



Stephenson

Environmental Management Australia

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EMISSION TEST REPORT (ETR) No. 7174/S25797/21

STYRENE SCRUBBER EMISSION MONITORING

ROCBOLT RESINS PTY LIMITED

SMEATON GRANGE, NSW 2567

PROJECT No.: 7174/S25797/21

DATE OF SURVEY: 18 OCTOBER 2021

DATE OF ISSUE: 30 NOVEMBER 2021

EMISSION TEST REPORT NO. 7174/S25797/21

	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:	7174/S25797/21
	Test Date:	18 October 2021
	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 & Analysis</i>	<i>Laboratory Analysis & Report No.</i>
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, ETR No. 7174
Moisture	NSW TM-22, USEPA M4	SEMA, ETR No. 7174
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, ETR No. 7174
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, ETR No. 7174
Particulate Matter less than 10 microns	NSW OM-5, USEPA M201A	SEMA, Particle Test Report No. 2198
Stack Pressure	NSW TM-2, USEPA M2	SEMA, ETR No. 7174
Stack Temperature	NSW TM-2, USEPA M2	SEMA, ETR No. 7174
Velocity	NSW TM-2, USEPA M2	SEMA, ETR No. 7174
Volatile Organic Compounds (styrene, benzene, total as n-Propane)	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No. 2021-4972
Volumetric Flowrate	NSW TM-2, USEPA M2	SEMA, ETR No. 7174

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 November 2021



P W Stephenson
 Managing Director

1.1 SCOPE OF WORK

The scope of work undertaken at Rocbolt Resins, Smeaton Grange, on October 18, 2021 is tabled below. Rocbolt Resins holds Environment Protection Licence (EPL) No. 20944.

Parameter	Styrene Scrubber Exhaust Stack	Units of Measure	NSW Approved Test Method
VOCs including Styrene and Benzene	2 samples	mg/m ³ or g/s	OM-2, TM-34
Particulate matter less than 10 microns	1 sample	mg/m ³	OM-5, USEPA 201A
Nitrogen Oxides	Continuous	mg/m ³	TM-11
Dry Gas Density	✓	kg/m ³	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 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
m/s	=	metres per second
m ³ /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 – 18 OCTOBER 2021

Parameter		Unit of measure	Average Measured Concentrations 18 October 2021 Exhaust Stack	EPL Licence 20944 Limit
Styrene	(as Styrene)	mg/m ³	15.0	220
	(as n-propane)	mg/m ³	6.34	--
	MER (as Styrene)	g/s	0.0055	--
Benzene	(as Benzene)	mg/m ³	<0.18	--
	MER (as Benzene)	g/s	<6.6 X 10 ⁻⁵	--
VOC (total)	(as n- propane)	g/s	0.0035	--
PM ₁₀	concentration	mg/m ³	0.73	--
	MER	g/s	0.0003	--
Oxides of nitrogen	concentration	mg/m ³	2	--
	MER	g/s	0.0007 (7 X 10 ⁻⁴)	--
Stack temperature		°C	19.4 - 20.9	--
Velocity		m/s	5.2	--
Volumetric flow		m ³ /s	0.36	--
Moisture		%	0.8	--
Molecular weight dry stack gas		g/g mole	28.9	--
Gas Density		kg/m ³	1.29	--
Stack pressure		kPa	101.9	--

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%
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/m³ which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m³ correlates to 5 mg/m³ with most quoted uncertainties of ± 5.3 mg/m³ @ 6.4 mg/m³. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m³ 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
NIXTOX™						
<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"/> N1200PHD	<input type="checkbox"/> N2000PHD	6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> N750PDB	<input type="checkbox"/> N1200PDB	3	<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"/>
<input type="checkbox"/> N1800PDB	<input type="checkbox"/> N5000PDB	15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ECONOSORB™						
<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

Manufacture and shipping point: TIGG Corporation, 2540 Pangum Road, Huber Springs, AR 72543, 501-362-8652, Fax: 501-362-3870

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, high oxygen concentrations and other oxidants to form heat. An increase in heat is not recommended with these materials.

CAUTION: High concentrations of volatile hydrocarbons and low flow rates may be detrimental to the carbon. The effect may be minimized by preheating the carbon with water. This is accomplished by flooding and draining the unit with water.

CAUTION: If tanks, vessels, pipes or other equipment is to be used in conjunction with this unit, the design and construction of the system must be such that it will not be subjected to excessive pressure and to avoid the risk of explosion. Check the carbon bed for any voids or channels. Check the carbon bed for any voids or channels. Check the carbon bed for any voids or channels.

CAUTION: In the event the unit is connected to a storage tank or other source of compressed gas, it may be necessary to install a flow indicator in the connecting line. This device should be installed in the connecting line.

CAUTION: When using this unit under normal conditions, the unit should be inspected for leaks and other damage. If any damage is found, the unit should be replaced or repaired. Do not use the unit if it is damaged or if it is not safe to use.

CAUTION: Do not use the unit if it is damaged or if it is not safe to use.

800-925-0011

1.6 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
646	Stopwatch	12-May-21	12-Nov-21
857	Digital Temperature Reader	06-May-21	06-Nov-21
920	Thermocouple	06-May-21	06-Nov-21
815	Digital Manometer	08-Dec-20	08-Dec-21
613	Barometer	07-Dec-20	07-Dec-21
183	Pitot	18-Mar-21	18-Mar-2022 Visually inspected On-Site before use
928	Balance		Response Check with SEMA Site Mass
125669	SKC PCXR Sampling Pump (Airmet)	25-Nov-20	25-Nov-21
ML 520- 24	Mesa Labs Defender DryCal Mass Flowmeter	15-Jul-21	15-Jul-22
946	Combustion Analyzer	1-Sep-21	01-Mar-22
708	Gas Meter	22-Feb-21	22-Feb-22
Gas Mixtures used for Analyser Span Response			
Conc.	Mixture	Cylinder No.	Expiry Date
100 ppm	Nitric Oxide	ALTF 3709	09-Aug-23
100 ppm	Total Oxide Of Nitrogen In Nitrogen		
100 ppm	Sulphur Dioxide In Nitrogen		

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 15 mg/m³ which was compliant with the EPL limit of 220 mg/m³. The styrene mass emission rate (MER) was less than 0.0055 grams per second (g/s).
- The average benzene MER (reported as benzene) was less than 6.6 X 10⁻⁵ g/s;
- The average total VOC MER (reported as n-propane) was 0.0035 g/s;
- The average emission concentration of Oxides of Nitrogen (NO_x) (expressed as nitrogen dioxide (NO₂)) was 2.0 mg/m³. The NO_x MER was 0.0007-g/s.
- The average PM₁₀ emission concentration was 0.73 mg/m³. The PM₁₀ MER was 0.0003 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.

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS



Peter Stephenson
 Stephenson Environmental Management Australia
 PO Box 6398
 SILVERWATER NSW 1811

Lab. Reference: 2021-4972

Samples analysed as received

SAMPLE ORIGIN: Project No: 7174; Sample ID: 728227;8

DATE OF INVESTIGATION: 18/10/2021

DATE RECEIVED: 19/10/21

ANALYSIS REQUIRED: Volatile Organic Compound

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.

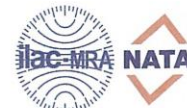
Increment and total pagination can be seen on the following pages.

Martin Mazereeuw

Manager

Date: 20/10/21

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 ABN 81 913 830 179



Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing



SafeWork NSW



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

Client: Stephenson
Sample ID: 728227

Date Sampled 18/10/2021
Date Analysed 18/10/2021
Reference Number 2021-4972-1

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	<LOQ	<LOQ	39	Benzene	71-43-2	<LOQ	<LOQ
2	n-Pentane	109-66-0	<LOQ	<LOQ	40	Ethylbenzene	100-41-4	<LOQ	<LOQ
3	2-Methylpentane	107-83-5	<LOQ	<LOQ	41	Isopropylbenzene	98-82-8	<LOQ	<LOQ
4	3-Methylpentane	96-14-0	<LOQ	<LOQ	42	1,2,3-Trimethylbenzene	526-73-8	<LOQ	<LOQ
5	Cyclopentane	287-92-3	<LOQ	<LOQ	43	1,2,4-Trimethylbenzene	95-63-6	<LOQ	<LOQ
6	Methylcyclopentane	96-37-7	<LOQ	<LOQ	44	1,3,5-Trimethylbenzene	108-67-8	<LOQ	<LOQ
7	2,3-Dimethylpentane	565-59-3	<LOQ	<LOQ	45	Styrene	100-42-5	80	<LOQ
8	n-Hexane	110-54-3	<LOQ	<LOQ	46	Toluene	108-88-3	<LOQ	<LOQ
9	3-Methylhexane	589-34-4	<LOQ	<LOQ	47	p-Xylene &/or m-Xylene	106-42-6 108-38-3	<LOQ	<LOQ
10	Cyclohexane	110-82-7	<LOQ	<LOQ	48	o-Xylene	95-47-6	<LOQ	<LOQ
11	Methylcyclohexane	108-87-2	<LOQ	<LOQ	Ketones (LOQ #49, #54 & #55 = 5µg/c/s; #50, #51, #52 & #53 = 25µg/c/s)				
12	2,2,4-Trimethylpentane	540-84-1	<LOQ	<LOQ	49	Acetone	67-64-1	22	<LOQ
13	n-Heptane	142-82-5	<LOQ	<LOQ	50	Acetoin	513-86-0	<LOQ	<LOQ
14	n-Octane	111-65-9	<LOQ	<LOQ	51	Diacetone alcohol	123-42-2	<LOQ	<LOQ
15	n-Nonane	111-84-2	<LOQ	<LOQ	52	Cyclohexanone	108-94-1	<LOQ	<LOQ
16	n-Decane	124-18-5	<LOQ	<LOQ	53	Isophorone	78-59-1	<LOQ	<LOQ
17	n-Undecane	1120-21-4	<LOQ	<LOQ	54	Methyl ethyl ketone (MEK)	78-93-3	<LOQ	<LOQ
18	n-Dodecane	112-40-3	<LOQ	<LOQ	55	Methyl isobutyl ketone (MIBK)	108-10-1	<LOQ	<LOQ
19	n-Tridecane	629-50-5	<LOQ	<LOQ	Alcohols (LOQ = 25µg/compound/section)				
20	n-Tetradecane	629-59-4	<LOQ	<LOQ	56	Ethyl alcohol	64-17-5	<LOQ	<LOQ
21	α-Pinene	80-56-8	<LOQ	<LOQ	57	n-Butyl alcohol	71-36-3	<LOQ	<LOQ
22	β-Pinene	127-91-3	<LOQ	<LOQ	58	Isobutyl alcohol	78-83-1	<LOQ	<LOQ
23	D-Limonene	138-86-3	<LOQ	<LOQ	59	Isopropyl alcohol	67-63-0	<LOQ	<LOQ
Chlorinated hydrocarbons (LOQ = 5µg/compound/section)					60	2-Ethyl hexanol	104-76-7	<LOQ	<LOQ
24	Dichloromethane	75-09-2	<LOQ	<LOQ	61	Cyclohexanol	108-93-0	<LOQ	<LOQ
25	1,1-Dichloroethane	75-34-3	<LOQ	<LOQ	Acetates (LOQ = 25µg/compound/section)				
26	1,2-Dichloroethane	107-06-2	<LOQ	<LOQ	62	Ethyl acetate	141-78-6	<LOQ	<LOQ
27	Chloroform	67-66-3	<LOQ	<LOQ	63	n-Propyl acetate	109-60-4	<LOQ	<LOQ
28	1,1,1-Trichloroethane	71-55-6	<LOQ	<LOQ	64	n-Butyl acetate	123-86-4	<LOQ	<LOQ
29	1,1,2-Trichloroethane	79-00-5	<LOQ	<LOQ	65	Isobutyl acetate	110-19-0	<LOQ	<LOQ
30	Trichloroethylene	79-01-6	<LOQ	<LOQ	Ethers (LOQ = 25µg/compound/section)				
31	Carbon tetrachloride	56-23-5	<LOQ	<LOQ	66	Ethyl ether	60-29-7	<LOQ	<LOQ
32	Perchloroethylene	127-18-4	<LOQ	<LOQ	67	tert-Butyl methyl ether (tBME)	1634-04-4	<LOQ	<LOQ
33	1,1,2,2-Tetrachloroethane	79-34-5	<LOQ	<LOQ	68	Tetrahydrofuran (THF)	109-99-9	<LOQ	<LOQ
34	Chlorobenzene	108-90-7	<LOQ	<LOQ	Glycols (LOQ = 25µg/compound/section)				
35	1,2-Dichlorobenzene	95-50-1	<LOQ	<LOQ	69	PGME	107-98-2	<LOQ	<LOQ
36	1,4-Dichlorobenzene	106-46-7	<LOQ	<LOQ	70	Ethylene glycol diethyl ether	629-14-1	<LOQ	<LOQ
Miscellaneous (LOQ #37= 5µg & #38=25µg/compound/section)					71	PGMEA	108-65-6	<LOQ	<LOQ
37	Acetonitrile	75-05-8	<LOQ	<LOQ	72	Cellosolve acetate	111-15-9	<LOQ	<LOQ
38	n-Vinyl-2-pyrrolidinone	88-12-0	<LOQ	<LOQ	73	DGMEA	112-15-2	<LOQ	<LOQ
Extra compound (LOQ = 25µg/compound/section)					Extra compound (LOQ = 25µg/compound/section)				
74	Bromopropane *	106-94-5	<LOQ	<LOQ	75	Naphthalene *	91-20-3	<LOQ	<LOQ
Total VOCs (LOQ = 50µg/compound/section)					102	<LOQ			
					Worksheet check				

2021-4972

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TestSafe Australia – Chemical Analysis Branch

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Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

SW08051 0817



SafeWork NSW



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

Client: Stephenson
Sample ID: 728228

Date Sampled 18/10/2021
Date Analysed 18/10/2021
Reference Number 2021-4972-2

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	<LOQ	<LOQ	39	Benzene	71-43-2	<LOQ	<LOQ
2	n-Pentane	109-66-0	<LOQ	<LOQ	40	Ethylbenzene	100-41-4	<LOQ	<LOQ
3	2-Methylpentane	107-83-5	<LOQ	<LOQ	41	Isopropylbenzene	98-82-8	<LOQ	<LOQ
4	3-Methylpentane	96-14-0	<LOQ	<LOQ	42	1,2,3-Trimethylbenzene	526-73-8	<LOQ	<LOQ
5	Cyclopentane	287-92-3	<LOQ	<LOQ	43	1,2,4-Trimethylbenzene	95-63-6	<LOQ	<LOQ
6	Methylcyclopentane	96-37-7	<LOQ	<LOQ	44	1,3,5-Trimethylbenzene	108-67-8	<LOQ	<LOQ
7	2,3-Dimethylpentane	565-59-3	<LOQ	<LOQ	45	Styrene	100-42-5	83	<LOQ
8	n-Hexane	110-54-3	<LOQ	<LOQ	46	Toluene	108-88-3	<LOQ	<LOQ
9	3-Methylhexane	589-34-4	<LOQ	<LOQ	47	p-Xylene &/or m-Xylene	106-42-3 106-48-6	<LOQ	<LOQ
10	Cyclohexane	110-82-7	<LOQ	<LOQ	48	o-Xylene	95-47-6	<LOQ	<LOQ
11	Methylcyclohexane	108-87-2	<LOQ	<LOQ	Ketones (LOQ 849, 854 & 855 =5µg/section; 850, 851, 852 & 853 =25µg/section)				
12	2,2,4-Trimethylpentane	540-84-1	<LOQ	<LOQ	49	Acetone	67-64-1	24	<LOQ
13	n-Heptane	142-82-5	<LOQ	<LOQ	50	Acetoin	513-86-0	<LOQ	<LOQ
14	n-Octane	111-65-9	<LOQ	<LOQ	51	Diacetone alcohol	123-42-2	<LOQ	<LOQ
15	n-Nonane	111-84-2	<LOQ	<LOQ	52	Cyclohexanone	108-94-1	<LOQ	<LOQ
16	n-Decane	124-18-5	<LOQ	<LOQ	53	Isophorone	78-59-1	<LOQ	<LOQ
17	n-Undecane	1120-21-4	<LOQ	<LOQ	54	Methyl ethyl ketone (MEK)	78-93-3	<LOQ	<LOQ
18	n-Dodecane	112-40-3	<LOQ	<LOQ	55	Methyl isobutyl ketone (MIBK)	108-10-1	<LOQ	<LOQ
19	n-Tridecane	629-50-5	<LOQ	<LOQ	Alcohols (LOQ = 25µg/compound/section)				
20	n-Tetradecane	629-59-4	<LOQ	<LOQ	56	Ethyl alcohol	64-17-5	<LOQ	<LOQ
21	α-Pinene	80-56-8	<LOQ	<LOQ	57	n-Butyl alcohol	71-36-3	<LOQ	<LOQ
22	β-Pinene	127-91-3	<LOQ	<LOQ	58	Isobutyl alcohol	78-83-1	<LOQ	<LOQ
23	D-Limonene	138-86-3	<LOQ	<LOQ	59	Isopropyl alcohol	67-63-0	<LOQ	<LOQ
Chlorinated hydrocarbons (LOQ = 5µg/compound/section)					60	2-Ethyl hexanol	104-76-7	<LOQ	<LOQ
24	Dichloromethane	75-09-2	<LOQ	<LOQ	61	Cyclohexanol	108-93-0	<LOQ	<LOQ
25	1,1-Dichloroethane	75-34-3	<LOQ	<LOQ	Acetates (LOQ = 25µg/compound/section)				
26	1,2-Dichloroethane	107-06-2	<LOQ	<LOQ	62	Ethyl acetate	141-78-6	<LOQ	<LOQ
27	Chloroform	67-66-3	<LOQ	<LOQ	63	n-Propyl acetate	109-60-4	<LOQ	<LOQ
28	1,1,1-Trichloroethane	71-55-6	<LOQ	<LOQ	64	n-Butyl acetate	123-86-4	<LOQ	<LOQ
29	1,1,2-Trichloroethane	79-00-5	<LOQ	<LOQ	65	Isobutyl acetate	110-19-0	<LOQ	<LOQ
30	Trichloroethylene	79-01-6	<LOQ	<LOQ	Ethers (LOQ = 25µg/compound/section)				
31	Carbon tetrachloride	56-23-5	<LOQ	<LOQ	66	Ethyl ether	60-29-7	<LOQ	<LOQ
32	Perchloromethylene	127-18-4	<LOQ	<LOQ	67	tert-Butyl methyl ether (tBME)	1634-04-4	<LOQ	<LOQ
33	1,1,2,2-Tetrachloroethane	79-34-5	<LOQ	<LOQ	68	Tetrahydrofuran (THF)	109-99-9	<LOQ	<LOQ
34	Chlorobenzene	108-90-7	<LOQ	<LOQ	Glycols (LOQ = 25µg/compound/section)				
35	1,2-Dichlorobenzene	95-50-1	<LOQ	<LOQ	69	PGME	107-98-2	<LOQ	<LOQ
36	1,4-Dichlorobenzene	106-46-7	<LOQ	<LOQ	70	Ethylene glycol diethyl ether	629-14-1	<LOQ	<LOQ
Miscellaneous (LOQ #37 = 5µg & #38 = 25µg/compound/section)					71	PGMEA	108-65-6	<LOQ	<LOQ
37	Acetonitrile	75-05-8	<LOQ	<LOQ	72	Cellosolve acetate	111-15-9	<LOQ	<LOQ
38	n-Vinyl-2-pyrrolidinone	88-12-0	<LOQ	<LOQ	73	DGMEA	112-15-2	<LOQ	<LOQ
Extra compound (LOQ = 25µg/compound/section)					Extra compound (LOQ = 25µg/compound/section)				
74	Bromopropane *	106-94-3	<LOQ	<LOQ	75	Naphthalene *	91-20-3	<LOQ	<LOQ
Total VOCs (LOQ = 50µg/compound/section)			107	<LOQ	Worksheet check				2021-4972

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TestSafe Australia – Chemical Analysis Branch

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Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

SA/08061 0817

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

All compounds (numbered 1-73) that are reported in the analysis are covered within the scope of NATA accreditation. Any additional compounds annotated with * are not covered by NATA accreditation.

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

Limit of Quantitation (LOQ) : 5µg/section; 25µg/section for oxygenated hydrocarbons except acetone, MEK and MIBK at 5µg/section and aromatic hydrocarbons at 1µg/section.

Method Description : Volatile organic compounds were trapped from the workplace air onto charcoal tubes by the use of a personal air monitoring pump. The volatile organic compounds were desorbed from the charcoal in the laboratory with CS₂. An aliquot of the desorbant was analysed by 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. The measurement uncertainty relates to the analysis of the analyte on the sampling device and does not take into consideration the sampling parameters such as pump flowrate, time, temperature and pressure. The measurement of uncertainty estimates are available upon request.

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