

## TECHNICAL MEMORANDUM

**DATE** 19 December 2019

**Reference No.** 1667000-184-M Rev0

**TO** Barro Group Pty Ltd

**FROM** Golder Associates

**EMAIL** cvanbrink@golder.com.au

### BARRO SUNSHINE LANDFILL – VOC RESULTS BY EVACUATED SUMMA CANISTER

Barro Group Pty Ltd (Barro) engaged Golder Associates (Golder) to undertake boundary monitoring for volatile organic compounds (VOCs) at 2 locations along the Barro Sunshine Landfill (the site) boundary following the identification of a hotspot in Cell 5 North. The following technical memorandum presents the results from the samples taken 12 and 15 December 2019.

#### Sampling Location

Monitoring for VOCs was undertaken at two locations using summa canisters, located near the western boundary (“West”) and northern boundary (“North”). These locations were chosen to best represent ambient air quality conditions at neighbouring residential properties. Details of the monitoring locations and corresponding siting assessment against criteria contained in AS3580.10.1 are presented in Table 1.

**Table 1: Monitoring locations – VOCs by evacuated canister**

Siting requirements (AS 3580.1.1)	Location ID	
	West	North
Co-ordinates (AMG)	308579, 5820432	3087310, 5820691
Clear sky angle 120°	✓	✓
Unrestricted air flow of 270° around sample inlet or 180° if inlet is on side of building	✓	✓
Height above ground to probe 2 m – 15 m	✓	✓
≥2 m from road	✓	✓
10 m from any object with a height exceeding 2 m below the height of sample inlet	X*	X*
No extraneous sources nearby	✓	✓

NOTE: \* trees are located approximately 8 meters from the monitoring locations and are situated on the far side of the monitor to the landfill

The location of the North and West summa canisters does not meet all the siting criteria contained in AS3580.10.1 due to trees located near the site boundary. The presence of nearby trees is a common non-compliance for ambient air quality monitoring sites, however for the purpose of the monitoring it is considered satisfactory.

## Sampling Methodology

The sampling for VOCs was in accordance with Golder Associates Test Method C9 “*Canister (Evacuated) Sampling for VOC and Reduced Sulphur compounds: In Ambient Air and Source Emissions*”.

Sampling was undertaken by collecting whole air samples in electro-polished (SUMMA) stainless steel canisters fitted with a flow restricting device. 6L canisters were used to sample a 24-hour period. The canister is under negative pressure and when opened, slowly draws a whole air sample into the canister. The canister is closed at the end of the monitoring period, while still under a negative pressure.

Canisters were sent to SGS (NATA Accreditation No. 2562) for analysis by Gas Chromatography / Mass Spectrometry (GC/MS) in accordance with USEPA Method TO-15.

The uncertainty varies with the level of component detected, SGS have report a range of uncertainty between 25.5% and 47.4%.

## Results

Volatile organic compound results above the limit of reporting (LOR) for the samples taken on the 12 and 15 December 2019 and are presented in Table 2. A complete list of volatile organic compound analysed are presented in Appendix A.

**Table 2: Results: VOCs by evacuated canister**

Sample No	19-1774	19-1775	19-1776	19-1777
Location	West	North	West	North
Sample start	12/12/2019 16:16	12/12/2019 16:31	15/12/2019 11:17	15/12/2019 11:11
Sample end	13/12/2019 16:12	13/12/2019 16:24	15/12/2019 11:51	15/12/2019 11:43
VOCs	Concentration $\mu\text{g}/\text{m}^3$	Concentration $\mu\text{g}/\text{m}^3$	Concentration $\mu\text{g}/\text{m}^3$	Concentration $\mu\text{g}/\text{m}^3$
Freon 11	1.6	<1.4	2.9	<1.5
Freon 12	2.7	2.9	5.6	2.9
Toluene	<2.8	<2.8	3.5	<2.8

The National Environment Protection (Air Toxics) Measure (NEMP) provides monitoring investigation level (MIL) values to assess air toxics monitoring data. The MIL value for toluene is 1000 parts per billion (ppb) (24-hour average). Sample (19-1776) collected on the western boundary 15 December 2019 has a reported toluene concentration of  $3.5 \mu\text{g}/\text{m}^3$  (0.85 ppb) which is significantly below the NEMP MIL level.

There are currently no state or national health criteria for assessment of Freon 11 or Freon 12 in ambient air.

**Important information relating to this report**

Your attention is drawn to the document, *Important Information Relating to this Report* (LEG04, RL2), which is contained in Appendix B. The statements presented in this document are intended to advise you of what your realistic expectations of this letter should be. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this letter are aware of the responsibilities each assumes in so doing. We would be pleased to answer any questions the reader may have regarding this document.



Carl Van Brink  
*Environmental Scientist*



Mark Tulau  
*Senior Air Quality Specialist*

CVB/MT/cvb

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**APPENDIX A**

**Lab Results**

Chartered Chemists

18-Dec-2019

**REPORT NUMBER: M191778**

Site/Client Ref: 1667000

Order No: 24658

**Golder Associates**

**Building 7 Botanicca Corporate Park  
570-588 Swan Street  
Richmond  
Victoria 3121  
Attention: Carl Van Brink**

## CERTIFICATE OF ANALYSIS

**SAMPLES:** Four samples were received for analysis  
**DATE RECEIVED:** 17-Dec-2019  
**DATE COMMENCED:** 17-Dec-2019  
**METHODS:** See Attached Results

**RESULTS:** Please refer to attached pages for results.

Note: Results are based on samples as received at SGS laboratories

**REPORTED BY:**



**Adam Atkinson**

Australian Chemistry Manager



NATA Accredited Laboratory Number: 2562  
Corporate Site Number: 14420  
Accredited for compliance  
with ISO/IEC 17025 - Testing.



# ANALYTICAL RESULTS

**Matrix: Canister**

**Method: TO-15.04 Receipt Vacuum / Pressure**

Units as Listed - ^^ Vacuum reported as inches of Mercury below standard atmospheric pressure

Test Started: 17-Dec-19

Analyte Name	Sampled Date	PQL	Leeder ID	2019026643	2019026644	2019026645	2019026646
			Client ID	19-1774 L4518	19-1775 L4521	19-1776 L4605	19-1777 R3465
Receipt Pressure (PSIA)	13-Dec-19		13-Dec-19	13-Dec-19	16-Dec-19	16-Dec-19	
Receipt Vacuum (inch Hg) ^^							

# ANALYTICAL RESULTS

Matrix: Canister

Method: TO-15.02 Volatile Organics (w/v)

Sample units are expressed in µg/m<sup>3</sup>

Test Started: 17-Dec-19

Analyte Name	Leeder ID Client ID	2019026643 19-1774 L4518	2019026644 19-1775 L4521	2019026645 19-1776 L4605	2019026646 19-1777 R3465	2019026647 19-1774 L4518
Acrolein		<3.3	<3.3	<3.4	<3.4	<3.3
Acrylonitrile		<8.5	<8.5	<8.7	<8.7	<8.5
tert-Amyl Methyl Ether		<2.8	<2.8	<2.9	<2.9	<2.8
Benzene		<2.4	<2.4	<2.4	<2.4	<2.4
Bromodichloromethane		<4.7	<4.7	<4.8	<4.9	<4.7
Bromoform		<5.6	<5.7	<5.8	<5.8	<5.6
Bromomethane		<4.2	<4.2	<4.4	<4.4	<4.2
1,3-Butadiene		<1.4	<1.4	<1.5	<1.5	<1.4
2-Butanone (Methyl Ethyl Ketone)		<2.4	<2.4	<2.4	<2.4	<2.4
tert-Butyl Alcohol		<2.4	<2.4	<2.4	<2.4	<2.4
n-Butylbenzene		<3.8	<3.8	<3.9	<3.9	<3.8
sec-Butylbenzene		<3.8	<3.8	<3.9	<3.9	<3.8
tert-Butylbenzene		<3.8	<3.8	<3.9	<3.9	<3.8
Carbon Tetrachloride		<4.7	<4.7	<4.8	<4.9	<4.7
Chlorobenzene		<2.8	<2.8	<2.9	<2.9	<2.8
Chloroethane		<2.8	<2.8	<2.9	<2.9	<2.8
Chloroform		<4.2	<4.2	<4.4	<4.4	<4.2
Chloromethane		<3.3	<3.3	<3.4	<3.4	<3.3
2-Chloroprene		<5.2	<5.2	<5.3	<5.3	<5.2
3-Chloropropene		<3.3	<3.3	<3.4	<3.4	<3.3
2-Chlorotoluene		<4.2	<4.2	<4.4	<4.4	<4.2
alpha-Chlorotoluene		<3.3	<3.3	<3.4	<3.4	<3.3
Cumene		<3.8	<3.8	<3.9	<3.9	<3.8
Cyclohexane		<1.9	<1.9	<1.9	<1.9	<1.9
o-Cymene		<3.8	<3.8	<3.9	<3.9	<3.8
Dibromochloromethane		<5.6	<5.7	<5.8	<5.8	<5.6
1,2-Dibromoethane (EDB)		<5.6	<5.7	<5.8	<5.8	<5.6
1,2-Dichlorobenzene		<6.1	<6.1	<6.3	<6.3	<6.1
1,3-Dichlorobenzene		<6.1	<6.1	<6.3	<6.3	<6.1
1,4-Dichlorobenzene		<6.1	<6.1	<6.3	<6.3	<6.1
1,1-Dichloroethane		<3.3	<3.3	<3.4	<3.4	<3.3
1,2-Dichloroethane		<4.7	<4.7	<4.8	<4.9	<4.7
1,1-Dichloroethene		<2.8	<2.8	<2.9	<2.9	<2.8
cis-1,2-Dichloroethene		<3.8	<3.8	<3.9	<3.9	<3.8
trans-1,2-Dichloroethene		<2.8	<2.8	<2.9	<2.9	<2.8
1,2-Dichloropropane		<8.5	<8.5	<8.7	<8.7	<8.5
cis-1,3-Dichloropropene		<2.8	<2.8	<2.9	<2.9	<2.8
trans-1,3-Dichloropropene		<3.3	<3.3	<3.4	<3.4	<3.3
Diisopropyl Ether		<3.3	<3.3	<3.4	<3.4	<3.3
1,4-Dioxane		<2.8	<2.8	<2.9	<2.9	<2.8

# ANALYTICAL RESULTS

Matrix: Canister

Method: TO-15.02 Volatile Organics (w/v)

Sample units are expressed in µg/m<sup>3</sup>

Test Started: 17-Dec-19

Analyte Name	Leeder ID Client ID	2019026643 19-1774 L4518 13-Dec-19	2019026644 19-1775 L4521 13-Dec-19	2019026645 19-1776 L4605 16-Dec-19	2019026646 19-1777 R3465 16-Dec-19	2019026647 19-1774 L4518 Duplicate
Ethyl Acetate		<3.8	<3.8	<3.9	<3.9	<3.8
Ethyl Benzene		<2.8	<2.8	<2.9	<2.9	<2.8
Ethyl tert-Butyl Ether		<2.4	<2.4	<2.4	<2.4	<2.4
4-Ethyltoluene		<2.8	<2.8	<2.9	<2.9	<2.8
Freon 11		1.6	<1.4	2.9	<1.5	1.6
Freon 113		<4.7	<4.7	<4.8	<4.9	<4.7
Freon 114		<1.4	<1.4	<1.5	<1.5	<1.4
Freon 12		2.7	2.9	5.6	2.9	2.7
Heptane		<3.3	<3.3	<3.4	<3.4	<3.3
Hexachlorobutadiene		<9.4	<9.4	<9.7	<9.7	<9.4
Hexane		<2.8	<2.8	<2.9	<2.9	<2.8
2-Hexanone		<2.8	<2.8	<2.9	<2.9	<2.8
m,p-Xylene		<6.1	<6.1	<6.3	<6.3	<6.1
Methyl Methacrylate		<3.3	<3.3	<3.4	<3.4	<3.3
Methyl tert-butyl ether		<2.8	<2.8	<2.9	<2.9	<2.8
4-Methyl-2-pentanone		<2.8	<2.8	<2.9	<2.9	<2.8
Naphthalene		<9.9	<9.9	<10	<10	<9.9
2-Propanol		<47	<47	<48	<49	<47
Propene		<4.7	<4.7	<4.8	<4.9	<4.7
Propylbenzene		<3.3	<3.3	<3.4	<3.4	<3.3
Styrene		<2.8	<2.8	<2.9	<2.9	<2.8
1,1,1,2-Tetrachloroethane		<4.7	<4.7	<4.8	<4.9	<4.7
1,1,2,2-Tetrachloroethane		<3.3	<3.3	<3.4	<3.4	<3.3
Tetrachloroethene		<5.2	<5.2	<5.3	<5.3	<5.2
Tetrahydrofuran		<1.9	<1.9	<1.9	<1.9	<1.9
Toluene		<2.8	<2.8	3.5	<2.9	<2.8
1,2,4-Trichlorobenzene		<17	<17	<17	<17	<17
1,1,1-Trichloroethane		<3.8	<3.8	<3.9	<3.9	<3.8
1,1,2-Trichloroethane		<3.8	<3.8	<3.9	<3.9	<3.8
Trichloroethene		<4.2	<4.2	<4.4	<4.4	<4.2
1,2,4-Trimethylbenzene		<3.8	<3.8	<3.9	<3.9	<3.8
1,3,5-Trimethylbenzene		<2.8	<2.8	<2.9	<2.9	<2.8
2,2,4-Trimethylpentane		<4.2	<4.2	<4.4	<4.4	<4.2
Vinyl Acetate		<3.3	<3.3	<3.4	<3.4	<3.3
Vinyl Bromide		<3.8	<3.8	<3.9	<3.9	<3.8
Vinyl Chloride		<1.9	<1.9	<1.9	<1.9	<1.9
o-Xylene		<2.8	<2.8	<2.9	<2.9	<2.8



# ANALYTICAL RESULTS

**Matrix: Canister**

**Method: TO-15.02 Volatile Organics (w/v)**

Sample units are expressed in  $\mu\text{g}/\text{m}^3$

Test Started: 17-Dec-19

Analyte Name	Sampled Date	Leeder ID
		Client ID
		2019026648
		Method
		Blank
		PQL
Acrolein		<1.4
Acrylonitrile		<3.6
tert-Amyl Methyl Ether		<1.2
Benzene		<1
Bromodichloromethane		<2
Bromoform		<2.4
Bromomethane		<1.8
1,3-Butadiene		<0.6
2-Butanone (Methyl Ethyl Ketone)		<1
tert-Butyl Alcohol		<1
n-Butylbenzene		<1.6
sec-Butylbenzene		<1.6
tert-Butylbenzene		<1.6
Carbon Tetrachloride		<2
Chlorobenzene		<1.2
Chloroethane		<1.2
Chloroform		<1.8
Chloromethane		<1.4
2-Chloroprene		<2.2
3-Chloropropene		<1.4
2-Chlorotoluene		<1.8
alpha-Chlorotoluene		<1.4
Cumene		<1.6
Cyclohexane		<0.8
o-Cymene		<1.6
Dibromochloromethane		<2.4
1,2-Dibromoethane (EDB)		<2.4
1,2-Dichlorobenzene		<2.6
1,3-Dichlorobenzene		<2.6
1,4-Dichlorobenzene		<2.6
1,1-Dichloroethane		<1.4
1,2-Dichloroethane		<2
1,1-Dichloroethene		<1.2
cis-1,2-Dichloroethene		<1.6
trans-1,2-Dichloroethene		<1.2
1,2-Dichloropropane		<3.6
cis-1,3-Dichloropropene		<1.2
trans-1,3-Dichloropropene		<1.4
Diisopropyl Ether		<1.4
1,4-Dioxane		<1.2

# ANALYTICAL RESULTS

**Matrix: Canister**

**Method: TO-15.02 Volatile Organics (w/v)**

Sample units are expressed in  $\mu\text{g}/\text{m}^3$

Test Started: 17-Dec-19

Analyte Name	Sampled Date	Leeder ID
		Client ID
		2019026648
		Method
		Blank
		PQL
Ethyl Acetate		<1.6
Ethyl Benzene		<1.2
Ethyl tert-Butyl Ether		<1
4-Ethyltoluene		<1.2
Freon 11		<0.6
Freon 113		<2
Freon 114		<0.6
Freon 12		<0.8
Heptane		<1.4
Hexachlorobutadiene		<4
Hexane		<1.2
2-Hexanone		<1.2
m,p-Xylene		<2.6
Methyl Methacrylate		<1.4
Methyl tert-butyl ether		<1.2
4-Methyl-2-pentanone		<1.2
Naphthalene		<4.2
2-Propanol		<20
Propene		<2
Propylbenzene		<1.4
Styrene		<1.2
1,1,1,2-Tetrachloroethane		<2
1,1,2,2-Tetrachloroethane		<1.4
Tetrachloroethene		<2.2
Tetrahydrofuran		<0.8
Toluene		<1.2
1,2,4-Trichlorobenzene		<7.2
1,1,1-Trichloroethane		<1.6
1,1,2-Trichloroethane		<1.6
Trichloroethene		<1.8
1,2,4-Trimethylbenzene		<1.6
1,3,5-Trimethylbenzene		<1.2
2,2,4-Trimethylpentane		<1.8
Vinyl Acetate		<1.4
Vinyl Bromide		<1.6
Vinyl Chloride		<0.8
o-Xylene		<1.2



## QA/QC RESULTS

**Matrix: Canister**

**Method: TO-15.02 Volatile Organics (w/v)**

Quality Control Results are expressed in Percent Recovery of expected result

Test Started: 17-Dec-19

Analyte Name	Sampled Date	Leeder ID	2019026649
		Client ID	Method
	PQL	Spike	
Acrylonitrile			100
Benzene			110
1,3-Butadiene			107
Chloroform			120

**Matrix: Canister**

**Method: TO-15.02 Volatile Organics (w/v)**

Quality Control Results are expressed in Percent Recovery of expected result

Test Started: 17-Dec-19

Analyte Name	Sampled Date	Leeder ID	2019026649
		Client ID	Method
	PQL	Spike	
Tetrachloroethene			95
Trichloroethene			95
Vinyl Chloride			114

## QUALIFIERS / NOTES FOR REPORTED RESULTS

PQL	Practical Quantitation Limit
nd	Not Detected – The analyte was not detected above the reported PQL.
is	Insufficient Sample to perform this analysis.
T	Tentative identification based on computer library search of mass spectra.
NC	Not calculated and/or Results below PQL
NV	No Vacuum, Canister received above standard atmospheric pressure
nr	Not Requested for analysis.
R	Rejected Result – results for this analysis failed QC checks.
SQ	Semi-Quantitative result – quantitation based on a generic response factor for this class of analyte.
IM	Inappropriate method of analysis for this compound
U	Unable to provide Quality Control data – high levels of compounds in sample interfered with analysis of QC results.
UF	Unable to provide Quality Control data- Surrogates failed QC checks due to sample matrix effects
L	Analyte detected at a level above the linear response of calibration curve.
E	Estimated result. NATA accreditation does not cover estimated results.
C1	These compounds co-elute.
--	Parameter Not Determined
CT	Elevated concentration. Results reported from carbon tube analysis
**	Sample shows non-petroleum hydrocarbon profile

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**APPENDIX B**

**Important Information Relating To  
This Report**

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

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At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

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Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

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**Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification**