



Stephenson

Environmental Management Australia

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EMISSION TEST REPORT (ETR) No. 7046/S25525/20

STYRENE SCRUBBER EFFICIENCY MONITORING

ROCBOLT RESINS PTY LIMITED

SMEATON GRANGE, NSW 2567

PROJECT No.: 7046/S25525/20

DATE OF SURVEY: 2 APRIL 2020

DATE OF ISSUE: 22 APRIL 2020



NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

EMISSION TEST REPORT No. 7046/S25525/20**The sampling and analysis was commissioned by:****Client**

Organisation: Rocbolt Resins Pty Limited
Contact: Andrew Sykes
Address: 40-44 Anzac Avenue, Smeaton Grange NSW 2567
Telephone: 02 4647 8388
Email: asykes@rocboltresins.com.au
Project Number: 7046/S25525/20
Test Date: 02 April 2020
Production Conditions: Normal operating conditions during testing

Analysis Requested: Dry gas density, volumetric flowrate, velocity, temperature, moisture, molecular weight of stack gases and volatile organic compounds including styrene

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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Test	Test Method Number for Sampling & Analysis	NATA Laboratory Analysis By: NATA Accreditation No. & Report No.
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, ETR No. 7046
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, ETR No. 7046
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, ETR No. 7046
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 7046
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 7046
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 7046
Volatile Organic Compounds (styrene and total as n-Propane)	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No. 2020-1586
Volumetric Flowrate	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 7046

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: 22 April 2020



P W Stephenson
Managing Director

1.1 SCOPE OF WORK

The scope of work undertaken at Rocbolt Resins, Smeaton Grange on April 2, 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	2 samples	mg/m ³ or g/s	TM-34
Dry Gas Density	✓	kg/m ³	TM-23
Moisture	✓	%	TM-22
Molecular weight of stack gases	✓	g.g-mole	TM-23
Temperature	✓	°C	TM-2
Velocity	✓	m/s	TM-2
Volumetric flowrate	✓	m ³ /s	TM-2

Key:

kg/m ³	=	kilograms per cubic metre
mg/m ³	=	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
OM	=	other method
m/s	=	metres per second
m ³ /s	=	dry cubic metre per second 0°C and 101.3 kilopascals (kPa)

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 information 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 – 2 APRIL 2020

Parameter		Unit of measure	Average Measured Concentrations 2 April 2020 Activated Carbon Dry Scrubber Exhaust Stack	EPL Licence 20944 Limit
Styrene	(as Styrene)	mg/m ³	0.85	220
	(as n-propane)	mg/m ³	0.36	--
	MER (as Styrene)	g/s	0.00028	--
VOC	(uncorrected)	mg/m ³	11.9	--
	(as n- propane)	mg/m ³	8.74	--
	MER (as n- propane)	g/s	0.0029	--
Stack temperature		°C	25	--
Velocity		m/s	5.2	--
Volumetric flow		m ³ /s	0.33	--
Moisture		%	0.8	--
Molecular weight dry stack gas		g/g mole	28.8	--
Gas Density		kg/m ³	1.29	--
Stack pressure		kPa	101.3	--

Key:

EPL	=	Environment Protection Licence
MER	=	Mass Emission Rate
VOC	=	Volatile organic compounds
mg/m ³	=	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 ³ /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 ³	=	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%
Oxygen	NSW TM-24, USEPA M3A	1% actual
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 M18	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.

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



1.6 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
647	Stopwatch	03-Dec-19	03-Jun-20
857	Digital Temperature Reader	02-Dec-19	02-Jun-20
768	Thermocouple	02-Dec-19	02-Jun-20
815	Digital Manometer	06-Dec-19	06-Dec-20
613	Barometer	05-Dec-19	05-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
928	Balance		Response Check with SEMA Site Mass
835	Personal Sampler	26-Feb-20	26-Feb-21
764	TSI THERMAL MASS FLOWMETER	04-Feb-20	04-Aug-20
946	combustion analyzer	16-Mar-20	16-Sep-20
Gas Mixtures used for Analyser Span Response			
Conc.	Mixture	Cylinder No.	Expiry Date
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

1.7 CONCLUSIONS

Emissions were monitored on April 2, 2020 on the discharge side of the two dry carbon scrubbing units connected in series at the Rocabolt Resins manufacturing facility with the following result:

- The average Styrene emission concentration (reported as Styrene) was 0.85 mg/m³ which is in compliance with the EPL limit of 220 mg/m³;and,
- Styrene mass emission rate was 0.00028 g/s.

- The average total VOC mass emission rate (reported as n-propane) was 0.0029 g/s with styrene and acetone being the major contributing volatile organic compounds;

- Rocabolt Resins advised that the variable speed extraction fan serving the scrubber system was running at its normal set point (20 Hertz) during the emission control system efficiency testing. This is of the order of 50% of total flow;

- However, the fan speed is variable depending on demand for fume extraction within the plant. Rocabolt Resins advise that this is both an energy conservation and scrubber efficiency optimisation policy.

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS



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

Lab. Reference: 2020-1586

Samples analysed as received

SAMPLE ORIGIN: Project No: 7046

DATE OF INVESTIGATION: 02/04/2020

DATE RECEIVED: 7/04/20

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: 22/04/20

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SafeWork NSW



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

Client : Jay Weber
Sample ID : 727901

Date Sampled : 2-Apr-2020
Reference Number : 2020-1586-1

No	Compounds	CAS No	Front	Back	No	Compounds	CAS No	Front	Back
			µg/section					µg/section	
Aliphatic hydrocarbons (LOQ = 5µg/compound/section)					Aromatic hydrocarbons (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	98-82-9	ND	ND
4	3-Methylpentane	96-14-0	ND	ND	42	1,2,3-Trimethylbenzene	526-73-0	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	565-39-3	ND	ND	45	Styrene	100-42-3	4	ND
8	n-Hexane	110-54-3	ND	ND	46	Toluene	108-88-3	ND	ND
9	3-Methylhexane	389-14-4	ND	ND	47	p-Xylene &/or m-Xylene	98-14-3	ND	ND
10	Cyclohexane	110-82-7	ND	ND	48	o-Xylene	93-87-6	ND	ND
11	Methylcyclohexane	108-87-2	ND	ND	Ketones (LOQ 809, 834 & 895 = 5µg/lit; 850, 851, 852 & 893 = 25µg/lit)				
12	2,2,4-Trimethylpentane	340-84-1	ND	ND	49	Acetone	67-64-1	60	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	123-42-3	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	78-39-1	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	628-50-5	ND	ND	Alcohols (LOQ = 25µg/compound/section)				
20	n-Tetradecane	628-59-4	ND	ND	56	Ethyl alcohol	64-17-5	ND	ND
21	α-Pinene	80-36-8	ND	ND	57	n-Butyl alcohol	71-36-3	ND	ND
22	β-Pinene	127-91-3	ND	ND	58	Isobutyl alcohol	78-82-1	ND	ND
23	D-Limonene	138-86-3	ND	ND	59	Isopropyl alcohol	67-63-0	ND	ND
Chlorinated hydrocarbons (LOQ = 5µg/compound/section)					60	2-Ethyl hexanol	104-78-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	71-34-1	ND	ND	Acetates (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	71-35-6	ND	ND	64	n-Butyl acetate	123-86-4	ND	ND
29	1,1,2-Trichloroethane	78-00-5	ND	ND	65	Isobutyl acetate	110-18-0	ND	ND
30	Trichloroethylene	79-01-6	ND	ND	Ethers (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 (tBME)	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	Glycols (LOQ = 25µg/compound/section)				
35	1,2-Dichlorobenzene	95-50-1	ND	ND	69	PGME	107-98-2	ND	ND
36	1,4-Dichlorobenzene	105-46-7	ND	ND	70	Ethylene glycol diethyl ether	829-14-1	ND	ND
Miscellaneous (LOQ 475 = 5µg & 838 = 25µg/compound/section)					71	PGMEA	108-65-8	ND	ND
37	Acetonitrile	75-05-8	ND	ND	72	Cellosolve acetate	111-15-9	ND	ND
38	n-Vinyl-2-pyrrolidone	86-12-0	ND	ND	73	DGMEA	112-18-2	ND	ND
Total VOCs (LOQ = 50µg/compound/section)					64	ND	Worksheet check	yes	yes

2020-1586

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TestSafe Australia - Chemical Analysis Branch

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Accreditation No. 3726

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5/9/2020 08:17



SafeWork NSW



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

Client : Jay Weber
Sample ID : 727902

Date Sampled : 2-Apr-2020
Reference Number : 2020-1586-2

No	Compounds	CAS No	Front	Back	No	Compounds	CAS No	Front	Back
			µg/section					µg/section	
Aliphatic hydrocarbons (LOQ = 5µg/compound/section)					Aromatic hydrocarbons (LOQ = 1µg/compound/section)				
1	2-Methylbutane	78-78-4	ND	ND	39	Benzene	71-43-2	ND	ND
2	n-Pentane	109-65-0	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	285-92-1	ND	ND	43	1,2,4-Trimethylbenzene	91-63-6	ND	ND
6	Methylcyclopentane	96-17-7	ND	ND	44	1,3,5-Trimethylbenzene	108-67-8	ND	ND
7	2,3-Dimethylpentane	563-59-1	ND	ND	45	Styrene	100-42-3	5	ND
8	n-Hexane	110-54-3	ND	ND	46	Toluene	108-69-3	ND	ND
9	3-Methylhexane	589-34-4	ND	ND	47	p-Xylene &/or m-Xylene	106-21-4	ND	ND
10	Cyclohexane	110-82-7	ND	ND	48	o-Xylene	95-47-6	ND	ND
11	Methylcyclohexane	108-87-2	ND	ND	Ketones (LOQ 800, 954 & 995 = 5µg/section; 898, 891, 892 & 893 = 25µg/section)				
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	58	ND
13	n-Heptane	142-82-3	ND	ND	50	Acetoin	513-86-0	ND	ND
14	n-Octane	111-63-9	ND	ND	51	Diacetone alcohol	123-42-7	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	Isothorone	76-59-1	ND	ND
17	n-Undecane	1129-21-4	ND	ND	54	Methyl ethyl ketone (MEK)	76-91-3	ND	ND
18	n-Dodecane	112-40-3	ND	ND	55	Methyl isobutyl ketone (MIBK)	108-10-1	ND	ND
19	n-Tridecane	628-50-5	ND	ND	Alcohols (LOQ = 25µg/compound/section)				
20	n-Tetradecane	628-59-4	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	76-81-1	ND	ND
23	D-Limonene	138-86-1	ND	ND	59	Isopropyl alcohol	67-63-0	ND	ND
Chlorinated hydrocarbons (LOQ = 5µg/compound/section)					60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-92-0	ND	ND
25	1,1-Dichloroethane	75-34-1	ND	ND	Acetates (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	71-35-6	ND	ND	64	n-Butyl acetate	123-86-4	ND	ND
29	1,1,2-Trichloroethane	78-00-5	ND	ND	65	Isobutyl acetate	110-19-0	ND	ND
30	Trichloroethylene	79-01-6	ND	ND	Ethers (LOQ = 25µg/compound/section)				
31	Carbon tetrachloride	56-23-5	ND	ND	66	Ethyl ether	60-29-7	ND	ND
32	Perchloromethylene	127-18-4	ND	ND	67	sec-Butyl methyl ether (sBME)	1634-04-4	ND	ND
33	1,1,2,2-Tetrachloroethane	79-14-5	ND	ND	68	Tetrahydrofuran (THF)	109-99-9	ND	ND
34	Chlorobenzene	108-90-7	ND	ND	Glycols (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
Miscellaneous (LOQ 615 = 5µg & 918 = 25µg/compound/section)					71	PGMEA	108-63-8	ND	ND
37	Acetonitrile	75-05-8	ND	ND	72	Cellulosolve acetate	111-15-9	ND	ND
38	n-Valyl-2-pyrrolidone	86-12-0	ND	ND	73	DGMEA	112-15-2	ND	ND
Total VOCs (LOQ = 50µg/compound/section)			63	ND	Worksheet check			yes	yes

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

ND = Not Detected

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 CS₂. An aliquot of the desorbent is analysed by capillary gas chromatography with mass spectrometry detection.

PCME : Propylene Glycol Monomethyl Ether

PGMEA : Propylene Glycol Monomethyl Ether Acetate

DGMEA : Diethylene Glycol Monomethyl 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 analysis. 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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