STACK EMISSIONS TESTING

Circular Plastics Australia,
Ettamogah, NSW, 2640

CPA Albury EPA Licence Compliance

PACT Recycling Joint Ventures

NATA
WORLD RECOGNISED
ACCREDITATION

Accredited for Compliance with ISO/IEC 17025 – Testing

Sampling Dates: 26 March 2024

Issued: 28 April 2024

Report: 247401.0031.R01.V01

DOCUMENT CONTROL

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Reference	Date	Description	Prepared	Checked
247401.0031.R01.V01_draft	19/04/2024	Internal Draft	Mitchell Steele	-
247401.0031.R01.V01	28/4/2024	Final	Mitchell Steele	Gary Hall

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NATA Accreditation Number: 15841
Accredited for compliance with ISO/IEC 17025 – Testing
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EXECUTIVE SUMMARY

PACT Recycling Joint Ventures commissioned Trinity Consultants to undertake monitoring of air emissions at their Ettamogah, NSW facility. Testing was completed to determine compliance with the Environmental Licence for the site (21519). Table 1 below provides a summary of the testing of emissions completed on 26 and 27 March 2024.

Table -1: Summary of Results

EPA No.	Site Description	Compound	Measured Value	Licence Limit	Units
5	Stack 5a (Boiler)	Total Solid Particles	0.3	50	mg/Nm^3
		Nitrogen Oxides (expressed as NO_2)	124	350	mg/Nm^3
		Carbon Monoxide	<1.3	125	mg/Nm^3
6	Stack 5b (Boiler)	Total Solid Particles	0.3	50	mg/Nm^3
		Nitrogen Oxides (expressed as NO_2)	118	350	mg/Nm^3
		Carbon Monoxide	3.3	125	mg/Nm^3
7	Stack 7a (Starlinger Flue gas)	Total Solid Particles	6.8	50	mg/Nm^3
		Total Organic compounds (VOC's) (as n-propane)	1.13	40	mg/Nm^3
8	Stack 7b (Starlinger Vacuum unit)	Total Solid Particles	1.6	50	mg/Nm^3
		Total Organic compounds (VOC's) (as n-propane)	1.9	40	mg/Nm^3
9	Stack 8a & b (Starlinger Gas Heater)	Total Solid Particles	[a]	50	mg/Nm^3
		Nitrogen Oxides (expressed as NO_2)	<0.21	350	mg/Nm^3
		Carbon Monoxide	<1.3	125	mg/Nm^3
10	Stack 8c (Starlinger Gas Heater)	Total Solid Particles	[a]	50	mg/Nm^3
		Nitrogen Oxides (expressed as NO_2)	<0.21	350	mg/Nm^3
		Carbon Monoxide	<1.3	125	mg/Nm^3

[a] No flow or emissions measured in the stack for EPA stack 9 and 10

1. INTRODUCTION

PACT Recycling Joint Ventures commissioned Trinity Consultants Australia Pty Ltd to conduct monitoring of air emissions from their Ettamogah, NSW Facility. Table 1-1 details the monitoring locations and the monitoring performed at each location. The monitoring was completed on 26 and 27 March 2024.

Table 1-1: Monitoring Locations and Parameters

Compound	Release Point					
	EPA 5	EPA 6	EPA 7	EPA 8	EPA 9	EPA 10
Velocity, Flowrate and Temperature	✓	✓	✓	✓	✓	✓
Oxygen and Carbon Dioxide	✓	✓	✓	✓	✓	✓
Moisture Content	✓	✓	✓	✓	✓	✓
Particulates	✓	✓	✓	✓	✓	✓
Oxides of Nitrogen (NO, NO_2, NO_x)	✓	✓	✓	✓	✓	✓
Carbon Monoxide	✓	✓	✓	✓	✓	✓
Volatile Organic Compounds (VOC)	-	-	✓	✓	-	-

The monitoring of air emissions at the Ettamogah Facility was completed during normal operating conditions. Any factors that may have affected the monitoring results were not observed by, or brought to the notice of Trinity Consultants Australia staff except where noted in this report.

Figure 1 – EPA 9 & EPA 7

Figure 2 – EPA 5 & EPA 6

Figure 3 – EPA 8 and EPA 10

2. METHODOLOGY

2.1 Emission Testing

Table 2-1 below lists the Methods used when undertaking emission monitoring at the Ettamogah Facility.

All air quality monitoring undertaken by Trinity Consultants Australia staff has been undertaken in accordance with the methods identified in Table 2-1 below unless as specified in Section 2.3.

Table 2-1: Summary of Emission Monitoring Methods

Measurement Parameter	Method Equivalency
Sampling Positions	**NSW EPA TM-1** (AS4323.1-2021 Selection of sampling positions and measurement of velocity in stacks)
Velocity, Flowrate and Temperature	**NSW EPA TM-2** (US EPA Method 2 Measurement of velocity in stacks)
Oxygen and Carbon Dioxide	**NSW EPA TM24 and 25** (USEPA Method 3a Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources)
Moisture Content	**NSW EPA TM-23** (USEPA Method 4 Determination of Moisture Content in Stack Gases)
Particulates	**NSW EPA TM-25** (AS4323.2-2021 Determination of Particulate Matter Emissions from Stationary Sources)
Oxides of Nitrogen (NO, NO_2, NO_x)	**NSW EPA TM-11** (USEPA Method 7E Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Carbon Monoxide (CO)	**NSW EPA TM-32** (USEPA Method 10 Determination of Carbon Monoxide Emissions from Stationary Sources)
Volatile Organic Compounds (VOC)	**NSW EPA TM-34** (USEPA Method 18 Measurement of Gaseous Organic Compounds) by Gas Chromatography)

2.2 Laboratory Analysis

Table 2-2 provides a list of the NATA accredited laboratories that performed the applicable analysis, NATA accreditation number, and report number.

Table 2-2: Table of NATA Accredited Laboratories with NATA Accreditation Number

Measurement Parameter	NATA Accreditation Number	Report Number
Volatile Organic Compounds (VOC)	National Measurement Institute- 198	**RN1425035**

2.3 Deviation from Methods

None.

2.4 Process Conditions

Sampling was conducted under normal process conditions. Sampling at each location was only conducted after the operator confirmed production was normal. Circular plastics retains their records of process conditions.

3. MONITORING RESULTS

3.1 Introduction

The following sections present a summary of results for each sampling location.

3.1.1 EPA 5

Results of emissions monitoring for Release Point EPA 5 are provided in Table 3-1 and Table 3-2 below for emissions monitoring completed on 27 March 2024.

Table 3-1: Flow and Sample Characteristics for Release Point EPA 5

Parameter	Monitoring Result	Units
Run Start Time	10:03	hh:mm
Run Stop Time	11:03	hh:mm
Meter Calibration Factor	1.021	-
Pitot Tube Coefficient	0.84	-
Nozzle Diameter	12.49	mm
Total Meter Volume	1.087	m^3
Average Meter Temperature	25	^oC
Average Stack Temperature	233	^oC
Barometric Pressure	746.16	mm Hg
Stack Static Pressure	-1.0	mm H_2O
Calculated Stack Moisture	14.4	%
Carbon Dioxide Percentage	8.39	%
Oxygen Percentage	5.46	%
Dry Gas Molecular Weight	29.56	g/g-mole
Wet Stack Gas Molecular Weight	27.90	g/g-mole
Average Stack Gas Velocity	4.8	m/s
Stack Diameter	0.250	m
Actual Stack Flow Rate	14	m^3/min
Dry Standard Stack Flow Rate	6.4	Nm^3/min
Percent of Isokinetic Rate	104.9	%

Table 3-2: Emissions Monitoring Results for Release Point EPA 5

Compound	Emission Concentration (mg/Nm^3)	Emission Rate (g/min)	Emission Rate (g/s)
Particulates	0.3	0.002	0.00003
NO_x (expressed as NO_2)	124	0.788	0.0131
Carbon Monoxide	<1.3	<0.008	<0.00013

3.1.2 EPA 6

Results of emissions monitoring for Release Point EPA 6 are provided in Table 3-3 and Table 3-4 below for emissions monitoring completed on 27 March 2024.

Table 3-3: Flow and Sample Characteristics for Release Point EPA 6

Parameter	Monitoring Result	Units
Run Start Time	07:40	hh:mm
Run Stop Time	08:40	hh:mm
Meter Calibration Factor	1.021	-
Pitot Tube Coefficient	0.84	-
Nozzle Diameter	12.49	mm
Total Meter Volume	1.069	m^3
Average Meter Temperature	19	^oC
Average Stack Temperature	211	^oC
Barometric Pressure	746.16	mm Hg
Stack Static Pressure	-1.0	mm H_2O
Calculated Stack Moisture	13.9	%
Carbon Dioxide Percentage	7.92	%
Oxygen Percentage	6.37	%
Dry Gas Molecular Weight	29.52	g/g-mole
Wet Stack Gas Molecular Weight	27.92	g/g-mole
Average Stack Gas Velocity	4.5	m/s
Stack Diameter	0.250	m
Actual Stack Flow Rate	13	m^3/min
Dry Standard Stack Flow Rate	6.4	Nm^3/min
Percent of Isokinetic Rate	105.6	%

Table 3-4: Emissions Monitoring Results for Release Point EPA 6

Compound	Emission Concentration (mg/Nm^3)	Emission Rate (g/min)	Emission Rate (g/s)
Particulates	0.3	0.002	0.00003
NO_x (expressed as NO_2)	118	0.749	0.0125
Carbon Monoxide	3.3	0.021	0.00035

3.1.3 EPA 7

Results of emissions monitoring for Release Point EPA 7 are provided in Table 3-5 and Table 3-6 below for emissions monitoring completed on 26 March 2024.

Table 3-5: Flow and Sample Characteristics for Release Point EPA 7

Parameter	Monitoring Result	Units
Run Start Time	10:00	hh:mm
Run Stop Time	11:04	hh:mm
Meter Calibration Factor	1.021	-
Pitot Tube Coefficient	0.84	-
Nozzle Diameter	9.24	mm
Total Meter Volume	1.589	m^3
Average Meter Temperature	25	^oC
Average Stack Temperature	137	^oC
Barometric Pressure	744.06	mm Hg
Stack Static Pressure	-4.3	mm H_2O
Calculated Stack Moisture	1.2	%
Carbon Dioxide Percentage	0.00	%
Oxygen Percentage	21.05	%
Dry Gas Molecular Weight	28.84	g/g-mole
Wet Stack Gas Molecular Weight	28.71	g/g-mole
Average Stack Gas Velocity	8.9	m/s
Stack Diameter	0.500	m
Actual Stack Flow Rate	110	m^3/min
Dry Standard Stack Flow Rate	67.65	Nm^3/min
Percent of Isokinetic Rate	99.0	%

Table 3-6: Emissions Monitoring Results for Release Point EPA 7

Compound	Emission Concentration (mg/Nm^3)	Emission Rate (g/min)	Emission Rate (g/s)
Particulates	6.8	0.46	0.0076
Volatile Organic Compounds (as n-propane)	1.13	0.076	0.0013

3.1.4 EPA 8

Results of emissions monitoring for Release Point EPA 8 are provided in Table 3-7 and Table 3-8 below for emissions monitoring completed on 26 March 2024.

Table 3-7: Flow and Sample Characteristics for Release Point EPA 8

Parameter	Monitoring Result	Units
Run Start Time	11:32	hh:mm
Run Stop Time	12:32	hh:mm
Meter Calibration Factor	1.021	-
Pitot Tube Coefficient	0.84	-
Nozzle Diameter	14.29	mm
Total Meter Volume	1.155	m^3
Average Meter Temperature	39	^oC
Average Stack Temperature	38	^oC
Barometric Pressure	744.06	mm Hg
Stack Static Pressure	0.1	mm H_2O
Calculated Stack Moisture	0.7	%
Carbon Dioxide Percentage	0.02	%
Oxygen Percentage	20.99	%
Dry Gas Molecular Weight	28.84	g/g-mole
Wet Stack Gas Molecular Weight	28.76	g/g-mole
Average Stack Gas Velocity	1.9	m/s
Stack Diameter	0.100	m
Actual Stack Flow Rate	0.91	m^3/min
Dry Standard Stack Flow Rate	0.78	Nm^3/min
Percent of Isokinetic Rate	99.6	%

Table 3-8: Emissions Monitoring Results for Release Point EPA 8

Compound	Emission Concentration (mg/Nm^3)	Emission Rate (g/min)	Emission Rate (g/s)
Particulates	1.6	0.0012	0.000021
Volatile Organic Compounds (as n-propane)	1.9	0.0015	0.000025

3.1.5 EPA 9

Results of emissions monitoring for Release Point EPA 9 are provided in Table 3-9 and Table 3-10 below for emissions monitoring completed on 26 March 2024. No flow or emissions were measured for stack 9.

Table 3-9: Flow and Sample Characteristics for Release Point EPA 9

Parameter	Monitoring Result	Units
Run Start Time	[a]	hh:mm
Run Stop Time	[a]	hh:mm
Meter Calibration Factor	[a]	-
Pitot Tube Coefficient	[a]	-
Total Meter Volume	[a]	m^3
Average Meter Temperature	[a]	^oC
Average Stack Temperature	35	^oC
Barometric Pressure	744.06	mm Hg
Stack Static Pressure	[a]	mm H_2O
Calculated Stack Moisture	[a]	%
Carbon Dioxide Percentage	0.01	%
Oxygen Percentage	20.95	%
Dry Gas Molecular Weight	28.84	g/g-mole
Wet Stack Gas Molecular Weight	[a]	g/g-mole
Average Stack Gas Velocity	[a]	m/s
Stack Diameter	0.5	m
Actual Stack Flow Rate	[a]	m^3/min
Dry Standard Stack Flow Rate	[a]	Nm^3/min
Percent of Isokinetic Rate	-	%

Table 3-10: Emissions Monitoring Results for Release Point EPA 9

Compound	Emission Concentration (mg/Nm^3)	Emission Rate (g/min)	Emission Rate (g/s)
Particulates	- [a]	- [a]	- [a]
NO_x (expressed as NO_2)	<0.21	- [a]	- [a]
Carbon monoxide	<1.3	- [a]	- [a]

[a] No flow or emissions measured in the stack for EPA stack 9

3.1.6 EPA 10

Results of emissions monitoring for Release Point EPA 10 are provided in Table 3-11 and Table 3-12 below for emissions monitoring completed on 26 March 2024. No flow or emissions were measured for stack 10.

Table 3-11: Flow and Sample Characteristics for Release Point EPA 10

Parameter	Monitoring Result	Units
Run Start Time	[a]	hh:mm
Run Stop Time	[a]	hh:mm
Meter Calibration Factor	[a]	-
Pitot Tube Coefficient	[a]	-
Total Meter Volume	[a]	m^3
Average Meter Temperature	[a]	^oC
Average Stack Temperature	39	^oC
Barometric Pressure	744.06	mm Hg
Stack Static Pressure	[a]	mm H_2O
Calculated Stack Moisture	[a]	%
Carbon Dioxide Percentage	0.00	%
Oxygen Percentage	21.00	%
Dry Gas Molecular Weight	28.84	g/g-mole
Wet Stack Gas Molecular Weight	[a]	g/g-mole
Average Stack Gas Velocity	[a]	m/s
Stack Diameter	0.25	m
Actual Stack Flow Rate	[a]	m^3/min
Dry Standard Stack Flow Rate	[a]	Nm^3/min
Percent of Isokinetic Rate	-	%

Table 3-12: Emissions Monitoring Results for Release Point EPA 10

Compound	Emission Concentration (mg/Nm^3)	Emission Rate (g/min)	Emission Rate (g/s)
Particulates	- [a]	- [a]	- [a]
NO_x (expressed as NO_2)	<0.21	- [a]	- [a]
Carbon Monoxide	<1.3	- [a]	- [a]

3.2 Accuracy of Monitoring Results

Tables 3-13 to 3-18 present a summary of the estimated method uncertainties for each of the monitoring parameters and location.

Table 3-13: Estimated Method Uncertainties for Release Point EPA 5

Measurement Parameter	Method	% Uncertainty	Uncertainty	Units
Oxygen	USEPA Method 3A	2.00%	0.11	%
Carbon Dioxide	USEPA Method 3A	2.00%	0.17	%
Oxides of Nitrogen (NO, NO_2, NO_x)	USEPA Method 7E	2.00%	2.47	ppm
Carbon Monoxide	USEPA Method 10	-	2.47	ppm
Particulates	AS 4323.2	-	0.73	mg/Nm^3

Table 3-14: Estimated Method Uncertainties for Release Point EPA 6

Measurement Parameter	Method	% Uncertainty	Uncertainty	Units
Oxygen	USEPA Method 3A	2.00%	0.13	%
Carbon Dioxide	USEPA Method 3A	2.00%	0.16	%
Oxides of Nitrogen (NO, NO_2, NO_x)	USEPA Method 7E	2.00%	2.35	ppm
Carbon Monoxide	USEPA Method 10	-	0.77	ppm
Particulates	AS 4323.2	-	0.73	mg/Nm^3

Table 3-15: Estimated Method Uncertainties for Release Point EPA 7

Measurement Parameter	Method	% Uncertainty	Uncertainty	Units
Oxygen	USEPA Method 3A	2.00%	0.42	%
Carbon Dioxide	USEPA Method 3A	2.00%	-	%
Particulates	AS 4323.2	-	0.60	mg/Nm^3
VOC's	USEPA 18	-	0.81	mg/Nm^3

Table 3-16: Estimated Method Uncertainties for Release Point EPA 8

Measurement Parameter	Method	% Uncertainty	Uncertainty	Units
Oxygen	USEPA Method 3A	2.00%	0.42	%
Carbon Dioxide	USEPA Method 3A	2.00%	1.31	%
Particulates	AS 4323.2	-	0.73	mg/Nm^3
VOC's	USEPA 18	-	0.89	mg/Nm^3

Table 3-17: Estimated Method Uncertainties for Release Point EPA 9

Measurement Parameter	Method	% Uncertainty	Uncertainty	Units
Oxygen	USEPA Method 3A	2.00%	0.42	%
Carbon Dioxide	USEPA Method 3A	2.00%	2.27	%
Oxides of Nitrogen (NO, NO_2, NO_x)	USEPA Method 7E	-	-	ppm
Carbon Monoxide	USEPA Method 10	-	-	ppm

Table 3-18: Estimated Method Uncertainties for Release Point EPA 10

Measurement Parameter	Method	% Uncertainty	Uncertainty	Units
Oxygen	USEPA Method 3A	2.00%	0.42	%
Carbon Dioxide	USEPA Method 3A	2.00%	2.09	%
Oxides of Nitrogen (NO, NO_2, NO_x)	USEPA Method 7E	-	-	ppm
Carbon Monoxide	USEPA Method 10	-	-	ppm

APPENDIX A GLOSSARY

Parameter or Term	Description
<	The analytes tested for was not detected, the value stated is the reportable limit of detection
µg	Micrograms (10^{-6}grams)
AS	Australian Standard
dscm	dry standard cubic meters (at 0°C and 1 atmosphere)
g	grams
kg	kilograms
m	metres
m^3	Cubic Metres, actual gas volume in cubic metres as measured.
mg	Milligrams
min	Minute
mg/m^3	Milligrams (10^{-3}) per cubic metre.
mmH_2O	Millimetres of water
Mole	The mole, symbol mol, is the SI unit of amount of substance. One mole contains exactly 6.022 140 76 x 10^{23} elementary entities. This number is the fixed numerical value of the Avogadro constant, N_A, when expressed in the unit mol^{-1} and is called the Avogadro number. The amount of substance, symbol n, of a system is a measure of the number of specified elementary entities. An elementary entity may be an atom, a molecule, an ion, an electron, any other particle or specified group of particles. This definition implies the exact relation N_A = 6.022 140 76 x 10^{23} mol^{-1}. Inverting this relation gives an exact expression for the mole in terms of the defining constant N_A: $1\ \text{mol} = \left(\frac{6.022\,140\,76 \times 10^{23}}{N_A} \right)$ The effect of this definition is that the mole is the amount of substance of a system that contains 6.022 140 76 x 10^{23}specified elementary entities.
N/A	Not Applicable
ng	Nanograms (10^{-9} grams)
Nm^3	Normalised Cubic Metres - Gas volume in dry cubic metres at standard temperature and pressure (0°C and 101.3 kPa).
ou	Odour Units
°C	Degrees Celsius
$µg/m^3$	Micrograms (10^{-6}) per cubic metre. Conversions from $µg/m^3$ to parts per volume concentrations (ie, ppb) are calculated at 25 °c.
ppb / ppm	Parts per billion / million.
PM	Particulate Matter.
PM_{10}, $PM_{2.5}$, PM_1	Fine particulate matter with an equivalent aerodynamic diameter of less than 10, 2.5 or 1 micrometres respectively. Fine particulates are predominantly sourced from combustion processes. Vehicle emissions are a key source in urban environments.
sec	Second
Sm^3	Standardised Cubic Metres - Gas volume in dry cubic metres at standard temperature and pressure (0°C and 101.3 kPa) and corrected to a standardised value (e.g. 7% O_2).
STP	Standard Temperature and Pressure (0°C and 101.3 kPa).
TVOC	Total Volatile Organic Compounds. These compounds can be both toxic and odorous.
USEPA	United States Environmental Protection Agency

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