



## Stephenson

Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)  
ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144  
Tel: (02) 9737 9991

E-Mail: [info@stephensonenv.com.au](mailto:info@stephensonenv.com.au)

### EMISSION TEST REPORT (ETR) No. 7107/S25705/20

#### STYRENE SCRUBBER EFFICIENCY MONITORING

ROCBOLT RESINS PTY LIMITED

SMEATON GRANGE, NSW 2567

PROJECT No.: 7107/S25705/20

DATE OF SURVEY: 14 OCTOBER 2020

DATE OF ISSUE: 30 OCTOBER 2020



NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

**EMISSION TEST REPORT No. 7107/S25705/20**

	<b>The sampling and analysis was commissioned by:</b>	
<b>Client</b>	Organisation:	Rocbolt Resins Pty Limited
	Contact:	Andrew Sykes
	Address:	40-44 Anzac Avenue, Smeaton Grange NSW 2567
	Telephone:	02 4647 8388
	Email:	<a href="mailto:asykes@rocboltresins.com.au">asykes@rocboltresins.com.au</a>
	Project Number:	7107/S25705/20
	Test Date:	14 October 2020
	Production Conditions:	Normal operating conditions during testing
	Analysis Requested:	Dry gas density, volumetric flowrate, velocity, temperature, moisture, molecular weight of stack gases, nitrogen oxides, particulate matter less than 10 microns, volatile organic compounds including styrene and benzene
	Sample Locations:	Styrene dry scrubber exhaust stack
	Sample ID Nos.:	See attachment A
	Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

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<i>Test</i>	<i>Test Method Number for Sampling &amp; Analysis</i>	<i>NATA Laboratory Analysis By: NATA Accreditation No. &amp; Report No.</i>
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, ETR No. 7107
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, ETR No. 7107
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, ETR No. 7107
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, Accreditation No. 15043, ETR No. 7107
Particulate Matter less than 10 microns	NSW OM-5, USEPA M201A	SEMA, Accreditation No. 15043, Particle Test Report No. 2180
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 7107
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 7107
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 7107
Volatile Organic Compounds (styrene, benzene, total as n-Propane)	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No. 2020-3770
Volumetric Flowrate	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 7107

**Deviations from Test Methods** Nil

**Sampling Times** NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.

**Reference Conditions** NSW - As per  
 (1) Environment Protection Licence conditions, or  
 (2) Part 3 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided in Attachment A.

Issue date: 30 October 2020



P W Stephenson  
 Managing Director

## 1.1 SCOPE OF WORK

The scope of work undertaken at Rocbolt Resins, Smeaton Grange, on October 14, 2020 is tabled below and was requested by Rocbolt Resins to address a requirement of their Environment Protection Licence (EPL) 20944.

Parameter	Styrene Scrubber Exhaust Stack	Units of Measure	NSW Approved Test Method
VOCs including Styrene and Benzene	2 samples	mg/m <sup>3</sup> or g/s	OM-2, TM-34
Particulate matter less than 10 microns	1 sample	mg/m <sup>3</sup>	OM-5, USEPA 201A
Nitrogen Oxides	Continuous	mg/m <sup>3</sup>	TM-11
Dry Gas Density	✓	kg/m <sup>2</sup>	TM-23
Moisture	✓	%	TM-22
Molecular weight of stack gases	✓	g.g-mole	TM-23
Temperature	✓	K	TM-2
Velocity	✓	m/s	TM-2
Volumetric flowrate	✓	m <sup>3</sup> /s	TM-2

### Key:

kg/m <sup>3</sup>	=	kilograms per cubic metre
mg/m <sup>3</sup>	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kPa)
g/s	=	grams per second
%	=	percentage
g.g-mole	=	grams per gram mole
g/s	=	grams per second
°C	=	degrees Celsius
TM	=	test method
m/s	=	metres per second
m <sup>3</sup> /s	=	dry cubic metre per second 0°C and 101.3 kilopascals (kPa)
AS	=	Australian Standard
hr	=	hour
*	=	method agreed to by Chris Kelly, NSW EPA. Refer Benbow Environmental.

## 1.2 PRODUCTION AND SAMPLING CONDITIONS

Rocbolt Resins personnel considered the manufacturing facility was operating under typical conditions on the day of testing. Details of production conditions are available on request.

The following description of the process was supplied by Rocbolt Resins,

*Rocbolt Resins manufactures resin capsules used as reinforcement for rocks/strata in the mining industry in conjunction with steel bolts and cables.*

*The capsules are a 2 part capsule, an outer plastic skin, sealed at both ends with clips and a separate inner compartment. The larger compartment consists of a highly viscous polyester resin mastic paste comprising approximately 20% polyester resin (contains Styrene monomer) & 80% inert limestone fillers. The smaller compartment consists of catalyst containing inert limestone fillers, benzoyl peroxide paste and oil or water as the carrier. The ratio of the two compartment ranges from 80:20 to 93:7 by weight.*

**1.3 SUMMARY OF EMISSION TEST RESULTS – 14 OCTOBER 2020**

Parameter		Unit of measure	Average Measured Concentrations 14 October 2020 Exhaust Stack	EPL Licence 20944 Limit
Styrene	(as Styrene)	mg/m <sup>3</sup>	22	220
	(as n-propane)	mg/m <sup>3</sup>	9.1	--
	MER (as Styrene)	g/s	0.0081	--
Benzene	(as Benzene)	mg/m <sup>3</sup>	<0.18	--
	MER (as Benzene)	g/s	<6.6 X 10 <sup>-5</sup>	--
VOC (total)	(as n- propane)	g/s	0.0092	--
PM <sub>10</sub>	concentration	mg/m <sup>3</sup>	<0.14	--
	MER	g/s	<0.0001	--
Oxides of nitrogen	concentration	mg/m <sup>3</sup>	2	--
	MER	g/s	0.0007 (7 X 10 <sup>-4</sup> )	--
Stack temperature		°C	24	--
Velocity		m/s	6	--
Volumetric flow		m <sup>3</sup> /s	0.37	--
Moisture		%	0.5	--
Molecular weight dry stack gas		g/g mole	28.9	--
Gas Density		kg/m <sup>3</sup>	1.29	--
Stack pressure		kPa	102.7	--

Key:

EPL	=	Environment Protection Licence
MER	=	Mass Emission Rate
VOC	=	Volatile organic compounds
mg/m <sup>3</sup>	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kPa)
g/s	=	grams per second
°C	=	degrees Celsius
m/s	=	metres per second
m <sup>3</sup> /s	=	dry cubic metre per second 0°C and 101.3 kilopascals (kPa)
%	=	percentage
<	=	less than
g/g mole	=	grams per gram mole
kg/m <sup>3</sup>	=	Kilograms per cubic metre
kPa	=	Kilo Pascals
--	=	not specified in EPL 20944

## 1.4 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA 4	25%
Nitrogen Oxides	NSW TM-11, USEPA M7E	15%
Oxygen and Carbon Dioxide	NSW TM-24, TM-25, USEPA M3A	1% actual
Particulate matter less than 10 microns	NSW OM-5, USEPA M201A	50%
Velocity	AS4323.1, NSW TM-2, USEPA 2	5%
Volatile Organic Compounds (adsorption tube)	NSW TM-34, USEPA M18	25%
Styrene as Volatile Organic Compound (adsorption tube)	NSW TM-34, USEPA 18	25%

### Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

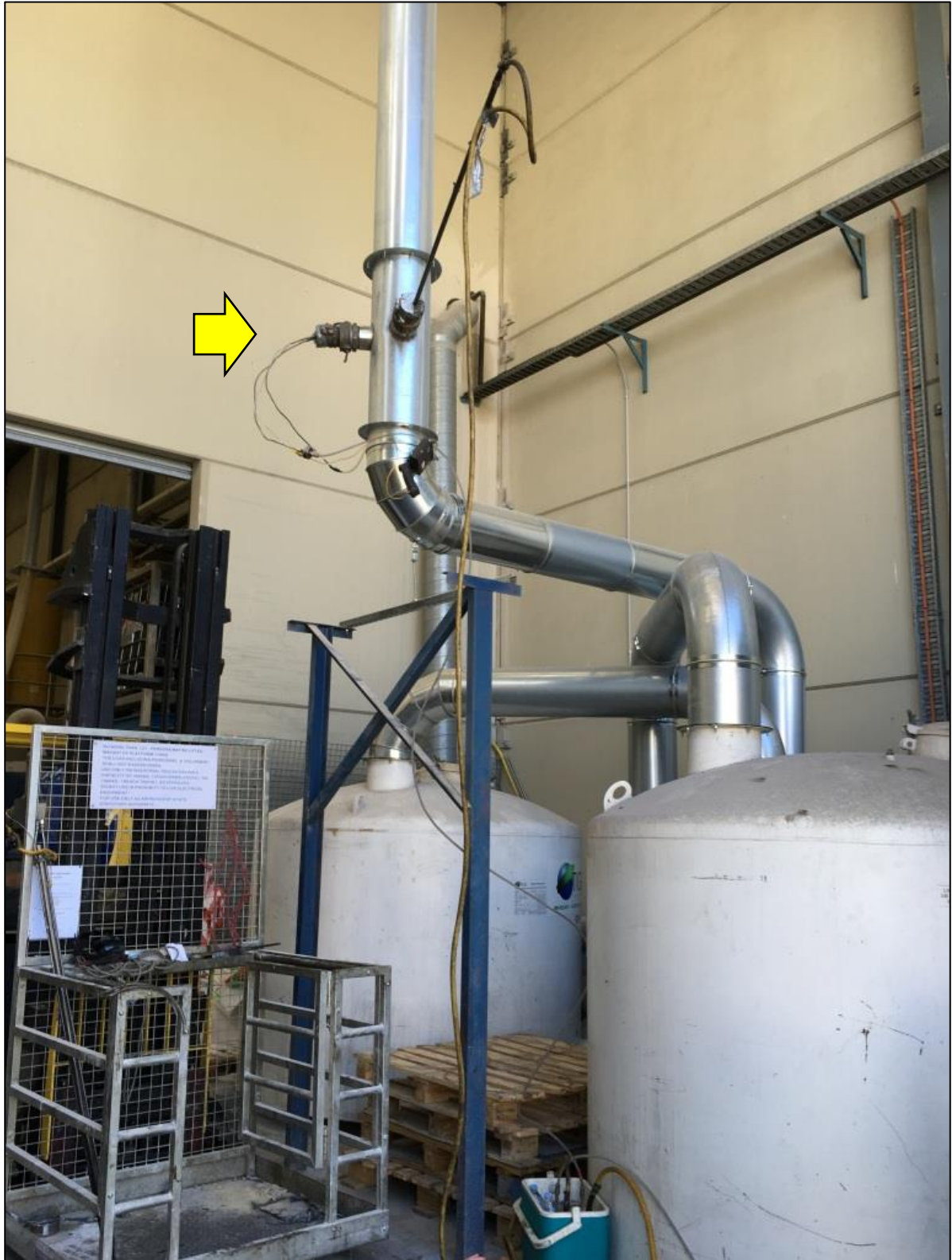
Sources: *Measurement Uncertainty – implications for the enforcement of emission limits* by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK

*Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.*

*Note: ISO 9096 is for 20-1000 mg/m<sup>3</sup> which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m<sup>3</sup> correlates to 5 mg/m<sup>3</sup> with most quoted uncertainties of ± 5.3 mg/m<sup>3</sup> @ 6.4 mg/m<sup>3</sup>. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m<sup>3</sup> under lab conditions.*

## 1.5 DRY SCRUBBER SAMPLING LOCATIONS

PHOTOGRAPH 1 DRY CARBON SCRUBBERS AND OUTLET SAMPLE PORTS





**PHOTOGRAPH 2 VARIABLE SPEED FAN EXTRACTING AIR FROM WITHIN PLANT TO SCRUBBER TOWERS IN SERIES**



PHOTOGRAPH 3 DRY SCRUBBER MANUFACTURER'S DETAILS



## VAPOR PHASE UNIT

INSTALLATION/OPERATING INSTRUCTIONS ATTACHED TO UNIT

MODEL	Maximum Operating		Media			
	Press. psig	Temp. °F	<input type="checkbox"/> Activated Carbon	<input type="checkbox"/> FIBER	<input type="checkbox"/> MMS	<input type="checkbox"/> SAFE
<b>NIXTOX™</b>						
<input type="checkbox"/> N400XP		Atm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> N20XP	<input type="checkbox"/> N50XP	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> N250	<input type="checkbox"/> N100	6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> N50	<input type="checkbox"/> N150	6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> N1200PHD	<input type="checkbox"/> N2000PHD	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> N750PDB	<input type="checkbox"/> N1200PDB	15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> N2500PDB	<input type="checkbox"/> N4000PDB	15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> NB15	<input type="checkbox"/> NB20	15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>ECONOSORB™</b>						
<input type="checkbox"/> Econo V		6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> EVP1000	<input type="checkbox"/> EVP2000	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> EV1000	<input type="checkbox"/> EV2000	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Other		1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> EV3000	<input type="checkbox"/> EV5000	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**CAUTION:** Wet activated carbon can reduce oxygen in confined spaces. Use low oxygen safety procedures when entering activated vessels containing activated carbon.

**CAUTION:** Unless unit has designated lifting legs, handle/hoist from bottom only.

**Technical or commercial inquiries:** TIGG Corporation, 1 Wilson Avenue, Oakdale, PA 15071, 800-925-0011 or 724-753-3001, email: info@tigg.com

**Manufacturer and shipping point:** TIGG Corporation, 2540 Pangum Road, Haber Springs, AR 72543, 301-362-8652, Fax: 301-362-3870

**WARRANTY:** TIGG Corporation warrants this assembly to be in accordance with its published specifications. Due to the wide variety of potential applications and conditions of use, no other express or implied warranty is made for performance, safety or suitability for a particular purpose.

**CAUTION:** Activated carbon can react with oxidizing or acidic volatile agents such as ozone, chlorine, nitrous, nitric, high oxygen concentrations and other oxidants to form heat. An exothermic reaction can occur if not recommended with these materials.

**CAUTION:** High concentrations of volatile hydrocarbons and olefins are not recommended with these materials. This should be avoided by providing the carbon with water which may be removed by flushing and drying the unit with water. This is accomplished by backwashing in its condition.

**CAUTION:** If a tank, vessel, or other container is being filled with gas, the unit should be disconnected and the gas valve closed to prevent air flow and another combustion. Do NOT backwash to prevent air flow and another combustion. Do NOT add water to the top of the bed because of possible buildup of pressure and to prevent the carbon bed from being compressed. Observe the carbon bed from the unit while adding the top. Use extreme caution in working with any wet, or moist carbon. To prevent explosion, always disconnect the top. Do not open the unit to change any other components. Do not open the unit to change any other components. Do not open the unit to change any other components. Do not open the unit to change any other components.

**CAUTION:** In the event the unit is connected to a storage tank or other source of compressed gas, it may be necessary to provide for protection for the venting air. This may include the installation of a flame arrester in the venting air.

**CAUTION:** When using this unit under normal use, the discharge is an approved safe waste stream. Do not use for hazardous or regulated materials. A large quantity of regulated material may require special handling or additional safety. Environmental regulations may influence proper disposal and disposal volume.

800-925-0011

**1.6 INSTRUMENT CALIBRATION DETAILS**

<b>SEMA Asset No.</b>	<b>Equipment Description</b>	<b>Date Last Calibrated</b>	<b>Calibration Due Date</b>
646	Stopwatch	11-May-20	11-Nov-20
857	Digital Temperature Reader	07-May-20	07-Nov-20
920	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
613	Barometer	05-Dec-19	05-Dec-20
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
928	Balance		Response Check with SEMA Site Mass
675	Personal Sampler	12-Mar-20	12-Mar-21
764	TSI Thermal Mass Flowmeter	23-Jul-20	23-Jan-21
946	Combustion Analyzer	02-Sep-20	02-Mar-21
708	Gas Meter	21-Feb-20	21-Feb-21
<b>Gas Mixtures used for Analyser Span Response</b>			
<b>Conc.</b>	<b>Mixture</b>	<b>Cylinder No.</b>	<b>Expiry Date</b>
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21
100 ppm 100 ppm 100 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALTF 3709	09-Aug-23
262 ppm 263 ppm 249 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB 4441	23-Jun-21

## 1.7 CONCLUSIONS

Emissions were monitored on the discharge side of the two dry carbon scrubbing units connected in series, at the Rocbolt Resins manufacturing facility with the following results:

- The average Styrene emission concentration (reported as Styrene) was 22 mg/m<sup>3</sup> which was compliant with the EPL limit of 220 mg/m<sup>3</sup>. The styrene mass emission rate (MER) was less than 0.0081 grams per second (g/s).
- The average benzene MER (reported as benzene) was less than 6.6 X 10<sup>-5</sup> g/s;
- The average total VOC MER (reported as n-propane) was 0.0092 g/s;
- The average emission concentration of Oxides of Nitrogen (NO<sub>x</sub>) (expressed as nitrogen dioxide (NO<sub>2</sub>)) was 2.0 mg/m<sup>3</sup>. The NO<sub>x</sub> MER was 0.0007-g/s.
- The average PM<sub>10</sub> emission concentration was less than 0.14 mg/m<sup>3</sup>. The PM<sub>10</sub> MER was less than 0.0001 g/s.
- Rocbolt Resins advised that the variable speed extraction fan serving the scrubber system was running at its normal set point (20 Hertz) during the system efficiency testing. This is of the order of 50% of total flow;
- However, the fan speed is variable depending on demand for extraction within the plant. Rocbolt Resins advise that this is both an energy conservation and scrubber efficiency optimisation policy.

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**ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS**



# Stephenson

Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)  
ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144 Australia  
Tel: (02) 9737 9991  
E-Mail: [info@stephensonenv.com.au](mailto:info@stephensonenv.com.au)

## Particle Test Report No. 2180

The analysis was commissioned by SEMA on behalf of:

<b>Client</b>	<b>Organisation:</b>	Rocbolt Resins Pty Limited
	<b>Contact:</b>	Andrew Sykes
	<b>Address:</b>	40-44 Anzac Avenue, Smeaton Grange NSW 2567
	<b>Telephone:</b>	02 4647 8388
	<b>Email:</b>	<a href="mailto:asykes@rocboltresins.com.au">asykes@rocboltresins.com.au</a>
	<b>Project Number:</b>	7107/S25705/20
	<b>Analysis Requested:</b>	OM-5
	<b>Chain of Custody Number</b>	S25716
	<b>Date Analysis Completed:</b>	15 October 2020
	<b>No. of Samples Tested:</b>	1
	<b>Sample Locations:</b>	EPL ID No. 45 (Boiler 2)
	<b>Sample ID Nos.:</b>	728106
	<b>Filter ID Nos.:</b>	15399

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**Identification**      The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

*Test*                    *Analysis Test Method*  
 PM<sub>10</sub>                    AS4323.2-1995 (R2014)  
                                  (NSW OM-5)

**Deviations from Test Methods**      Nil

**Issue Date**  
 15 October 2020



Peter Stephenson  
 Managing Director

**Gravimetric Results - Test Report No. 2180**

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Stack PM <sub>10</sub>	728106	15399	14/10/2020	15/10/2020	<0.0001

Key:  
 g = grams



Jay Weber  
 Stephenson Environmental Management Australia  
 PO Box 6398  
 SILVERWATER NSW 1811

**Lab. Reference:** 2020-3770

Samples analysed as received

**SAMPLE ORIGIN:** Project No: 7107

**DATE OF INVESTIGATION:** 14/10/2020

**DATE RECEIVED:** 16/10/20

**ANALYSIS REQUIRED:** Volatile Organic Compounds

### REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

Increment and total pagination can be seen on the following pages.

Martin Mazereeuw

Manager

**Date:** 23/10/20

**TestSafe Australia – Chemical Analysis Branch**  
 Level 2, Building 1, 9-15 Chilvers Road, Thornleigh, NSW 2120, Australia  
 T: +61 2 9473 4000 E: [lab@safework.nsw.gov.au](mailto:lab@safework.nsw.gov.au) W: [testsafe.com.au](http://testsafe.com.au)  
 ABN 81 913 830 179



Accreditation No. 3726

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SafeWork NSW



**Analysis of Volatile Organic Compounds in Workplace Air by GC/MS**

Client: Stephenson  
Sample ID : 728104

Date Sampled 14/10/2020  
Date Analysed 22/10/2020  
Reference Number 2020-3770-1

No	Compounds	CAS No	Front	Back	No	Compounds	CAS No	Front	Back
			µg/section					µg/section	
<b>Aliphatic hydrocarbons</b> (LOQ = 5µg/compound/section)					<b>Aromatic hydrocarbons</b> (LOQ = 1µg/compound/section)				
1	2-Methylbutane	78-78-4	ND	ND	39	Benzene	71-43-2	ND	ND
2	n-Pentane	109-66-0	ND	ND	40	Ethylbenzene	100-41-4	ND	ND
3	2-Methylpentane	107-83-5	ND	ND	41	Isopropylbenzene	98-82-8	ND	ND
4	3-Methylpentane	96-14-0	ND	ND	42	1,2,3-Trimethylbenzene	526-73-8	ND	ND
5	Cyclopentane	287-92-3	ND	ND	43	1,2,4-Trimethylbenzene	95-63-6	ND	ND
6	Methylcyclopentane	96-37-7	ND	ND	44	1,3,5-Trimethylbenzene	108-67-8	ND	ND
7	2,3-Dimethylpentane	563-59-3	ND	ND	45	Styrene	100-42-5	115	1
8	n-Hexane	110-54-3	ND	ND	46	Toluene	108-88-3	ND	ND
9	3-Methylhexane	589-34-4	ND	ND	47	p-Xylene &/or m-Xylene	106-42-3 106-16-4	ND	ND
10	Cyclohexane	110-82-7	ND	ND	48	o-Xylene	95-47-6	ND	ND
11	Methylcyclohexane	108-87-2	ND	ND	<b>Ketones</b> (LOQ #49, #54 & #55 = 5µg/cis; #50, #51, #52 & #53 = 25µg/cis)				
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	112	ND
13	n-Heptane	142-82-5	ND	ND	50	Acetoin	513-86-0	ND	ND
14	n-Octane	111-65-9	ND	ND	51	Diacetone alcohol	123-42-2	ND	ND
15	n-Nonane	111-84-2	ND	ND	52	Cyclohexanone	108-94-1	ND	ND
16	n-Decane	124-18-5	ND	ND	53	Isophorone	78-59-1	ND	ND
17	n-Undecane	1120-21-4	ND	ND	54	Methyl ethyl ketone (MEK)	78-93-3	ND	ND
18	n-Dodecane	112-40-3	ND	ND	55	Methyl isobutyl ketone (MIBK)	108-10-1	ND	ND
19	n-Tridecane	629-50-5	ND	ND	<b>Alcohols</b> (LOQ = 25µg/compound/section)				
20	n-Tetradecane	629-59-4	ND	ND	56	Ethyl alcohol	64-17-5	ND	ND
21	α-Pinene	80-56-8	ND	ND	57	n-Butyl alcohol	71-36-3	ND	ND
22	β-Pinene	127-91-3	ND	ND	58	Isobutyl alcohol	78-83-1	ND	ND
23	D-Limonene	138-86-3	ND	ND	59	Isopropyl alcohol	67-63-0	ND	ND
<b>Chlorinated hydrocarbons</b> (LOQ = 5µg/compound/section)					60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	75-34-3	ND	ND	<b>Acetates</b> (LOQ = 25µg/compound/section)				
26	1,2-Dichloroethane	107-06-2	ND	ND	62	Ethyl acetate	141-78-6	ND	ND
27	Chloroform	67-66-3	ND	ND	63	n-Propyl acetate	109-60-4	ND	ND
28	1,1,1-Trichloroethane	71-55-6	ND	ND	64	n-Butyl acetate	123-86-4	ND	ND
29	1,1,2-Trichloroethane	79-00-5	ND	ND	65	Isobutyl acetate	110-19-0	ND	ND
30	Trichloroethylene	79-01-6	ND	ND	<b>Ethers</b> (LOQ = 25µg/compound/section)				
31	Carbon tetrachloride	56-23-5	ND	ND	66	Ethyl ether	60-29-7	ND	ND
32	Perchloroethylene	127-18-4	ND	ND	67	tert-Butyl methyl ether (MTBE)	1634-04-4	ND	ND
33	1,1,2,2-Tetrachloroethane	79-34-5	ND	ND	68	Tetrahydrofuran (THF)	109-99-9	ND	ND
34	Chlorobenzene	108-90-7	ND	ND	<b>Glycols</b> (LOQ = 25µg/compound/section)				
35	1,2-Dichlorobenzene	95-50-1	ND	ND	69	PGME	107-98-2	ND	ND
36	1,4-Dichlorobenzene	106-46-7	ND	ND	70	Ethylene glycol diethyl ether	629-14-1	ND	ND
<b>Miscellaneous</b> (LOQ #37= 5µg & #38=25µg/compound/section)					71	PGMEA	108-65-6	ND	ND
37	Acetonitrile	75-05-8	ND	ND	72	Cellosolve acetate	111-15-9	ND	ND
38	n-Vinyl-2-pyrrolidinone	88-12-0	ND	ND	73	DGMEA	112-15-2	ND	ND
<b>Total VOCs</b> (LOQ = 50µg/compound/section)				228	ND	Worksheet check			2020-3770-

**TestSafe Australia – Chemical Analysis Branch**

ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia  
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au



Accreditation No. 3726

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SafeWork NSW



**Analysis of Volatile Organic Compounds in Workplace Air by GC/MS**

Client: Stephenson  
Sample ID : 728105

Date Sampled 14/10/2020  
Date Analysed 22/10/2020  
Reference Number 2020-3770-2

No	Compounds	CAS No	Front	Back	No	Compounds	CAS No	Front	Back
			µg/section					µg/section	
<b>Aliphatic hydrocarbons (LOQ = 5µg/compound/section)</b>					<b>Aromatic hydrocarbons (LOQ = 1µg/compound/section)</b>				
1	2-Methylbutane	78-78-4	ND	ND	39	Benzene	71-43-2	ND	ND
2	n-Pentane	109-66-0	ND	ND	40	Ethylbenzene	100-41-4	ND	ND
3	2-Methylpentane	107-83-5	ND	ND	41	Isopropylbenzene	98-82-8	ND	ND
4	3-Methylpentane	96-14-0	ND	ND	42	1,2,3-Trimethylbenzene	526-73-8	ND	ND
5	Cyclopentane	287-92-3	ND	ND	43	1,2,4-Trimethylbenzene	95-63-6	ND	ND
6	Methylcyclopentane	96-37-7	ND	ND	44	1,3,5-Trimethylbenzene	108-67-8	ND	ND
7	2,3-Dimethylpentane	565-59-3	ND	ND	45	Styrene	100-42-5	130	ND
8	n-Hexane	110-54-3	ND	ND	46	Toluene	108-88-3	ND	ND
9	3-Methylhexane	589-34-4	ND	ND	47	p-Xylene &/or m-Xylene	106-47-8 106-38-3	ND	ND
10	Cyclohexane	110-82-7	ND	ND	48	o-Xylene	95-47-6	ND	ND
11	Methylcyclohexane	108-87-2	ND	ND	<b>Ketones (LOQ #49, #54 &amp; #55 = 5µg/c/s; #50, #51, #52 &amp; #53 = 25µg/c/s)</b>				
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	120	ND
13	n-Heptane	142-82-5	ND	ND	50	Acetoin	513-86-0	ND	ND
14	n-Octane	111-65-9	ND	ND	51	Diacetone alcohol	123-42-2	ND	ND
15	n-Nonane	111-84-2	ND	ND	52	Cyclohexanone	108-94-1	ND	ND
16	n-Decane	124-18-5	ND	ND	53	Isophorone	78-59-1	ND	ND
17	n-Undecane	1120-21-4	ND	ND	54	Methyl ethyl ketone (MEK)	78-93-3	ND	ND
18	n-Dodecane	112-40-3	ND	ND	55	Methyl isobutyl ketone (MIBK)	108-10-1	ND	ND
19	n-Tridecane	629-50-5	ND	ND	<b>Alcohols (LOQ = 25µg/compound/section)</b>				
20	n-Tetradecane	629-59-4	ND	ND	56	Ethyl alcohol	64-17-5	ND	ND
21	α-Pinene	80-56-8	ND	ND	57	n-Butyl alcohol	71-36-3	ND	ND
22	β-Pinene	127-91-3	ND	ND	58	Isobutyl alcohol	78-83-1	ND	ND
23	D-Limonene	138-86-3	ND	ND	59	Isopropyl alcohol	67-63-0	ND	ND
<b>Chlorinated hydrocarbons (LOQ = 5µg/compound/section)</b>					60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	75-34-3	ND	ND	<b>Acetates (LOQ = 25µg/compound/section)</b>				
26	1,2-Dichloroethane	107-06-2	ND	ND	62	Ethyl acetate	141-78-6	ND	ND
27	Chloroform	67-66-3	ND	ND	63	n-Propyl acetate	109-60-4	ND	ND
28	1,1,1-Trichloroethane	71-55-6	ND	ND	64	n-Butyl acetate	123-86-4	ND	ND
29	1,1,2-Trichloroethane	79-00-5	ND	ND	65	Isobutyl acetate	110-19-0	ND	ND
30	Trichloroethylene	79-01-6	ND	ND	<b>Ethers (LOQ = 25µg/compound/section)</b>				
31	Carbon tetrachloride	56-23-5	ND	ND	66	Ethyl ether	60-29-7	ND	ND
32	Perchloroethylene	127-18-4	ND	ND	67	tert-Butyl methyl ether (MTBE)	1634-04-4	ND	ND
33	1,1,2,2-Tetrachloroethane	79-34-5	ND	ND	68	Tetrahydrofuran (THF)	109-99-9	ND	ND
34	Chlorobenzene	108-90-7	ND	ND	<b>Glycols (LOQ = 25µg/compound/section)</b>				
35	1,2-Dichlorobenzene	95-50-1	ND	ND	69	PGME	107-98-2	ND	ND
36	1,4-Dichlorobenzene	106-46-7	ND	ND	70	Ethylene glycol diethyl ether	629-14-1	ND	ND
<b>Miscellaneous (LOQ #37= 5µg &amp; #38=25µg/compound/section)</b>					71	PGMEA	108-65-6	ND	ND
37	Acetonitrile	75-05-8	ND	ND	72	Cellosolve acetate	111-15-9	ND	ND
38	n-Vinyl-2-pyrrolidinone	88-12-0	ND	ND	73	DGMEA	112-15-2	ND	ND
<b>Total VOCs (LOQ = 50µg/compound/section)</b>			250	ND	Worksheet check			2020-3770-2	

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**TestSafe Australia – Chemical Analysis Branch**

ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia  
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SW08051 0817

*Analysis of Volatile Organic Compounds in Workplace Air by GC/MS*

ND = Not Detected

All compounds numbered 1-73 are included of this analysis in the scope of NATA accreditation.

Method : Analysis of Volatile Organic Compounds in Workplace Air by Gas Chromatography/Mass Spectrometry  
Method Number : WCA.207

Limit of Quantitation : 5µg/section; 25µg/section for oxygenated hydrocarbons except acetone, MEK and MIBK at 5µg/section.

Brief Description : Volatile organic compounds are trapped from the workplace air onto charcoal tubes by the use of a personal air monitoring pump. The volatile organic compounds are then desorbed from the charcoal in the laboratory with CS<sub>2</sub>. An aliquot of the desorbant is analysed by capillary gas chromatography with mass spectrometry detection.

PGME : Propylene Glycol Monomethyl Ether

PGMEA : Propylene Glycol Monomethyl Ether Acetate

DGMEA : Diethylene Glycol Monoethyl Ether Acetate

**Measurement Uncertainty**

The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

**Quality Assurance**

In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-

- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

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