SOURCE EMISSIONS MONITORING – LION CO TOOHEYS

Project ID: 14882

25/05/2023

Release: R0

Prepared For:
LION Co- Tooheys Lidcombe

Assured Environmental

DOCUMENT CONTROL PAGE

Project Title: Source Emissions Monitoring – Lion Co - Tooheys

Project Reference ID: 14882

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Table 1: History of Revisions

Revision	Date	Issued to	Changes
R0	25/05/2023	Jason Lee	Initial Release

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ACCREDITED FOR COMPLIANCE TO ISO/IEC 17025

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EXECUTIVE SUMMARY

Assured Environmental (AE) conducted emissions monitoring at the LION Co- Tooheys facility located at Lidcombe, NSW. The emissions monitoring completed on the stack release point was undertaken to determine the concentration and mass emission rate of the parameters listed in Table 2 below. All testing was conducted on the 2nd of May 2023 in accordance with New South Wales Environmental Protection Licence (Licence number – 1167) during normal operating conditions.

Table 2: Summary of Emissions

Release Point Parameter	Unit of Measure		Stack result	License Limit
Site	-		Tooheys	
Sample location	-		Lidcombe	
Run ID	-		1	
Test parameter	-		VOCs	
Date of testing	dd-mm-yyyy		2/05/2023	
Time of test	hh:mm		9:05	
Average stack temperature	K		480	
Average stack temperature	°C		207	
Atmospheric Pressure	kPa		102	
Absolute stack pressure	mbar		1014	
Average stack gas water vapour content	%-vol		8.20	
Average carbon dioxide content	%-vol		5.69	
Average oxygen content	%-vol		10.2	
Dry gas density	kg/Nm^3		1.31	
Dry gas molecular weight	g/gmole		29.3	
Sample volume (dry gas meter)	Nm^3		0.03	
Exhaust Velocity	m/sec		21.3	
Actual stack volume flow	m^3/min		231	
Dry standard stack flow rate	Nm^3/min		121	
Actual stack volume flow	m^3/sec		3.85	
Dry standard stack flow rate	Nm^3/sec		2.01	
Pre leak test	m^3/min @ kPA		0 @ na	
Post Leak Test	m^3/min @ kPA		0 @ na	
Oxides of nitrogen (NO_2)	mg/Nm^3		158	
NOx Concentration at 5 % O2	mg/Nm^3		235	250
Emission rate	g/sec		0.318	
Carbon monoxide	mg/Nm^3		551	
CO Concentration at 5 % O2	mg/Nm^3		817	
Emission rate	g/sec		1.11	
TVOC (as propane)	mg/Nm^3	<	0.911	
TVOC Concentration at 5 % O2	mg/Nm^3	<	1.35	40
Emission rate	g/sec	<	0.002	

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1 INTRODUCTION

Assured Environmental (AE) was appointed by LION Co- Tooheys to sample and analyse source emissions from their facility located in Lidcombe, NSW. Sampling was conducted by AE during day shift operations on the 2nd of March 2023. The plant was considered to be operating at typical capacity at the time of sampling.

AE was responsible for the collection and analysis of samples, unless otherwise indicated. The samples were recovered and stored in the appropriate manner until their return to the laboratory where the samples were prepared and analysed according to the methodologies listed in this report.

2 METHODOLGY & EQUIPMENT

2.1 Sampling Methodology

All sampling and analysis were carried out in accordance with the listed requirements in Table 3. Any sample specific comments in relation to the application of these methods on this project have been documented. The results presented in this report are related to one or more reference calibrations held by AE.

Table 3: Scope, Test Methods & Accreditation

Parameter	Method	NATA	COMMENTS	ITEMS
Sample plane criteria	AS4323.1	Yes	A	1
Gas velocity, temperature & flow rate	USEPA Method 2	Yes	Nil	1
Stack gas density	USEPA Method 3	Yes	Nil	1
Oxygen & carbon dioxide	USEPA Method 3A	Yes	B	1
Stack gas water vapour content	USEPA Method 4	Yes	Nil	1
Oxides of nitrogen – as NO2	USEPA Method 7E	Yes	B	1
Carbon monoxide	USEPA Method 10	Yes	B	1
Total VOC's	USEPA Method 18	Yes	C	1

Table 4: Sampling Notes

Note	Comment
A	Sample location is compliant as per AS4323.1. The temperature and velocity survey showed that the sample position complied to items (a) to (f) as per AS4323.1.
B	Analyser calibration performed in the AE laboratory prior to conducting field work and post field work.
C	Total VOCs was be analysed from a Carbon tube.

Table 5: Analysis By

Note	Company	Work performed	NATA ID	Report Number
1	AE	Sampling & Analysis	19703	14882
2	ELS	Analysis	2901	322442-[R00]

2.2 Sample Locations

Table 6 provides a description of each of the sampling points utilised for the sampling program. For each sampling point, an assessment of compliance against the requirements of AS4323.1:2021 was undertaken. Based on this analysis, and in accordance with the requirements of the standard, sampling locations are identified as either ideal, non-ideal or non-conforming. Where a sampling plane is identified as non-ideal or non-conforming, no alternative ideal sampling planes representative of the source were available at the facility.

Table 6: Assessment of Compliance with AS4323.1

AS4323.1	Sample location	Lidcombe
	Description	Cogen
	Stack coordinates	UTM 56s:
	Easting	319069.25 m E
	Southing	6252742.34 m S
	Stack Exit point from ground (m)	15
	Stack Shape	CIRCULAR
	Ideal Sampling Plane Assessment	
	Stack Diameter (m)	0.48
	Stack Cross Section Area (m2)	0.18
	Distance to upstream disturbance (m) (from disturbance)	1.40
	Upstream Diameters (D)	2.92
	Distance to downstream disturbance (m) (from disturbance)	1.90
	Downstream diameters (D)	3.96
4.2.2 Table 1	Meets Requirements AS4323.1 Table 1	No
	Non- Ideal Sampling Plane Assessment	
	Assessment required?	No
	Total traverse point factors	1.1
	Non-conforming Sampling Plane Assessment	
4.2.2(a)	Gas flow in same direction	Yes
4.2.2(b)	Gas flow steady & evenly distributed (cyclonic or swirl <15°)	Yes
4.2.2(c)	Temperature difference between points <10%, and each point <10% of average	Yes
4.2.2(d)	Ratio of highest to lowest differential pressure & ratio highest to lowest velocity	1.2 1.1
4.2.2(e)	Minimum differential pressure	21.09
	Gas temperature above dewpoint	Yes
	Sampling Plane Type	
4.2.2, 4.2.3, 4.2.4	Sampling plane type	Non-ideal
	Alternative sampling plane available?	No
	Number of Sample Points Adopted	
	Port size (mm)	110
	Port Thread Type	Flange
	Number of traverses	2
	Number of points per traverse	6
	Total number of traverse points	12
	Flow & temperature compliance check	Yes

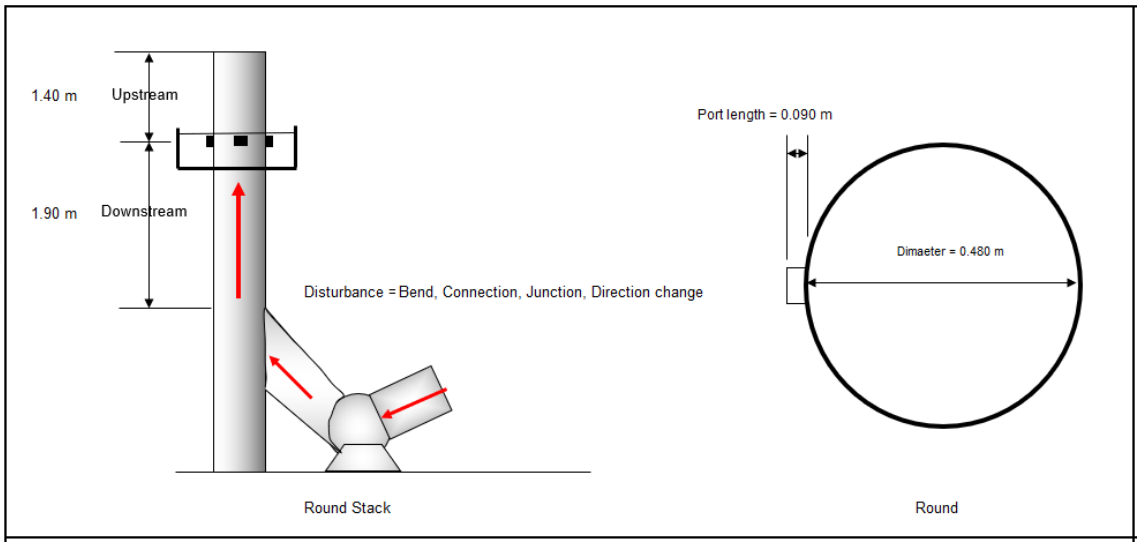

Figure 1: Schematic of sampling location.

Figure 2: Sample Location

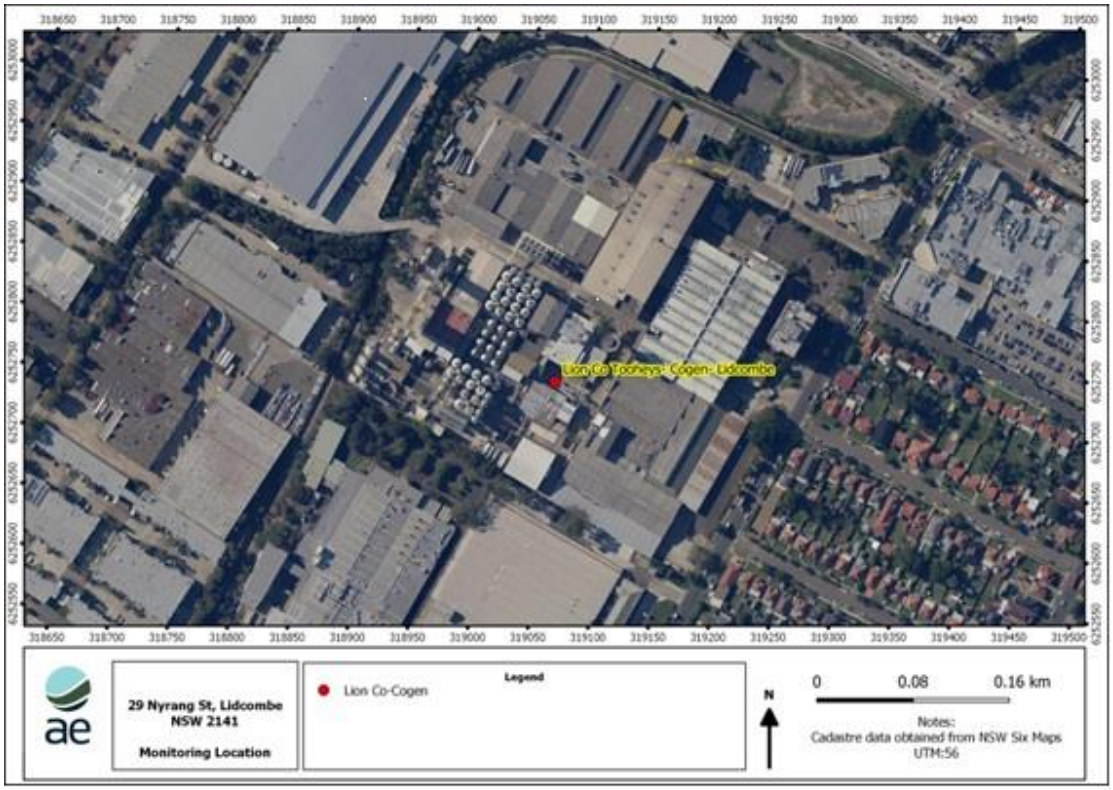

Figure 3: Site Location

2.3 Plant Operational Data

Table 7 below summarises the plant operation data at the time of sampling. All process conditions were provided by client to AE.

Table 7: Production Details

Item	Baghouse
Address	29 Nyrang St, Lidcombe NSW 2141
Production rate	See below production details- Appendix A

2.4 Measurement Uncertainty

There is an inherent uncertainty associated with any scientific measurement, including stack emissions monitoring. The measurement uncertainty can be controlled with strict adherence to the reference methodology along with utilising appropriate calibration standards with corresponding acceptable uncertainty reports.

Many source sampling methods do not outline exact procedures for establishing direct measurement uncertainty. In the absence of a defined procedure, the uncertainty budgets presented are based on estimations using ISO-GUM method.

Each individual source and test may have a unique associated uncertainty assigned, due to factors such as the stack sample location in relation to the positioning requirements of AS4323.1, stack temperature, water vapour content and sample analysis.

The table below outlines the estimated uncertainties associate with reports presented within this report.

Table 8: Sample Uncertainty

Parameter	Reference method	Uncertainty ± %	Coverage factor	Confidence coefficient %
Velocity	USEPA Method 2	6.6	2	95
Temperature	USEPA Method 2	3.0	2	95
Moisture content	USEPA Method 4	5.0	2	95
Oxygen	USEPA Method 3A	6.0	2	95
Particulate matter	AS 4323.2	20	2	95
Combustion gases	USEPA Method 6C, 7E & 10	9.0	2	95
VOC's	USEPA Method 18	20	2	95

2.5 Calibration Records

The sampling equipment was transported to site using AE's mobile lab and freight contractors. Prior to commencement of sampling, the mobile laboratory was set up at the base of the stack and used as a temporary site office and laboratory whilst on site. Sampling consoles, analysers, calibration gases and sample recovery equipment were set up with umbilical's connecting these sampling consoles to the probes and impingers in accordance with the methods.

All equipment used in the sampling program was calibrated in accordance with AE's NATA accredited procedures. Table 9 presents a summary of the calibration status of each of the key equipment used in the sampling program.

Table 9: Calibration Records

Equipment	Description	Equipment ID	Calibration Due Date	Calibration Information
Pitot	PN524	PN52	20/12/2023	-
Nozzle	SN730	SN730	09/11/2023	-
Gas Analyser	SN830	SN830	01/11/2023	-
Thermocouple	TN107	TN107	10/08/2023	-
SKC Pump	SN941	SN941	30/05/2023	

3 MONITORING RESULTS

Table 10: Results

Source Data	Stack SDS version - 3.49		
Client			Lion Co
Site			Tooheys
Sample Point			Lidcombe
Reference Method			USEPA M18 - CONSTANT FLOW
Test Parameters			VOCs
Process conditions			Normal
Historical Data & Hardware Information - Manual Sample			
Run Start Date		dd-mm-yyyy	2/05/2023
Project ID			14882
Run ID			-1
Run Start Time	Ti	hh:mm	9:05
Run Stop Time	Tf	hh:mm	10:05
Positioning compliance check with AS4323.1			Non-ideal
Flow & temperature compliance check with AS4323.1			Yes
Traverse pt factors; up, down, total & trav pts			1.1 , 1 , 1.1 , 12
Console Serial Number			SN941
Meter Calibration Factor	(Y)		1.0
Orifice Coefficient		(DH@)	N/A
Pitot Tube Coefficient	(Cp)		0.84
Actual Nozzle Diameter	(Dna)	mm	N/A
Stack Test Data			
Initial Meter Volume	(Vm)i	m^3	0.0000
Final Meter Volume	(Vm)f	m^3	0.0300
Actual Sampling Time	(Q)	minutes	60
Average Meter Temperature	(tm)avg	°C	19.61
Average Stack Temperature	(ts)avg	°C	207.5
Barometric Pressure	(Pb)	mb	1016
Stack Static Pressure	(Pstatic)	mm H2O	-15.26
Absolute Stack Pressure	(Ps)	mb	1014
Sample Volumes			
Actual Meter Volume	(Vm)	m^3	0.0300
Standard Meter Volume	(Vm)std	Nm^3	0.0281
Moisture Content Data			
Water vapour concentration	(Bws(calc))	%	8.20
Stack Gas Density Analysis Data			
Carbon Dioxide Percentage	(%CO2)	%	5.69
Oxygen Percentage	(%O2)	%	10.18
Carbon Monoxide Percentage	(%CO)	%	0.04
Nitrogen Percentage	(%N2)	%	84.09
Dry Gas Molecular Weight	(Md)	kg/Nm^3	1.31
Dry Gas Molecular Weight	(Md)	g/g-mole	29.32
Wet Stack Gas Molecular Weight	(Ms)	g/g-mole	28.39
Volumetric Flow Rate Data (at Sample Plane)			
Average Stack Gas Velocity	(vs)	m/sec	21.26
Stack Diameter	Ds	m	0.48
Stack Cross-Sectional Area	(As)	m^2	0.181
Upstream distance (from disturbance)	B	m	1.40
Downstream distance (from disturbance)	A	m	1.90
Actual Stack Flow Rate	(Qaw)	m^3/min	231
Wet Standard Stack Flow Rate	(Qsw)	$Nm^3/min\text{-}wet$	131
Dry Standard Stack Flow Rate	(Qsd)	$Nm^3/min\text{-}dry$	120.6
Percent of Isokinetic Rate	(I)	%	N/A
Instrumental Analyser - Historical Data & Hardware Information			
Analyser serial number, make & model		value	SN830
Analyser Run Start Time	Ti	hh:mm	0.527
Analyser Run Stop Time	Tf	hh:mm	0.574
Analyser Total Sampling Time	(Q)	hh:min	0.047
Instrumental Analyser Raw Data Averages			
Oxides of Nitrogen	(NOx)	ppm	77.1
Average Oxides of Nitrogen (USEPA Method 7E - instrumental analyser)			
Nitrogen Oxides (NOx as NO2)	(Conc)	mg/Nm^3	158
Nitrogen Oxides at 5 % O2	(Conc)	mg/Nm^3	235
Nitrogen Oxides (NOx as NO2)	(E)	g/min	19.1
TVOC			
TVOC at 5 % O2	(Conc)	mg/Nm^3	< 1.35
TVOC emission rate	(E)	g/min	< 0.11

4 QUALITY ASSURANCE & QUALITY CONTROL (QA/QC)

Assured Environmental operates within a quality system based upon the requirements of ISO17025.Our quality system defines specific procedures and methodologies to ensure any project undertaken by Assured Environmental is conducted with the highest level of quality given the specific confines of each project. The overall objective of our QA/QC procedures is to representatively sample and accurately analyse components in the gas streams and therefore report valid measurements of emission concentrations.

To ensure representativeness of field work, our quality procedures target:

1. Correct sampling locations
2. Sample time
3. Frequency of samples and
4. Method selection & adherence

To ensure representativeness of lab work, our quality procedures target:

1. Sample preservation
2. Chain of custody (COC)
3. Sample preparation and
4. Analytical techniques

Assured Environmental maintains strict quality assurance throughout all its sampling programs, covering on-site 'field work' and the analytical phase of our projects. Our QA program covers the calibration of all sampling and analytical apparatus where applicable and the use of spikes, replicate sample and reference standards. The test methodologies used for this project are outlined in the methods section of this document. Field test data has been recorded and calculated using direct entry into Microsoft Excel spreadsheets following the procedures of the appropriate test methods. Determination of emission concentrations has been performed using the same Microsoft Excel spreadsheets which are partially supplied as an attachment to this report. More detailed information can be supplied upon request.

QA/QC checks for this project will use validation techniques and criteria appropriate to the type of data and the purpose of the measurement to approve the test report. Records of all data will be maintained. Complete chain of custody (COC) procedures has been followed to document the entire custodial history of each sample. The COC forms also served as a laboratory sheet detailing sample ID and analysis requirements.

Table 11: Sampling data QA/QC checklist

Sampling Data QA/QC Checklist	Comment
Use of appropriate test methods	Yes
'Normal' operation of the process being tested, as instructed by the client	Yes
Use of properly operating and calibrated test equipment	Yes
Use of high purity reagents	Yes
Performance of leak checks post sample (at least)	Yes

Table 12: Laboratory data QA/QC checklist

Laboratory Data QA/QC Checklist	Comment
Use of appropriate analytical methods	Yes
Use of properly operating and calibrated analytical equipment	Yes
Precision and accuracy comparable to that achieved in similar projects	Yes
Accurate reporting	Yes

5 GLOSSARY OF TERMS

The following terms and abbreviations may be used in this report:

Table 13: Abbreviations & Definitions

Abbreviation	Definition
%v/v	percent volume to volume ratio
<	The analytes tested for was not detected; the value stated is the reportable limit of detection
AE	Assured Environmental
Am^3	Gas volume in cubic metres at measured conditions
AS	Australian Standard
BH	Back half of sample train (filter holder and impingers) (referred to during sample recovery)
CARB	California Air Resources Board methods
CEMS	Continuous Emission Monitoring System
CO	Carbon monoxide
CO_2	Carbon dioxide
COC	Chain of custody
CSA	Cross sectional area
dd/mm/yyyy	day - month - year
DECC	Department of Environment & Climate Change
DP	Discharge point
dscm	dry standard cubic meters
ELS	EnviroLab Services
EPA	Environmental Protection Agency
EPL	Environmental Protection Licence
EWP	Elevated work platform
FH	Front half of sample train (probe and filter holder) (referred to during sample recovery)
g	Grams
g/g mole	gram per gram - mole
H_2O	Water
H2S	Hydrogen sulphide
H2SO3	Sulphuric acid
hh:mm	hours: minutes
ISO	International Standards Organisation
ISO17025	ISO for the General requirements for the competence of testing and calibration laboratories
kg	Kilograms
m	Metres
m/sec	metres per second
m^3	actual gas volume in cubic metres as measured
mbar	Millibars
MDL	Method detection limit
mg	Milligrams (10^{-3} grams)
min	Minute
mL	Millilitres
mm	Millimetres
mmH_2O	Millimetres of water
Mole	SI unit that measures the amount of substance
MRU	Gas analyser brand
N/A	Not applicable
NATA	National Association of Testing Authorities
NATO	North Atlantic Treaty Organisation
ng	Nanograms (10^{-9} grams)
NH_3	Ammonia
NIOSH	National institute for occupational safety and health (USA)
NM	Non-methane
Nm^3	Gas volume in dry cubic metres at standard temperature and pressure (0°C and 101.3 kPa)
NMI	National Measurement Institute
NO	Nitrogen monoxide
NO_2	Nitrogen dioxide
NPI	National Pollutant Inventory
NR	Not required on this occasion
NSW	New South Wales
O2	Oxygen

Abbreviation	Definition
°C	Degrees Celsius
OH&S	Occupational Health & Safety
OM	Other Method
OSHA	Occupational Safety and Health Act
ou	Odour unit
PAH	Polycyclic Aromatic Hydrocarbon
PM	Particulate matter (total)
PM10	Particles with a diameter of 10 micrometres or less
PM2.5	Particles with a diameter of 2.5 micrometres or less
ppb	Parts per billion
ppm	Parts per million
PQL	Practical quantitation limit
PSD	Particle size distribution
Q1	Quarter 1
Q2	Quarter 2
Q3	Quarter 3
Q4	Quarter 4
QA	Quality assurance
QC	Quality control
RMS	Root mean square
SCAQMD	South Coast Air Quality Management District
sec	Second
SI	Standards international
Sm^3	Gas volume in dry cubic metres at standard temperature and pressure (0°C and 101.3 kPa) and corrected to a standardised value.
SO_2	Sulphur dioxide
SO3	Sulphur trioxide
SSI	State Significant Infrastructure
STP	Standard temperature and pressure (0°C and 101.3 kPa)
TM	Test Method
TO	USEPA air toxics method
TWA	Time weighted average
USEPA	United States Environmental Protection Authority
UTM	Universal Transverse Mercator
VOC	Volatile organic compound

APPENDIX A: PROCESS DATA

Name:	PLC date: 02.05.2023	Number of faults: 0 Number of alarms: 1
Comment: Toohey's	PLC release: 2.50.21-m03	State: Load run Operation mode: Mains
Number: 9296876	PLC operating system: 2.53.03	Actual power: 1906 kW Actual speed: 1500.9 1/min
Engine type: TCG2020V20	Visualisation: 3.4.2	Operation hours: 31034 Starts: 1982
Serial number CPU-P: 233500100-01891	Serial number BRT: 26030040114483	Serial number DZR: 832600092