



Stephenson

Environmental Management Australia

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EMISSION TEST REPORT (ETR) No. 6016/V3/S25186A/18

STYRENE SCRUBBER EFFICIENCY MONITORING

ROCBOLT RESINS PTY LIMITED

SMEATON GRANGE, NSW 2567

PROJECT No.: 6016/V3/S25186A/18

DATE OF SURVEY: 3 DECEMBER 2018

DATE OF ISSUE: 7 DECEMBER 2018

DATE OF V2 ISSUE: 10 DECEMBER 2018

DATE OF V3* ISSUE: 13 DECEMBER 2018

*Refer Section 1.2.



NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

EMISSION TEST REPORT NO. 6016/V3/S25186A/18

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:	6016/V3/S25186A/18
Test Date:	3 December 2018
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 and 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>NATA Laboratory Analysis By: NATA Accreditation No. & Report No.</i>
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, ETR No. 6016
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, ETR No. 6016
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, ETR No. 6016
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, Accreditation No. 15043, ETR No. 6016
Particulate Matter less than 10 microns	NSW OM-5, USEPA M201A	SEMA, Accreditation No. 15043, Particle Test Report No. 2114
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 6016
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 6016
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 6016
Volatile Organic Compounds (styrene, Benzene, total as n-Propane)	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No. 2018-6227
Volumetric Flowrate	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, ETR No. 6016

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.

Re-Issue date: 13 December 2018



P W Stephenson
Managing Director

1.1 SCOPE OF WORK

The scope of work undertaken at Rocbolt Resins, Smeaton Grange, on December 3, 2018 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 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 information was sent to SEMA from Rocbolt Resins, amending the V2 description.

**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 – 3 DECEMBER 2018

Parameter	Unit of measure	Average Measured Concentrations 3 December 2018 Exhaust Stack		EPL Licence 20944 Limit
Stack temperature	°C	25		
Velocity	m/s	5		
Volumetric flow	m ³ /s	0.29		
Moisture	%	1.6		
Molecular weight dry stack gas	g/g mole	28.8		
Gas Density	kg/m ³	1.29		
Stack pressure	kPa	101.2		
Particulate matter less than 10 microns	mg/m ³	0.55		
Particulate matter less than 10 microns	g/s	0.00016		
Oxides of nitrogen	mg/m ³	25		
Oxides of nitrogen	g/s	0.0073		
		Run 1	Run 2	
Styrene (as Styrene)	mg/m ³	43.3	61.1	220
Styrene (as n-propane)	mg/m ³	18.3	25.8	
Styrene MER (as Styrene)	g/s	0.013	0.018	
Benzene (as Benzene)	mg/m ³	<0.18	<0.18	
Benzene MER (as Benzene)	g/s	<5.3 X 10 ⁻⁵	<5.3 X 10 ⁻⁵	
Volatile Organic Compounds (as n-propane)	g/s	0.012	0.013	

Key: °C = degrees Celsius
 % = percentage
 < = less than
 EPL = Environment Protection Licence
 kg/m³ = Kilograms per cubic metre
 kPa = Kilo Pascals
 g/g mole = grams per gram mole
 m/s = metres per second
 m³/s = dry cubic metre per second 0°C and 101.3 kilopascals (kPa)
 MER = Mass Emission Rate
 mg/m³ = milligrams per cubic metre at 0°C and 101.3 kilopascals (kPa)

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"/> VHM <input type="checkbox"/> SARA
			Atm.	130		
<input type="checkbox"/> N400XP	<input type="checkbox"/> N50XP	<input type="checkbox"/> N100XP	3	130	<input type="checkbox"/> Other	<input type="checkbox"/> HSB <input type="checkbox"/> SARA
<input type="checkbox"/> N20XP			6	130		
<input type="checkbox"/> N250	<input type="checkbox"/> N100	<input type="checkbox"/> N150	6	200		
<input type="checkbox"/> N50	<input type="checkbox"/> N1200PHD	<input type="checkbox"/> N2000PHD	3	130		
<input type="checkbox"/> N1200PHD	<input type="checkbox"/> N2000PHD	<input type="checkbox"/> N4000PHD	15	180		
<input type="checkbox"/> N750PDB	<input type="checkbox"/> N1200PDB	<input type="checkbox"/> N1500PDB	15	180		
<input type="checkbox"/> N2500PDB	<input type="checkbox"/> N4000PDB	<input type="checkbox"/> N5000PDB				
<input type="checkbox"/> NB15	<input type="checkbox"/> NB20					

ECONO\$ORB			
<input type="checkbox"/> Econo V	<input type="checkbox"/> EVP2000	<input type="checkbox"/> EV3000	<input type="checkbox"/> EV5000
<input type="checkbox"/> EVP1000	<input type="checkbox"/> EV2000		
<input type="checkbox"/> EV1000			
<input type="checkbox"/> Other			

CAUTION: VHM activated carbon can reduce oxygen in confined spaces. Use low oxygen safety procedures when entering atmosphere.

CAUTION: Unless unit has designated lifting tags, handle from bottom only.

Technical or commercial inquiries:
TIGG Corporation
1 Wilson Avenue
Oskaloosa, IA 52571
800-925-0011 or 724-703-3001
email: info@tigg.com

Manufacture and shipping point:
TIGG Corporation
2540 Pangburn Road
Haber Springs, AR 72543
501-362-8600
Fax: 501-362-3471

WARRANTY:
TIGG Corporation warrants this assembly to be in accordance with its published specifications. Use in the absence of these specifications and conditions of use, no other express or implied warranty is made 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 agents such as strong oxidizers, bleaches, high-temperature solvents and other oxidizing agents. Do not use activated carbon in the presence of these materials.

CAUTION: High concentrations of hydrocarbon vapors may cause a fire or explosion. Do not use activated carbon in the presence of these materials.

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800-925-0011

1.6 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
708	Gas Meter	21-Mar-18	21-Mar-19
647	Stopwatch	16-Jul-18	16-Jan-19
858	Digital Temperature Reader	13-Jul-18	13-Jan-19
920	Thermocouple	13-Jul-18	13-Jan-19
916	Nozzle PM10 Head	16-Jan-18	16-Jan-19
815	Digital Manometer	07-Feb-18	07-Feb-19
613	Barometer	05-Feb-18	05-Feb-19
723	Pitot	24-May-18	24-May-2019 Visually inspected On-Site before use
928	Balance		Response Check with SEMA Site Mass
753	Personal Sampler	07-May-18	07-May-19
764	TSI THERMAL MASS FLOWMETER	06-Nov-18	06-May-19
946	combustion analyzer	24-Jul-18	24-Jan-19
929	Calibrated Site Mass	21-Mar-18	21-Mar-19
Gas Mixtures used for Analyser Span Response			
Conc.	Mixture	Cylinder No.	Expiry Date
400 ppm 400 ppm 401 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB6150	05-May-20
262 ppm 263 ppm 249 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB 4441	23-Jun-21
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 discharge sides of the dry carbon scrubbing units at the Rocbolt Resins manufacturing facility with the following result:

- The average Styrene emission concentration reported as Styrene 52.2 mg/m³ which was compliant with the EPL limit of 220 mg/m³;
- The average benzene emission mass emission rate reported as benzene was less than 5.3 X 10⁻⁵ g/s;
- The average total VOC mass emission rate reported as n-propane was 0.013 g/s;
- The average emission concentration of Oxides of Nitrogen (NO_x) (expressed as nitrogen dioxide (NO₂)) was 25 mg/m³. This emission measurement result, however may have been influenced by the number of diesel powered trucks that unload directly in front of this dry scrubbing unit. The only combustion source that would generate NO_x on the Rocbolt Resins site was the oxy acetylene welding station in the workshop;
- The average Particulate Matter less than 10 microns (PM₁₀) emission concentration was 0.55 mg/m³;
- 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

**Stephenson**

Environmental Management Australia

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Particle Test Report No. 2114

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Rocbolt Resins Pty Limited
	Contact:	Andrew Sykes
	Address:	40-44 Anzac Avenue, Smeaton Grange, NSW 2567
	Telephone:	02 4647 8388
	Email:	Rasykes@rocboltresins.com.au
	Project Number:	6016/S25186/18
	Analysis Requested:	Gravimetric - OM-5
	Chain of Custody Number	S25244
	Date Analysis Completed:	5 December 2018
	No. of Samples Tested:	1
	Sample Locations:	Stack
	Sample ID Nos.:	727297
	Filter ID Nos.:	15054

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NATA accredited laboratory number 15043.
Accredited for Compliance with ISO/IEC 17025.

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*
TSP AS4323.2-1995 (R2014)

Deviations from Test Methods Nil

Issue Date
5 December 2018



Jay Weber
Testing Supervisor

Gravimetric Results – Test Report No. 2114

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Stack R1 PM ₁₀	727297	15054	3/12/2018	5/12/2018	0.00040

Key:
g = grams



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

Lab. Reference: 2018-6227

SAMPLE ORIGIN: Project 6016

DATE OF INVESTIGATION: 03/12/2018

DATE RECEIVED: 4/12/18

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: 4/12/18

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Accreditation No. 3726

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SafeWork NSW

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

Client : Jay Weber

Date Sampled : 3-Dec-2018

Sample ID : 727298

Reference Number le : 2018-6227-1

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	98-82-8	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	42	196
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	106-42-1 & 106-38-1	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 #49, #54 & #55 = 5µg/c/s; #50, #51, #52 & #53 = 25µg/c/s)				
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	ND	151
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	Alcohols (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
Chlorinated hydrocarbons (LOQ = 5µg/compound/section)					60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	75-34-3	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	71-55-6	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	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 (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	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 #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
Total VOCs (LOQ = 50µg/compound/section)			ND	347	Worksheet check			yes	yes

2018-6227.xlsx

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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 : Jay Weber
Sample ID : 727299

Date Sampled : 3-Dec-2018
Reference Number : 2018-6227-2

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back 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	98-82-8	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	24	312
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	106-42-6 106-38-1	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 #49, #54 & #55 = 5µg/c/s; #50, #51, #52 & #53 = 25µg/c/s)				
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	76	48
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	Alcohols (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
Chlorinated hydrocarbons (LOQ = 5µg/compound/section)					60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	75-34-3	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	71-55-6	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	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 (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	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 #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
Total VOCs (LOQ = 50µg/compound/section)			136	360	Worksheet check			yes	yes

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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 : Jay Weber

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 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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