	1010 hPa (s	start);	1010 hPa (finish)
Meter start:	386.1768	Time start:	11:01
Meter correction factor (GMf) :		1.0100	

	Stopwatch					1 12 124	
	Time at	Distance	Isokinetic			Impinger	Flowrate
Sampling	Sampling	from far wall	Flowrate	Meter Inlet	Meter Outlet	Train Outlet	Attained
Position No.	Position	(mm)	(L/min)	Temp. (°C)	Temp. (°C)	Temp (°C)	(Y/N)
1/1	0:05:00	31	11.3	33.0	31.0		Yes
1/2	0:10:00	103	12.6	34.0	32.0		Yes
1/3	0:15:00	209	12.7	34.0	33.0		Yes
1/4	0:20:00	496	13.3	35.0	33.0		Yes
1/5	0:25:00	602	11.9	35.0	34.0		Yes
1/6	0:30:00	674	10.1	36.0	34.0		Yes
2/1	0:35:00	31	11.9	37.0	34.0		Yes
2/2	0:40:00	103	12.5	36.0	34.0		Yes
2/3	0:45:00	209	12.2	36.0	34.0		Yes
2/4	0:50:00	496	12.9	36.0	35.0		Yes
2/5	0:55:00	602	11.6	37.0	35.0		Yes
2/6	1:00:00	674	10.6	37.0	35.0		Yes
			-7.19				
							<u> </u>
		-					
Averages				35.5	33.7	no result	
Motor Einiah	•	396 0170		Time Einich		10.00	
Total Candon	nato collectod:	300.9170	ml	Silica del Me(a)	lused:	12.02	
i otar Condens	sale conected.	5	110	Silica yel NO(S)	useu.	110	

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

Date:	5-Jan-	16
Client:	RivCott	
AECOM's Project No:		60480321
Stack/Duct Description:		Unloading Fan: 1A-1 Round 3
Test 1:Total Particulate		

Time :	12:10	Barometric Pr	ressure :	1010	hPa
Page No. :	1 of 1	Pitot Correction	on Factor :	0.84	
Sampling Port No:	1 to 2	Stack Gas De	ensity:	1.27	ka/m <sup>3</sup>
Pitot Tube Type :	S				(0 °C. Wet. 1 Atm)
		Max		T	
	Distance	Differential			
Sampling Position	from far wall	Pressure	Max Temp.	Max Temp. (Ts)	Corrected Velocity
No.	(mm)	AP kilo	°C	ĸ	(Vs) m/s
	()	Pascals			
1/1	1	0.162	50.0	323.2	14.6
1/2	73	0.184	50.0	323.2	15.6
1/3	179	0.206	50.0	323.2	16.4
1/4	466	0.189	51.0	324.2	15.8
1/5	572	0.191	51.0	324.2	15.9
1/6	644	0.129	50.0	323.2	13.0
	011	0.120	00.0	020.2	10.0
2/1	1	0.177	50.0	323.2	15.2
2/1	73	0.187	50.0	323.2	15.7
2/2	170	0.107	50.0	323.2	15.1
2/3	115	0.175	51.0	323.2	16.5
2/4	572	0.200	51.0	324.2	15.0
2/5	614	0.172	51.0	324.2	13.0
2/0	044	0.140	51.0	324.2	13.0
			and the second second		
		10			
	10				
Average			50.4	323.6	15.2

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 7.6 mm 1010.75 hPa



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STACK	ANALYSIS	- FINAL	CALCULATIONS	
Total Par	ticulate			

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

**RivCott** Date: 5-Jan-16 Client: AECOM's Project No: 60480321 Stack/Duct Description: Unloading Fan: 1A-1 Round 3 (A) Sample gas volume at standard conditions 0.7482 m<sup>3</sup> Average barometric Metered volume (MV<sub>3</sub>): pressure (PBARO) 34.6 °C Average gas meter temp. (T<sub>M2</sub>): 1010 hPa Average pressure at 307.8 K meter (P<sub>M.2</sub>) 1010.00 hPa Sample gas volume (MV<sub>4</sub>); (0°C, dry 0.6620 m<sup>3</sup> gas, 1 atm pressure): (B) Total Particulate concentration at standard conditions Blank thimble No .: Blank weight: 0 g Τ9 **Total Particulate Weight** 0.0037 g Thimble No. used: Final Total Particulate Weight (Mp1): 0.00370 g 0.0056 g/m<sup>3</sup> (0°C, dry gas,  $=M_{p1}/MV_{4}=$ Total Particulate Concentration (C1): 1atm pressure) ;and  $C_2 =$ 5.6 mg/m<sup>3</sup> (0°C, dry gas, CO<sub>2</sub> Basis 12 % 1atm pressure) 0.0 % Average CO<sub>2</sub>%: 0.0056 g/m3 (0°C, dry gas, 1atm = C<sub>a</sub> x 12/CO<sub>2</sub>% = Therefore, C<sub>c</sub>: pressure, 12% CO<sub>2</sub>) 5.6 mg/m<sup>3</sup> (0°C, dry gas, 1atm ;and C<sub>c1</sub> = pressure, 12% CO<sub>2</sub>) O<sub>2</sub> Basis 7 % Average O<sub>2</sub>%: 20.9 % 0.78 g/m<sup>3</sup> (0°C, dry gas, 1atm pressure, Therefore, Ch: =C<sub>a</sub> x (21 - O<sub>2ref</sub>%)/(21 - O<sub>2mea</sub>%) 7%  $O_2$ ) ;and C<sub>b1</sub> = 780 mg/m<sup>3</sup> (0°C, dry gas, 1atm pressure, 7%  $O_2$ ) (C) Moisture content Silica Gel Number: K9 5 mL (=grams)  $V_v =$ 8.6 g (from laboratory report)  $V_w =$ (recorded on Volume of Water Vapour Condensed (Vwc(std)) = 0.0067 Laboratory Form Volume of Water Vapour Condensed (V<sub>wsg(std)</sub>) = 0.0115 108) Therefore, B<sub>ws</sub> = (Vwc(std)+Vwsg(std)) (Vwc(std)+Vwsq(std)+Vm(std)) B<sub>ws</sub> = 2.67 %



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#### ANZ Emission Measurement Calculations Spreadsheet

#### STACK ANALYSIS - FINAL CALCULATIONS CONTINUED

**Total Particulate** 

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

(i) Initial gas density for sampling:

1.28 kg/m<sup>3</sup> (from Laboratory Form 107)

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

1.29 kg/m<sup>3</sup> (0°C, wet, 1 atm pressure)

1.29 kg/m<sup>3</sup> (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

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

1.087 kg/m<sup>3</sup> (stack conditions, wet)

15.18 m/s (stack conditions, wet)

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

15.17 m/s

15.20 m/s

N/A m/s

(E) Gas Velocities

(i) Average of pre-sampling velocities:

(ii) Average of post-sampling velocities:

(iii) Average of while-sampling velocities:

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

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

4.9 m<sup>3</sup>/s (0°C, dry gas, 1 atm pressure)

Qstack =		Vs x A =		5.93 m <sup>3</sup> /s (stack conditions)	
Qstd =	Qstack x	<u>Ps</u> x	<u>(Tstd)</u> x	<u>(100 - B<sub>w</sub>)</u>	
		(Pstd)	(Ts)	100	

=

Qstd =

(G) Mass Emission Rate

Rm =	C <sub>1a</sub> x Qstd = =	0.027 27	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure	) )	
	C <sub>1a</sub> x Qstd =	0.027	g/s (0°C, dry gas, 1 atm pressure	12%	CO <sub>2</sub> )
	=	27	mg/s (0°C, dry gas, 1 atm pressure	12%	CO <sub>2</sub> )
	C <sub>1a</sub> x Qstd =	3.8	g/s (0°C, dry gas, 1 atm pressure	7%	O <sub>2</sub> )
	=	3800	mg/s (0°C, dry gas, 1 atm pressure	7%	O <sub>2</sub> )

## AECOM

### ANZ Emission Measurement Calculations Spreadsheet

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EMISSION MONITORING RESULTS, UNL RIVCOTT 5-Jan-16 TOTAL PARTICU	OADING FAN: 1A-1 ROUND 3	
Sampling Conditions:		
Stack internal diameter at test location	705 mm	
Stack gas temperature (average)	50.2 °C 323.4 k	<
Stack pressure (average)	1011 hPa	
Stack gas velocity (average, stack conditions)	15 m/s	
Stack gas flowrate (stack conditions)	5.9 m <sup>3</sup> /s	
Stack gas flowrate (0ºC, dry gas, 1 atm pressure)	4.9 m <sup>3</sup> /s	
Total Particulate Testing		
Test Period	11:01 - 12:02	
Total Particulate Mass	3.7 mg	
Gas Volume Sampled	0.662 m <sup>3</sup>	
Total Particulate Emission*1	5.6 mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate*2	27 mg/s	
Regulatory Limit	50 mg/m <sup>3</sup>	
Moisture Content (%)	2.7	
Gas Density (dry at 1 atmosphere)	1.29 kg/m <sup>3</sup>	
Dry Molecular Weight	28.8 g/g-mole	

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

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

for each test.

Q4AN(EV)-332-FM31

#### **RivCott**

AECOM's Project Number:

6-Jan-16

**Emission Source:** Feeder Dust Round 1

Date Sampled:

ANALYTE(S)

METHOD

60480321

**Total Particulate** 

NSW EPA TM - 15

Observations made during testing period:

Sampling Performed By:

James Lang

Dylan Turnbull



Q4AN(EV)-332-FM31

#### **STACK ANALYSIS - PRE-SAMPLING**

Date:6-Jan-16Client:RivCottAECOM's Project No:60480321Stack/Duct Description:Feeder Dust Round 1Test 1:Total Particulate

		Measurement/Obser	vations	
Stack Inter	nal Dimensions:			
Diameter	705	mm	Cross Sectional Area : 0.39	m <sup>2</sup>
OR	Length	Width		
Length/Wid	dth (mm)		Minimum No. of	
Equivalent	Diameter N/A	mm	sampling points= 12	
Distance fr	om sampling plane to		Total No. of sampling points =	12
nearest dis	turbances:		PM2.5/10=	NA
			No. of sampling traverses/ports	
Upstream (	(m) = 5.5		sampled =	2
No. Diamet	ters = 7.8		PM2.5/10=	NA
Type of Up	stream Disturbance:	Bend	No. of sampling points on each	
Downstrea	m (m) = 5.5		traverse/port =	6
No. Diame	ters = 7.8		PM2.5/10=	NA
Type of Do	wn Stream Disturbance:	Bend		10.00m (0.
			Exclusion of any sample point	
Position of	each sampling point, for e	each traverse:	numbers - comments:	
	eeen een pinig penin, ier e			
	Δ	В	PM10/2.5.A PM2	5/10 B
No	Distance from wall	S-type Pitot distances	Distance from wall S-Type Pito	t distances
1	31	1		diotanooo
2	103	73		
3	209	179		
4	496	466		
5	602	572		
6	674	644		
7				
8				
9				
10		We dot 1	Check of total points against	
11			minimum, (yes/no) - comments:	
12				
13				
14				
15				
16		9	$\cap$	
17				
18			//	
19			General Comments:	
20				
	Mi 2			
Signed:	Aft		Checked:	
	U C	No. of the second se	U	



Q4AN(EV)-332-FM31

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

Date:6-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Feeder Dust Round 1

Sampling time start:	9:00	Sampling port No.:	1		
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (dry)	
1	9:00	0	20.9	0.0	
2	9:01	0	20.9	0.0	
3	9:02	0	20.9	0.0	
4	9:03	0	20.9	0.0	
5	9:04	0	20.9	0.0	
6	9:05	0	20.9	0.0	
7	9:06	0	20.9	0.0	
8	9:07	0	20.9	0.0	
	Averages:	0.0 pp	om 20.9	% 0.0	%
Moisture content (M3):	0.99				
Moisture percentage (M	M2): 1.50	%			

#### Measurements

CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	
Gas Com	positions converted to wet basis:			
CO:	0.0000 %,(wet)	N <sub>2</sub> :	77.9 %,(wet)	8
CO <sub>2</sub> :	0.0 %,(wet)	<b>O</b> <sub>2</sub> :	20.6 %,(wet)	
H <sub>2</sub> O:	1.50 %(=M2)			
Therefore	e, stack gas density (GD) =	1.28 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore	e, stack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	



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

6-Jan-16 Date: Client: **RivCott** AECOM's Project No: Stack/Duct Description: Test 1: Total Particulate

60480321 Feeder Dust Round 1

Sampling time start:	10:30	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (dry)
1	10:30	0	20.9	0.0
2	10:31	0	20.9	0.0
3	10:32	0	20.9	0.0
4	10:33	0	20.9	0.0
5	10:34	0	20.9	0.0
6	10:35	0	20.9	0.0
7	10:36	0	20.9	0.0
8	10:37	0	20.9	0.0
	Averages:	0.0 ppr	n 20.9 %	6 0.0 %
Moisture content (M3):	0.98			
Moisture percentage (M	2.34	%		

Measurements

CO:	0.0000 %.(drv)	N <sub>2</sub> :	79.1 %.(drv)	
CO <sub>2</sub> :	0.0 %.(drv)	02:	20.9 %.(drv)	
Gas Com	positions converted to wet basis:	2		
CO:	0.0000 %,(wet)	N <sub>2</sub> :	77.3 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	O <sub>2</sub> :	20.4 %,(wet)	
H <sub>2</sub> O:	2.34 %(=M2)			
Therefore	, stack gas density (GD) =	1.28 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore	, stack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	



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

Date:6-Jan-16Client:RivCottAECOM's Project No:6048Stack/Duct Description:FeederTest 1:Total ParticulateFeeder

60480321 Feeder Dust Round 1

<b>T</b> :	0.00			1010	1.5
l'ime :	9:00	Barometric Pi	ressure :	1010	hPa
Page No. :	1 of 1	Pitot Correctio	on Factor :	0.84	2
Sampling Port No:	1 to 2	Stack Gas De	ensity:	1.28	kg/m°
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)
		Max.			
Sompling Desition	Distance	Differential	Max Tomp	May Tamp (Ta)	Competed Male situ
Sampling Position	from far wall	Pressure	wax remp.	Max Temp. (Ts)	Corrected velocity
NO.	(mm)	$\Delta P$ , kilo	°C	ĸ	(Vs) m/s
		Pascals			
1/1	1	0.127	28.0	301.2	12.4
1/2	73	0.147	29.0	302.2	13.4
1/3	179	0.138	29.0	* 302.2	13.0
1/4	466	0.110	29.0	302.2	11.6
1/5	572	0.120	30.0	303.2	12.1
1/6	644	0.085	30.0	303.2	10.2
2/1	1	0.096	29.0	302.2	10.8
2/2	73	0.130	29.0	302.2	12.6
2/3	179	0.134	29.0	302.2	12.8
2/4	466	0.126	30.0	303.2	12.4
2/5	572	0.101	30.0	303.2	11.1
2/6	644	0.081	30.0	303.2	10.0
	-				
			100 a.A		
Average			29.3	302.5	11.9

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 5 mm 1010.49 hPa



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#### STACK ANALYSIS

#### SAMPLING OF TOTAL PARTICULATE

Date: 6-Jan-1	6						
Client: RivCott							
AECOM's Project No:		60480321					
Stack Description No.:	Feeder Dust I	Round 1					
Sample Nozzle No .:	s2		Sample Nozzle Are	a (An):	1.42	x 10 <sup>-5</sup> m <sup>2</sup>	
Sampling Port No .:	1 to 2		Thimble No:		T12		
Page No:	1 of 1		Blank thimble No:		NA		
Leak Check (Pre-Sampli	ng)		Leak Check (Post	Sampling	I)		
Meter start: 387.007	8 Meter finish:	387.0078	Meter start:	387.6355	Meter finish:	387.6355	
Time start: 9:2	7 Time finish:	9:28	Time start:	10:33	Time finish:	10:34	
Therefore, leakage rate =	no leak	L/min	Therefore, leakage	rate =	no leak	L/min	
(>0.1 I/min. is unacceptab	le)		(>0.1 l/min. is unac	ceptable)			
Repeat:			Repeat:				
Comments:			Comments:				

#### Sampling Record Table

Barometric Pressure:	1010 hPa (s	tart);	1010 hPa (finish)
Meter start:	387.0094	Time start:	9:30
Meter correction factor (GMf) :		1.0100	

	Stopwatch						
•	Time at	Distance	Isokinetic			Impinger	Flowrate
Sampling	Sampling	from far wall	Flowrate	Meter Inlet	Meter Outlet	Train Outlet	Attained
Position No.	Position	(mm)	(L/min)	Temp. (°C)	Temp. (°C)	Temp (°C)	(Y/N)
1/1	0:05:00	31	10.5	22.0	20.0		Yes
1/2	0:10:00	103	11.3	23.0	21.0		Yes
1/3	0:15:00	209	11.0	25.0	22.0		Yes
1/4	0:20:00	496	9.8	27.0	23.0		Yes
1/5	0:25:00	602	10.2	28.0	24.0		Yes
1/6	0:30:00	674	8.6	29.0	25.0		Yes
2/1	0:35:00	31	9.1	30.0	25.0	-	Yes
2/2	0:40:00	103	10.6	30.0	26.0		Yes
2/3	0:45:00	209	10.8	31.0	27.0		Yes
2/4	0:50:00	496	10.4	31.0	27.0		Yes
2/5	0:55:00	602	9.3	32.0	28.0	1	Yes
2/6	1:00:00	674	8.4	33.0	29.0		Yes
		14					
						12	
						-	
					· · · ·		
							· · · · · · · · · · · · · · · · · · ·
							- and the second second second
Averages				28.4	24.8	no result	
Motor Einish	<u>.</u>	207 6240	<u>la , es , e</u>	Time Einich:	1 27.0	10.21	
Total Condens	sate collected:	507.0349	ml	Silica gel No(s)	used:	G100	

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

Date:	6-Jan-	16
Client:	RivCott	
AECOM's Project No:		60480321
Stack/Duct Description:		Feeder Dust Round 1
Test 1:Total F	Particulate	

Time : 10:30 Barometric Pressure :		1010	hPa		
Page No	1 of 1	Pitot Correction Factor		0.84	
Sampling Port No:	1 to 2	Stack Gas De	ancitu:	1.28	ka/m <sup>3</sup>
Ditet Tube Tupe :	1102	Older Oas De	insity.	1.20	(0°C Mot 1 Atm)
Pilot Tube Type .	3	Mox			(0 C, Wei, TAIM)
	Distance	Differential			
Sampling Position	from for woll	Differential	Max Temp.	Max Temp. (Ts)	Corrected Velocity
No.	from far wall	Pressure	°C	K	(Vs) m/s
	(mm)	$\Delta P$ , KIO		-	
1/1	1	Pascais 0.101	22.0	205.2	11.0
1/1	72	0.101	32.0	305.2	12.2
1/2	170	0.120	32.0	305.2	12.2
1/3	179	0.130	32.0	305.2	11.0
1/4	400 570	0.113	33.0	306.2	10.5
1/5	5/2	0.089	33.0	306.2	10.5
1/0	044	0.076	33.0	306.2	9./
2/1	1	0.100	22.0	205.0	10.0
2/1	70	0.120	32.0	305.2	12.2
2/2	/3	0.130	32.0	305.2	12.7
2/3	1/9	0.145	33.0	306.2	13.4
2/4	466	0.119	33.0	306.2	12.1
2/5	572	0.113	33.0	306.2	11.8
2/6	644	0.085	33.0	306.2	10.3
	· · · · ·				
	-				
			-		
Average			32.6	305.8	11.7

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 7.5 mm 1010.74 hPa



Q4AN(EV)-332-FM31

JIAGN MNALIDIG - I MAL GALGGLA MUT	ST	ACK	ANALYSIS	- FINAL	CALCULATIONS
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#### **Total Particulate**

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

Date: 6-Jan-16 AECOM's Project No:	60480321	Client: Stack/Duct	RivCott Description:	Feeder Du	ist Round 1
(A) Sample gas volume at standard c	conditions				
Metered volume (MV <sub>3</sub> ): Average gas meter temp. (T <sub>M,2</sub> ):	0.6318 26.6	m <sup>3</sup> °C	Average barom pressure (P <sub>BAR</sub>	netric o)	1010 hPa
	299.8	К	Average press meter (P <sub>M,2</sub> )	ure at	1010.00 hPa
Sample gas volume (MV <sub>4</sub> ); (0°C, dry gas, 1 atm pressure):	0.5739	m <sup>3</sup>			
(B) Total Particulate concentration at Blank thimble No.: NA Thimble No. used: T12 Final Total Particulate Weight (Mp1): Total Particulate Concentration (C1):	standard condi 0.00710	g =M <sub>p1</sub> /MV <sub>4</sub> =	Blank weight: Total Particulat	e Weight 0.012	g 0.0071 g g/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
CO <sub>2</sub> Basis 12 % Average CO <sub>2</sub> %:	0.0 %	;and C <sub>2</sub> =		12	<sup>2</sup> mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
Therefore, C <sub>c</sub> :	= C <sub>a</sub> x 12/0	CO <sub>2</sub> % =	0.012	g/m <sup>3</sup> (0°C, pressure,	dry gas, 1atm 12% CO <sub>2</sub> )
		;and C <sub>c1</sub> =	12	mg/m <sup>3</sup> (0° pressure,	C, dry gas, 1atm 12% CO <sub>2</sub> )
O <sub>2</sub> Basis 7 % Average O <sub>2</sub> %:	20.9 %				
Therefore, $C_b$ : = $C_a x (21)$	- O <sub>2ref</sub> %)/(21 - 0	D <sub>2mea</sub> %)	1.7	′g/m³ (0°C, 7%	dry gas, 1atm pressure, $O_2$ )
		;and C <sub>b1</sub> =	1700	0 mg/m <sup>3</sup> (0°) 7%	C, dry gas, 1atm pressure, O <sub>2</sub> )
(C) Moisture content Silica Gel Number: G100					
$V_v =$ 5.3 g (from lab Volume of Water Vapour Condensed Volume of Water Vapour Condensed Therefore, $B_{ws} =$ $(V_w$	$poratory report)$ $d (V_{wc(std)}) =$ $d (V_{wsg(std)}) =$ $(V_{wc(std)} + V_{wsg(std)} + V_{w$	0.0067 0.0071 )) m(std))	V <sub>w</sub> =	Ę	5 mL (=grams) (recorded on Laboratory Form 108)
B <sub>ws</sub> =	2.34 %				



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#### **STACK ANALYSIS - FINAL CALCULATIONS CONTINUED**

**Total Particulate** 

ANZ

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

(i) Initial gas density for sampling:

1.28 kg/m<sup>3</sup> (from Laboratory Form 107)

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

1.29 kg/m<sup>3</sup> (0°C, wet, 1 atm pressure) 1.29 kg/m<sup>3</sup> (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

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

1.156 kg/m<sup>3</sup> (stack conditions, wet)

11.79 m/s (stack conditions, wet)

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

11.72 m/s

N/A m/s

(E) Gas Velocities

(i) Average of pre-sampling velocities: 11.87 m/s

(ii) Average of post-sampling velocities:

(iii) Average of while-sampling velocities:

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

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

Qstack =		Vs x A =		4.60 m <sup>3</sup> /s (stack conditions)
Qstd =	Qstack x	<u>Ps</u> x	<u>(Tstd)</u> x	<u>(100 - B<sub>w</sub>)</u>
		(Pstd)	(Ts)	100

=

Qstd = 4.0 m<sup>3</sup>/s (0°C, dry gas, 1 atm pressure)

#### (G) Mass Emission Rate

Rm =	C <sub>1a</sub> x Qstd = =	0.048 48	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure	) )	
	C <sub>1a</sub> x Qstd =	0.048	g/s (0°C, dry gas, 1 atm pressure	12%	CO <sub>2</sub> )
	=	48	mg/s (0°C, dry gas, 1 atm pressure	12%	CO <sub>2</sub> )
	C <sub>1a</sub> x Qstd =	6.8	g/s (0°C, dry gas, 1 atm pressure	7%	O <sub>2</sub> )
	=	6800	mg/s (0°C, dry gas, 1 atm pressure	7%	O <sub>2</sub> )

## AECOM

### ANZ Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, I	FEEDER DUST ROUND 1	
RIVCOTT	5 <b>a</b>	
6-Jan-16		
TOTAL PARTICUL	ATE	
Sampling Conditions:		
Stack internal diameter at test location	705 mm	
Stack gas temperature (average)	31.0 °C	304.2 K
Stack pressure (average)	1011 hPa	
Stack gas velocity (average, stack conditions)	12 m/s	
Stack gas flowrate (stack conditions)	4.6 m <sup>3</sup> /s	
Stack gas flowrate (0ºC, dry gas, 1 atm pressure)	4 m <sup>3</sup> /s	
Total Particulate Testing	MACONIA MORE	80-1005-100 10-1
Test Period	9:30 -	10:31
Total Particulate Mass	7.1 mg	
Gas Volume Sampled	0.574 m <sup>3</sup>	
Total Particulate Emission*1	12 mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate*2	48 mg/s	
Regulatory Limit	50 mg/m <sup>3</sup>	
Moisture Content (%)	2.3	
Gas Density (dry at 1 atmosphere)	1.29 kg/m <sup>3</sup>	
Dry Molecular Weight	28.8 g/g-mole	

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

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

Q4AN(EV)-332-FM31

AECOM's Project Number: 60480321

Emission Source:

Date Sampled:

6-Jan-16

Feeder Dust Round 2

ANALYTE(S)

**Total Particulate** 

METHOD

NSW EPA TM - 15

Observations made during testing period:

Sampling Performed By:

James Lang

Dylan Turnbull

AECO

Q4AN(EV)-332-FM31

#### **STACK ANALYSIS - PRE-SAMPLING**

Date:6-Jan-16Client:RivCottAECOM's Project No:60480321Stack/Duct Description:Feeder Dust Round 2Test 1:Total Particulate

Measurement/Observations						
Stack Inter	nal Dimensions:		82			
Diameter	705	mm	Cross Sectional Area	• 0.39 m <sup>2</sup>		
OR	Length	Width				
Length/Wid	dth (mm)		Minimum No. of			
Equivalent	Diameter N/A	mm	sampling points=	12		
Distance fr	om sampling plane to		Total No. of sampling	points =	12	
nearest dis	sturbances:			PM2.5/10=	NA	
			No. of sampling trave	rses/ports		
Upstream (	(m) = 5.5		sampled =		2	
No. Diamet	ters = 7.8			PM2.5/10=	NA	
Type of Up	stream Disturbance:	Bend	No. of sampling points	s on each	-	
Downstrea	m (m) = 5.5		traverse/port =		6	
No. Diamet	ters = 7.8			PM2.5/10=	NA	
Type of Do	wn Stream Disturbance:	Bend				
			Exclusion of any sam	ple point		
Position of	each sampling point, for	each traverse:	numbers - comments:			
	А	В	PM10/2.5 A	PM2.5/10 E	3	
No.	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot dista	ances	
1	31	1				
2	103	73				
3 .	209	179				
4	496	466				
5	602	572				
6	674	644				
7						
8						
9						
10			Check of total points a	against		
11			]minimum, (yes/no) - c	omments:		
12						
13						
14				*		
15				1		
16				//		
17				/ /		
18			/			
19			General Comments:	/		
20				/		
1	FStor?			7		
Signed	1 W		Checked:			

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

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

Date:6-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Feeder Dust Round 2

1.50 %

Sampling time start:	10:30	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (dry)
1	10:30	0	20.9	0.0
2	10:31	0	20.9	0.0
3	10:32	0	20.9	0.0
4	10:33	0	20.9	0.0
5	10:34	0	20.9	0.0
6	10:35	0	20.9	0.0
7	10:36	0	20.9	0.0
8	10:37	0	20.9	0.0
	Averages:	0.0 pr	om 20.9 %	6 0.0 %
Moisture content (M3):	0.99			

Moisture percentage (M2):

#### Measurements

CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	-
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	
Gas Compos	itions converted to wet bas	is:		
CO:	0.0000 %,(wet)	N <sub>2</sub> :	77.9 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	O <sub>2</sub> :	20.6 %,(wet)	
H₂O:	1.50 %(=M2)			
Therefore, st	ack gas density (GD) =	1.28 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore, st	ack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	

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

6-Jan-16 Date: **RivCott** Client: AECOM's Project No: Stack/Duct Description: Test 1: Total Particulate

60480321 Feeder Dust Round 2

Sampling time start:	0:00	Sampling port No.	.:	1			5
Measurement No.	Time sampled	CO (ppm). (dry)	С	D <sub>2</sub> (%), (dry)		CO <sub>2</sub> (%), (dry)	
1	0:00	0		20.9		0.0	
2		0		20.9		0.0	
3		0	8 1	20.9		0.0	
4		0		20.9		0.0	_
5		0	-	20.9		0.0	
6		0		20.9		0.0	
7		0		20.9	41	0.0	
8		0		20.9		0.0	
	Averages:	0.0	ppm	20.9	%	0.0	%
Moisture content (M3)	: 0.98						
Moisture percentage (	M2): 2.49	%					

Moisture percentage (M2):

#### Measurements

6 mm					
CO:	0.0000 %,(dry)		N <sub>2</sub> :	79.1 %,(dry)	i i i i i i i i i i i i i i i i i i i
CO <sub>2</sub> :	0.0 %,(dry)		O <sub>2</sub> :	20.9 %,(dry)	
Gas Compos	sitions converted to wet basis:	_			
					1
CO:	0.0000 %,(wet)	•3	N <sub>2</sub> :	77.1 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)		O <sub>2</sub> :	20.4 %,(wet)	
H <sub>2</sub> O:	2.49 %(=M2)				2.57
Therefore, st	ack gas density (GD) =	1.28	kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore, st	ack gas density (GD) =	1.29	kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	

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

Date:	6-Jan-	16		
Client:	RivCott			
AECOM's Pro	ject No:	60480321		
Stack/Duct D	escription:	Feeder Dust Round 2		
Test 1:Total F	Particulate			

Time :	10:30	Barometric Pi	ressure :	1010	hPa
Page No.: 1 of 1		Pitot Correction Factor :		0.84	2
Sampling Port No:	1 to 2	Stack Gas De	ensity:	1.28	kg/m <sup>3</sup>
Pitot Tube Type :	S			< 11 L	(0 °C, Wet, 1 Atm)
		Max.			
Compling Desition	Distance	Differential	Max Tomp	May Tamp (Ta)	Compated Valasity
Sampling Position	from far wall	Pressure	Max remp.	Max Temp. (15)	
NO.	(mm)	ΔP. kilo	ъС	ĸ	(Vs) m/s
	, , ,	Pascals			
1/1	1	0.101	32.0	305.2	11.2
1/2	73	0.120	32.0	305.2	12.2
1/3	179	0.130	32.0	305.2	12.7
1/4	466	0.113	33.0	306.2	11.8
1/5	572	0.089	33.0	306.2	10.5
1/6	644	0.076	33.0	306.2	9.7
2/1	1	0.120	32.0	305.2	12.2
2/2	73	0.130	32.0	305.2	12.7
2/3	179	0.145	33.0	306.2	13.4
2/4	466	0.119	33.0	306.2	12.1
2/5	572	0.113	33.0	306.2	11.8
2/6	644	0.085	33.0	306.2	10.3
210	0.14	0.000	00.0	500.2	10.0
				-	
				0	
Average			32.6	305.8	11.7

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 7.5 mm 1010.74 hPa



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#### STACK ANALYSIS

#### SAMPLING OF TOTAL PARTICULATE

Date: 6-Jan-16						
Client: RivCott						
AECOM's Project No:		60480321				
Stack Description No.:	Feeder Dust Ro	ound 2				
Sample Nozzle No.:	s2		Sample Nozzle Are	ea (An):	1.42	x 10 <sup>-5</sup> m <sup>2</sup>
Sampling Port No.:	1 to 2		Thimble No:		T22	
Page No:	1 of 1		Blank thimble No:		0	
Leak Check (Pre-Samplin	a)		Leak Check (Post	Sampling	1)	
Meter start: 387.6555	Meter finish:	387.6555	Meter start:	388.2441	Meter finish:	388.2441
Time start: 10:47	Time finish:	10:48	Time start:	11:55	Time finish:	11:56
Therefore, leakage rate =	no leak I	L/min	Therefore, leakage	rate =	no leak	L/min
(>0.1 l/min. is unacceptable	e)		(>0.1 l/min. is unac	ceptable)		
Repeat:			Repeat:			
Comments:			Comments:			

#### Sampling Record Table

Barometric Pressure:	1010 hPa (s	tart);	1010 hPa (finish)
Meter start:	387.6563	Time start:	10:49
Meter correction factor (GMf) :		1.0100	

	Stopwatch						
	Time at	Distance	Isokinetic			Impinger	Flowrate
Sampling	Sampling	from far wall	Flowrate	Meter Inlet	Meter Outlet	Train Outlet	Attained
Position No.	Position	(mm)	(L/min)	Temp. (°C)	Temp. (°C)	Temp (°C)	(Y/N)
1/1	0:05:00	31	9.4	24.0	21.0		Yes
1/2	0:10:00	103	10.2	25.0	22.0		Yes
1/3	0:15:00	209	10.6	26.0	23.0		Yes
1/4	0:20:00	496	9.8	28.0	25.0		Yes
1/5	0:25:00	602	8.7	29.0	27.0		Yes
1/6	0:30:00	674	8.1	30.0	28.0		Yes
2/1	0:35:00	31	10.2	30.0	28.0		Yes
2/2	0:40:00	103	10.6	30.0	28.0		Yes
2/3	0:45:00	209	11.2	30.0	28.0		Yes
2/4	0:50:00	496	10.1	30.0	28.0		Yes
2/5	0:55:00	602	9.8	30.0	28.0		Yes
2/6	1:00:00	674	8.6	31.0	28.0		Yes
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	<u> </u>	<u>                                     </u>			<u> </u>		
		<del>                                      </del>	l	l	<u> </u>		
Averages	l	11		28.6	26.2	no result	
Meter Finish	<u>.</u>	388 2435		Time Finish		11.51	
Total Condens	sate collected:	300.2433	ml	Silica gel No(s)	used:	P8	



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

Date:	6-Jan-	16
Client:	RivCott	
AECOM's Pro	ject No:	60480321
Stack/Duct De	escription:	Feeder Dust Round 2
Test 1:Total F	Particulate	

Time :	12:05	Barometric Pressure :		1010	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No: 1 to 2		Stack Gas Density:		1.28	kg/m <sup>3</sup>
Pitot Tube Type :	S				(0 °C, Wet, 1 Atm)
		Max.			(
	Distance	Differential			
Sampling Position	from far wall	Pressure	Max Temp.	Max Temp. (Ts)	Corrected Velocity
No.	(mm)	AP, kilo	°C	к	(Vs) m/s
	(	Pascals			= inc
1/1	1	0.098	33.0	306.2	11.0
1/2	73	0.129	33.0	306.2	12.6
1/3	179	0.134	33.0	306.2	12.9
1/4	466	0.106	34.0	307.2	11.5
1/5	572	0.101	34.0	307.2	11.2
1/6	644	0.073	34.0	307.2	9.5
2/1	1	0.146	33.0	306.2	13.5
2/2	73	0.141	34.0	307.2	13.3
2/3	179	0.129	34.0	307.2	12.7
2/4	466	0.111	34.0	307.2	11.8
2/5	572	0.107	34.0	307.2	11.5
2/6	644	0.094	33.0	306.2	10.8
		0.001	00.0	000.2	10.0
			<u>9-111-111-1111-1111</u>		
			2005		
			<u></u>		
			1.1.1.1.1.1.1		
Aug2222			22.0	200.0	11.0
Average			33.6	306.8	11.9

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 5.5 mm 1010.54 hPa



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#### STACK ANALYSIS - FINAL CALCULATIONS

#### **Total Particulate**

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

Date: 6-Jan-16 AECOM's Project No:	60480321	Client: Stack/Duct	RivCott Description:	Feeder Du	st Round 2
(A) Sample gas volume at standard co	onditions				
Metered volume (MV <sub>3</sub> ): Average gas meter temp. $(T_{M2})$ :	0.5931 27.4	m³ ⁰C	Average barom pressure (P <sub>BARO</sub>	uetric o)	1010 hPa
	300.6	к	Average pressumeter (P <sub>M.2</sub> )	ure at	1010.00 hPa
Sample gas volume (MV <sub>4</sub> ); (0°C, dry gas, 1 atm pressure):	0.5373	m³			
<ul> <li>(B) Total Particulate concentration at a Blank thimble No.:</li> <li>Thimble No. used: T22</li> <li>Final Total Particulate Weight (Mp1):</li> <li>Total Particulate Concentration (C1):</li> </ul>	standard condi 0 0.00830	g =M <sub>p1</sub> /MV <sub>4</sub> =	Blank weight: Total Particulat	e Weight 0.015	g 0.0083 g g/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
$CO_2$ Basis 12 % Average $CO_2$ %:	0.0 %	;and C <sub>2</sub> =		15	mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
Therefore, C <sub>c</sub> :	= C <sub>a</sub> x 12/0	CO <sub>2</sub> % =	0.015	g/m <sup>3</sup> (0°C, pressure, 1	dry gas, 1atm 12% CO₂)
		;and C <sub>c1</sub> =	15	mg/m <sup>3</sup> (0°C pressure, 1	C, dry gas, 1atm 12% CO <sub>2</sub> )
O <sub>2</sub> Basis 7 %					
Average O <sub>2</sub> %: 2	0.9 %				
Therefore, $C_b$ : = $C_a \times (21 - C_b)$	· O <sub>2ref</sub> %)/(21 - C	D <sub>2mea</sub> %)	2.1	g/m <sup>3</sup> (0°C, 7%	dry gas, 1atm pressure, $O_2$ )
		;and C <sub>b1</sub> =	2100	mg/m <sup>3</sup> (0°0 7%	C, dry gas, 1atm pressure, O <sub>2</sub> )
(C) Moisture content Silica Gel Number: P8	*				
$V_v =$ 7.3 g (from label Volume of Water Vapour Condensed Volume of Water Vapour Condensed Therefore, $B_{ws} =$ (Vwc	$\begin{aligned} & (\nabla_{wc(std)}) = \\ & (\nabla_{wsg(std)}) = \\ & (\nabla_{wsg(std)} + \nabla_{wsg(std)} + \nabla_{$	0.0040 0.0097 )) n(std))	V <sub>w</sub> =	3	, mL (=grams) (recorded on Laboratory Form 108)
B <sub>ws</sub> = 2	2.49 %				


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#### **STACK ANALYSIS - FINAL CALCULATIONS CONTINUED** Total Particulate

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

(i) Initial gas density for sampling:

1.28 kg/m<sup>3</sup> (from Laboratory Form 107)

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

1.29 kg/m<sup>3</sup> (0°C, wet, 1 atm pressure) 1.29 kg/m<sup>3</sup> (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

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

1.148 kg/m<sup>3</sup> (stack conditions, wet)

11.79 m/s (stack conditions, wet)

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

11.72 m/s

11.86 m/s

N/A m/s

(E) Gas Velocities

ANZ

(i) Average of pre-sampling velocities:

(ii) Average of post-sampling velocities:

(iii) Average of while-sampling velocities:

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

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

Qstack =		Vs x A =		4.60 m <sup>3</sup> /s (stack conditions)		
Qstd =	Qstack x	<u>Ps</u> x	<u>(Tstd)</u> x	<u>(100 - B<sub>w</sub>)</u>		
		(Pstd)	(Ts)	100		

=

Qstd =  $4.0 \text{ m}^3/\text{s} (0^\circ \text{C}, \text{dry gas}, 1 \text{ atm pressure})$ 

(G) Mass Emission Rate

Rm =	C <sub>1a</sub> x Qstd =	0.06	g/s (0°C, dry gas, 1 atm pressure	)		
	=	60	mg/s (0°C, dry gas, 1 atm pressure	)		
	C <sub>1a</sub> x Qstd =	0.06	g/s (0°C, dry gas, 1 atm pressure		12%	$CO_2)$
	=	60	mg/s (0°C, dry gas, 1 atm pressure		12%	CO <sub>2</sub> )
	C <sub>1a</sub> x Qstd =	8.4	g/s (0°C, dry gas, 1 atm pressure		7%	O <sub>2</sub> )
	=	8400	mg/s (0°C, dry gas, 1 atm pressure		7%	O <sub>2</sub> )

## AECOM

## ANZ Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, FEEDER DUST ROUND 2 RIVCOTT 6-Jan-16						
	OTAL PARTICULATE					
Sampling Conditions:						
Stack internal diameter at test location		705 mm				
Stack gas temperature (average)		33.1 °C	306.3 K			
Stack pressure (average)		1011 hPa				
Stack gas velocity (average, stack conditions)		12 m/s				
Stack gas flowrate (stack conditions)		4.6 m <sup>3</sup> /s				
Stack gas flowrate (0°C, dry gas, 1 atm pressure	e)	4 m <sup>3</sup> /s				
Total Particulate Testing			×			
Test Period		10:49 -	11:51			
Total Particulate Mass		8.3 mg				
Gas Volume Sampled		0.537 m <sup>3</sup>				
Total Particulate Emission*1		15 mg/m <sup>3</sup>				
Total Particulate Mass Emission Rate*2		60 mg/s				
Regulatory Limit		50 mg/m <sup>3</sup>				
Moisture Content (%)		2.5				
Gas Density (dry at 1 atmosphere)		1.29 kg/m <sup>3</sup>				
Dry Molecular Weight		28.8 g/g-mole				

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

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

for each test.

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#### RivCott

AECOM's Project Number: 60480321

Emission Source: Feeder Dust Round 3

Date Sampled:

6-Jan-16

ANALYTE(S)

**Total Particulate** 

METHOD

NSW EPA TM - 15

Observations made during testing period:

Sampling Performed By:

James Lang

Dylan Turnbull

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

ATCO

Q4AN(EV)-332-FM31

#### **STACK ANALYSIS - PRE-SAMPLING**

Date:6-Jan-16Client:RivCottAECOM's Project No:60480321Stack/Duct Description:Feeder Dust Round 3Test 1:Total Particulate

		Measurement/Obser	rvations		
Stack Inter	nal Dimensions:				
Diameter	705	mm	Cross Sectional Area	: 0.39 m <sup>2</sup>	
OR	Length	Width			
Lenath/Wig	dth (mm)		Minimum No. of		
Equivalent	Diameter N/A	mm	sampling points=	12	
Distance fr	om sampling plane to		Total No. of sampling	points =	12
nearest dis	sturbances.			PM2 5/10=	NA
			No. of sampling trave	rees/ports	1.17.5
Unstroom	(m) = 5.5		compled -	1363/ponts	2
No Diama	(11) = 3.3		Sampleu –	DM2 5/10-	
No. Diame	iers – 7.0	David		PIVI2.5/10-	NA
Type of Up	istream Disturbance:	Bena	INO. OF Sampling points	s on each	
Downstrea	m(m) = 5.5		traverse/port =		6
No. Diame	ters = 7.8			PM2.5/10=	NA
Type of Do	wn Stream Disturbance:	Bend			
1 of 1 of 1			Exclusion of any sam	ple point	
Position of	each sampling point, for	each traverse:	numbers - comments:		
	А	В	PM10/2.5 A	PM2.5/10	)в
No	Distance from wall	S-type Pitot distances	Distance from wall	S-Type Pitot dis	stances
1	31	1			
2	103	73			
3	209	179			
4	496	466			
5	602	572			
6	674	644		14	
	0/4	044			
8					
9				I	
10			Check of total points	against	
11			minimum, (yes/no) - c	comments:	
12					
13					
14					
15			× ×		
16					
17				1	
18					
19			General Comments:		
20			1 //		
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Signed	LAN		Checked:		
			/ ~		

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



Q4AN(EV)-332-FM31

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

Date: 6-Jan-16 Client: **RivCott** AECOM's Project No: Stack/Duct Description: **Total Particulate** Test 1:

60480321 Feeder Dust Round 3

Sampling time start:	12:05	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (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	n 20.9 %	b 0.0 %
Moisture content (M3)	. 0.99			
Moisture percentage (	M2): 1.50	%		

Moisture percentage (M2):

#### Measurements

CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	
Gas Com	positions converted to wet basis:			
CO:	0.0000 %,(wet)	N <sub>2</sub> :	77.9 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	O <sub>2</sub> :	20.6 %,(wet)	
H <sub>2</sub> O:	1.50 %(=M2)			
Therefore	, stack gas density (GD) =	1.28 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore	, stack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	



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

Date:6-Jan-16Client:RivCottAECOM's Project No:Stack/Duct Description:Test 1:Total Particulate

60480321 Feeder Dust Round 3

Sampling time start:	0:00	Sampling port No.:	1	
Measurement No.	Time sampled	CO (ppm). (dry)	O <sub>2</sub> (%), (dry)	CO <sub>2</sub> (%), (dry)
1	0:00	0	20.9	0.0
2		0	20.9	0.0
3		0	20.9	0.0
4		0	20.9	0.0
5		0	20.9	0.0
6		0	20.9	0.0
7		0	20.9	0.0
8		0	20.9	0.0
	Averages:	0.0 ppm	20.9 %	<u>% 0.0 %</u>
Moisture content (M3):	0.97			
Moisture percentage (N	M2): 2.96	%	2 <sup>.00</sup>	

Measurements

CO:	0.0000 %,(dry)	N <sub>2</sub> :	79.1 %,(dry)	
CO <sub>2</sub> :	0.0 %,(dry)	O <sub>2</sub> :	20.9 %,(dry)	
Gas Com	positions converted to wet basis:			
CO:	0.0000 %,(wet)	N <sub>2</sub> :	76.8 %,(wet)	
CO <sub>2</sub> :	0.0 %,(wet)	O <sub>2</sub> :	20.3 %,(wet)	
H <sub>2</sub> O:	2.96 %(=M2)			
Therefore	, stack gas density (GD) =	1.27 kg/m <sup>3</sup>	(0°C, wet, 1 atm pressure)	
Therefore	, stack gas density (GD) =	1.29 kg/m <sup>3</sup>	(0°C, dry, 1 atm pressure)	1. 1.11110 - 1110



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

Date:6-Jan-16Client:RivCottAECOM's Project No:6044Stack/Duct Description:FeederTest 1:Total ParticulateFeeder

60480321 Feeder Dust Round 3

Time :	12:05	Barometric Pr	ressure :	1010	hPa
Page No. :	1 of 1	Pitot Correction Factor :		0.84	
Sampling Port No	1 to 2	Stack Gas De	ensity:	1 28	ka/m <sup>3</sup>
Pitot Tube Type :	5	Oldok Odo De	nony.	1.20	$(0^{\circ}C)$ (Met 1 Atm)
i not rube rype .	<u> </u>	Max			
	Distance	Differential			
Sampling Position	from far wall	Pressure	Max Temp.	Max Temp. (Ts)	Corrected Velocity
No.	(mm)	AD kilo	°C	К	(Vs) m/s
	((()))	Pascals			
1/1	1	0.098	33.0	306.2	11.0
1/2	73	0.000	33.0	306.2	12.6
1/3	179	0.134	33.0	306.2	12.9
1/4	466	0.106	34.0	307.2	11.5
1/5	572	0.101	34.0	307.2	11.2
1/6	644	0.073	34.0	307.2	9.5
2/1	1	0.146	33.0	306.2	13.5
2/2	73	0.141	34.0	307.2	13.2
2/3	179	0.129	34.0	307.2	12.7
2/4	466	0.111	34.0	307.2	11.7
2/5	572	0.107	34.0	307.2	11.5
2/6	644	0.094	33.0	306.2	10.8
		0.00 )			
					anto a la companya de
				1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	
		V			
				ц. (	
Average			33.6	306.8	11.8

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 5.5 mm 1010.54 hPa



#### STACK ANALYSIS

#### SAMPLING OF TOTAL PARTICULATE Date: 6-Jan-16

Date.	0 0011 10						
Client: R	ivCott						
AECOM's Proje	ect No:		60480321				
Stack Descripti	ion No.:	Feeder Dust I	Round 3				
Sample Nozzle	No.:	s2		Sample Nozzle Are	ea (An):	1.42	x 10 <sup>-5</sup> m <sup>2</sup>
Sampling Port	No.:	1 to 2		Thimble No:	. ,	N12	
Page No:		1 of 1		Blank thimble No:		0	
Leak Check (F	Pre-Sampling	g)		Leak Check (Pos	t Sampling	)	
Meter start:	388.2484	Meter finish:	388.2484	Meter start:	388.8756	Meter finish:	388.8756
Time start:	12:06	Time finish:	12:07	Time start:	13:12	Time finish:	13:13
Therefore, leak	age rate =	no leak	L/min	Therefore, leakage	e rate =	no leak	L/min
(>0.1 l/min. is u	unacceptable	:)		(>0.1 l/min. is una	cceptable)		
Repeat:				Repeat:			
Comments:				Comments:			

#### Sampling Record Table

Barometric Pressure:	1010 hPa (s	tart);	1010 hPa (finish)
Meter start:	388.2500	Time start:	12:08
Meter correction factor (GMf) :		1.0100	

	Stopwatch												
	Time at	Distance	Isokinetic			Impinger	Flowrate						
Sampling	Sampling	from far wall	Flowrate	Meter Inlet	Meter Outlet	Irain Outlet	Attained						
Position No.	Position	(mm)	(L/min)	Temp. (°C)	Temp. (°C)	Temp (°C)	(Y/N)						
1/1	0:05:00	31	9.2	30.0	29.0		Yes						
1/2	0:10:00	103	10.5	32.0	30.0		Yes						
1/3	0:15:00	209	10.7	33.0	30.0		Yes						
1/4	0:20:00	496	9.5	33.0	30.0		Yes						
1/5	0:25:00	602	9.3	34.0	31.0		Yes						
1/6	0:30:00	674	7.9	35.0	31.0		Yes						
2/1	0:35:00	31	11.2	35.0	32.0		Yes						
2/2	0:40:00	103	11.0	36.0	32.0		Yes						
2/3	0:45:00	209	10.5	36.0	32.0		Yes						
2/4	0:50:00	496	9.7	36.0	33.0		Yes						
2/5	0:55:00	602	9.5	36.0	33.0		Yes						
2/6	1:00:00	674	9.0	36.0	33.0		Yes						
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		+			+	<u> </u>							
Averages		+	<b> </b>	34 3	31 3	no result							
Motor	<u></u>	200 0700		Time Einich	1 51.5	10.40	L						
Total Conden	sate collected:	388.8722	ml	Silica gel No(s)	Meter Finish:     388.8722     Time Finish:     13:10       Total Condensate collected:     2 ml     Silica gel No(s) used:     P5								

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

Date:	6-Jan-	16
Client:	RivCott	
AECOM's Pro	ject No:	60480321
Stack/Duct De	escription:	Feeder Dust Round 3
Test 1:Total F	Particulate	

Time :	13:15	Barometric Pr	ressure :	1010	hPa
Page No. :	1 of 1	Pitot Correction Eactor		0.84	
Sampling Port No:	1 to 2	Stack Gas Dansity:		1 27	ka/m <sup>3</sup>
Ditet Tube Type :	6		lisity.	1.21	(0°C Wet 1 Atm)
Filot Tube Type .	3	Mox			
	Distance	Differential			
Sampling Position	from for well	Differential	Max Temp.	Max Temp. (Ts)	Corrected Velocity
No.	from lar wall	Pressure	°C	К	(Vs) m/s
	(mm)	ΔP, KIIO			
1/1		Pascals	24.0	207.0	11.0
1/1	72	0.103	34.0	307.2	11.3
1/2	170	0.129	34.0	307.2	12.7
1/3	179	0.129	34.0	307.2	12.7
1/4	400	0.113	35.0	308.2	11.9
1/5	572	0.111	35.0	308.2	11.8
1/6	644	0.080	35.0	308.2	10.0
0/4		0.400	04.0	007.0	40.0
2/1	1	0.132	34.0	307.2	12.9
2/2	73	0.136	34.0	307.2	13.1
2/3	179	0.137	34.0	307.2	13.1
2/4	466	0.119	34.0	307.2	12.2
2/5	572	0.113	35.0	308.2	11.9
2/6	644	0.104	35.0	308.2	11.4
	1				
				2	
			-		
					8
Average			34.4	307.6	12.1

Static Pressure (Dwyer) (Pa): Static Pressure (U-tube, if required) : Absolute pressure in stack (hPa) : kPa 0 mm 1010.00 hPa



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<b>STACK ANALYSIS - FINA</b>	<b>AL CALCULATIONS</b>
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#### Total Particulate (Calculations performed in accordance with relevant test method as defined on cover page)

Date: AECOM's Projec	6-Jan-16 ct No:	60480321	Client: Stack/Duct	RivCott Description:	Feeder Du	ist Round 3
(A) Sample gas	volume at standard	conditions				
Metered volume Average gas me	e (MV₃): eter temp. (T <sub>M,2</sub> ):	0.6284 32.8	m³ °C	Average baron pressure (P <sub>BAR</sub>	netric <sub>Ro</sub> )	1010 hPa
		306.0	к	Average press meter ( $P_{M,2}$ )	sure at	1010.00 hPa
Sample gas volu gas, 1 atm press	ume (MV <sub>4</sub> ); (0°C, dr sure):	y 0.5592	m <sup>3</sup>			
(B) Total Particu Blank thimble No Thimble No. use Final Total Parti Total Particulate	late concentration a o.: ed: N12 culate Weight (Mp1 e Concentration (C1	at standard condi 0 ): 0.00980 ):	g =M <sub>p1</sub> /MV <sub>4</sub> =	Blank weight: Total Particula	te Weight 0.018	g 0.0098 g 3 g/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
CO <sub>2</sub> Basis Average CO <sub>2</sub> %:	12 %	0.0 %	;and C <sub>2</sub> =		18	<sup>3</sup> mg/m <sup>3</sup> (0°C, dry gas, 1atm pressure)
Therefore, C <sub>c</sub> :		= C <sub>a</sub> x 12/0	CO <sub>2</sub> % =	0.018	3 g/m <sup>3</sup> (0°C, pressure,	dry gas, 1atm 12% CO <sub>2</sub> )
			;and C <sub>c1</sub> =	18	3 mg/m <sup>3</sup> (0 <sup>o</sup> pressure,	C, dry gas, 1atm 12% CO <sub>2</sub> )
O <sub>2</sub> Basis Average O <sub>2</sub> %:	7 %	20.9 %				
Therefore, $C_b$ :	=C <sub>a</sub> x (2	1 - O <sub>2ref</sub> %)/(21 - (	D <sub>2mea</sub> %)	2.5	5 g/m <sup>3</sup> (0°C, 7%	, dry gas, 1atm pressure, $O_2$ )
			;and C <sub>b1</sub> =	2500	0 mg/m <sup>3</sup> (0° 7%	C, dry gas, 1atm pressure, $O_2$ )
(C) Moisture con Silica Gel Numb $V_v =$ Volume of Wate Volume of Wate Therefore, B <sub>ws</sub> =	ntent ber: P5 10.8 g (from la er Vapour Condense er Vapour Condense = (V	aboratory report) ed $(V_{wc(std)}) =$ ed $(V_{wsg(std)}) =$ $(V_{wc(std)}+V_{wsg($	0:0027 0.0144 ((ر	V <sub>w</sub> =	2	2 mL (=grams) (recorded on Laboratory Form 108)

B<sub>ws</sub> = 2.96 %



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## **Emission Measurement Calculations Spreadsheet**

#### **STACK ANALYSIS - FINAL CALCULATIONS CONTINUED** Total Particulate

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

(i) Initial gas density for sampling:

1.28 kg/m<sup>3</sup> (from Laboratory Form 107)

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

1.29 kg/m<sup>3</sup> (0°C, wet, 1 atm pressure)

1.29 kg/m<sup>3</sup> (0°C, dry, 1 atm pressure)

(iii) Gas density at stack conditions =

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

1.144 kg/m<sup>3</sup> (stack conditions, wet)

11.96 m/s (stack conditions, wet)

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

11.84 m/s

12.08 m/s

N/A m/s

(E) Gas Velocities

ANZ

(i) Average of pre-sampling velocities:

(ii) Average of post-sampling velocities:

(iii) Average of while-sampling velocities:

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

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

4.0 m<sup>3</sup>/s (0°C, dry gas, 1 atm pressure)

Qstack =		Vs x A =		4.67 m <sup>3</sup> /s (stack conditions)	
Qstd =	Qstack x	<u>Ps</u> x	<u>(Tstd)</u> x	<u>(100 - B<sub>w</sub>)</u>	
		(Pstd)	(Ts)	100	

=

Qstd =

(G) Mass Emission Rate

Rm =	C <sub>1a</sub> x Qstd = =	0.072 72	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure	) )		3
	C <sub>1a</sub> x Qstd = =	0.072 72	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure		12% 12%	CO <sub>2</sub> ) CO <sub>2</sub> )
	C <sub>1a</sub> x Qstd = =	10 10000	g/s (0°C, dry gas, 1 atm pressure mg/s (0°C, dry gas, 1 atm pressure		7% 7%	O <sub>2</sub> ) O <sub>2</sub> )

## AECOM

## ANZ Emission Measurement Calculations Spreadsheet

Q4AN(EV)-332-FM31

EMISSION MONITORING RESULTS, RIVCOTT 6-Jan-16 TOTAL PARTICU	FEEDER DUST ROUND 3 LATE	
Sampling Conditions:		-
Stack internal diameter at test location	705 mm	
Stack gas temperature (average)	34.0 °C 307.2 K	
Stack pressure (average)	1010 hPa	
Stack gas velocity (average, stack conditions)	12 m/s	
Stack gas flowrate (stack conditions)	4.7 m <sup>3</sup> /s	
Stack gas flowrate (0 <sup>0</sup> C, dry gas, 1 atm pressure)	4 m <sup>3</sup> /s	
Total Particulate Testing		
Test Period	12:08 - 13:10	
Total Particulate Mass	9.8 mg	
Gas Volume Sampled	0.559 m <sup>3</sup>	
Total Particulate Emission*1	18 mg/m <sup>3</sup>	
Total Particulate Mass Emission Rate*2	72 mg/s	
Regulatory Limit	50 mg/m <sup>3</sup>	
Moisture Content (%)	3.0	
Gas Density (dry at 1 atmosphere)	1.29 kg/m <sup>3</sup>	
Dry Molecular Weight	28.8 g/g-mole	

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

\*2 Mass emission rate determined from pre and post test sampling flow measurements and the respective test moisture content. See Q<sub>std</sub> in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Appendix B

# Laboratory Analytical Reports (2 pages)

## Appendix B Laboratory Analytical Reports (2 pages)

# Steel River Testing

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

#### **STACK EMISSION - MOISTURE REPORT**

Description:Stack Emission Samples Received:Date:21-Jan-16Report To:Colin Clarke 17 Warabrook Blvd, Warabrook NSW 2304Copy to:FILEJar IDMoisture (g)F249.7F996.1FA79.8F005.319210.0K98.6M235.9P306.1P510.8P510.8P47.3P306.1P306.1P306.1P510.8P306.1P510.8P47.3P56.8P57.3P67.3P76.8P87.3P87.3P16.8	<u>Origin:</u> Project:	AECOM - Newcastle 60480321		Report :	10418-0-M	Page 1 of 1
Report To:Coin Clarke 17 Warabrook Blvd, Warabrook NSW 2304Copy to:FILEJar IDMoisture (g)F249.7F996.1FA79.8FA82.7G1005.319210.0K98.6M235.9P306.1P510.8P53.8P110.8P26.1P36.1P36.1P36.1P36.1P36.1P36.1P36.1P47.3P510.8P57.3P47.3P56.8P57.3P67.3P76.8	Description :	Stack Emission Samples Received: 11-Jan-16		Date :	21-Jan-16	
Jar ID       Moisture (g)         F24       9.7         F99       6.1         FA7       9.8         FA8       2.7         G100       5.3         I92       10.0         K9       8.6         M23       5.9         P30       6.1         P5       10.8         P8       7.3         Z11       6.8	<u>Report To :</u>	Colin Clarke 17 Warabrook Blvd, Warabro	ok NSW 2304	<u>Copy to:</u>	FILE	
F249.7F996.1FA79.8FA82.7G1005.3I9210.0K98.6M235.9P306.1P510.8P87.3Z116.8	Jar ID		Moisture (g)			
F996.1FA79.8FA82.7G1005.319210.0K98.6M235.9P306.1P510.8P87.3Z116.8	F24		9.7			
FA79.8FA82.7G1005.3I9210.0K98.6M235.9P306.1P510.8P87.3Z116.8	F99		6.1			
FA82.7G1005.3I9210.0K98.6M235.9P306.1P510.8P87.3Z116.8	FA7		9.8			
G1005.3I9210.0K98.6M235.9P306.1P510.8P87.3Z116.8	FA8		2.7			
19210.0K98.6M235.9P306.1P510.8P87.3Z116.8	G100		5.3			
K98.6M235.9P306.1P510.8P87.3Z116.8	192		10.0			
M23     5.9       P30     6.1       P5     10.8       P8     7.3       Z11     6.8	К9		8.6			
P30     6.1       P5     10.8       P8     7.3       Z11     6.8	M23		5.9			
P5     10.8       P8     7.3       Z11     6.8	P30		6.1			
P8 7.3 Z11 6.8	P5		10.8			
Z11 6.8	P8		7.3			
	Z11		6.8			



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V **Reported By:** 

leu 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

<u>Origin:</u> Project:	AECOM - Newcastle 60480321	Report :	10418-0-P	Page 1 of 1
Description :	Stack Emission Samples Received: 11-Jan-16	Date :	21-Jan-16	
<u>Report To :</u>	Colin Clarke 17 Warabrook Blvd, Warabrook NSW 2304	<u>Copy to:</u>	FILE	

Thimble ID		Volume (mL)	Total Particulate Matter (g)
N12	Thimble	-	0.0098
N4	Thimble	-	0.0107
N6	Thimble	-	0.0087
S36	Thimble	-	0.0215
T1	Thimble	-	0.0040
T11	Thimble	×	0.0064
T12	Thimble	-	0.0071
T15	Thimble	-	0.0173
T18	Thimble		0.0048
T22	Thimble	7 <del>-</del> 7	0.0083
T25	Thimble	-	0.0250
 Т9	Thimble	-	0.0037



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Note : Sampled by Client

. Canflett M Reported By:\_

Michael Campbell

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

#### AECOM

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