TECHNICAL MEMORANDUM

DATE 27 February 2020 1667000-206-TM-Rev0

TO Barro Group Pty Ltd,

CC

FROM Golder Associates Pty Ltd **EMAIL** mtulau@golder.com.au

BARRO SUNSHINE LANDFILL – VOLATILE ORGANIC COMPOUNDS (VOC) MONITORING RESULTS

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 sampling conducted on the 19th to 20th and 22nd to 23rd of February 2020.

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 120^0	✓	✓
Unrestricted air flow of 270^0 around sample inlet or 180^0 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	✗*	✗*
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-

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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.

Sample analysis was conducted by Gas Chromatography / Mass Spectrometry (GC/MS) in accordance with USEPA Method TO-15. The method uncertainty varies with the level of component detected and has been report between 25.5% and 47.4%.

Sampling was conducted by Golder Associates (NATA Laboratory accreditation No. 1910). Sample analysis was conducted by SGS (NATA Laboratory Accreditation No. 2562)

Results

Volatile organic compound results above the limit of reporting (LOR) for the sampling conducted on the 19th to 20th and 22nd to 23rd of February 2020 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

Site	West	North	West	North
Sample No	20-367	20-368	20-371	20-372
Sample start	19/02/2020	19/02/2020	22/02/2020	22/02/2020
Sample end	20/02/2020	20/02/2020	23/02/2020	23/02/2020
Compound	**Concentration µg/m^3**			
Freon 11	<1.2	2.5	<1.5	1.7
Freon 12	2.3	4.5	2.8	2.8

All samples collected reported freon 12 concentrations above the limit of reporting (LOR). Samples 20-368 and 20-372 also reported a concentration above the LOR for freon 11.

The *State Environment Protection Policy (Air Quality Management)* (SEPP(AQM)) sets out statutory requirements for managing and assessing air emissions in Victoria. The aim of the SEPP(AQM) is to ensure that prescribed air quality objectives are met and to protect the beneficial uses of the air environment. Schedule B of the SEPP(AQM) lists intervention levels which are used in the assessment of local or neighbourhood air monitoring data. Schedule B specifies criteria as a 1-hour average and are therefore, not directly comparable to the monitored concentrations collected over a 24-hour period. Twenty-four hour criteria have been derived using the EPA Victoria recommended method outlined in EPA Victoria Publication 1551.

There are currently no Victorian or National ambient air quality objectives for freon 11 and freon 12.

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.

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CVB/MDT/cvb

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APPENDIX A

Lab Reports

Appendix A - Volatile Organic compounds

Location	West	North	West	North
Sample No	20-367	20-368	20-371	20-372
Start date	19/02/2020	19/02/2020	22/02/2020	22/02/2020
End date	20/02/2020	20/02/2020	23/02/2020	23/02/2020
Compound	**Concentration (µg/m^3)**		**Concentration (µg/m^3)**	
Acrolein	<2.8	<3.2	<3.4	<2.8
Acrylonitrile	<7.2	<8.1	<8.8	<7.3
tert-Amyl Methyl Ether	<2.4	<2.7	<2.9	<2.4
Benzene	<2	<2.3	<2.5	<2
Bromodichloromethane	<4	<4.5	<4.9	<4.1
Bromoform	<4.8	<5.4	<5.9	<4.9
Bromomethane	<3.6	<4.1	<4.4	<3.7
1,3-Butadiene	<1.2	<1.4	<1.5	<1.2
2-Butanone (Methyl Ethyl Ketone)	<2	<2.3	<2.5	<2
tert-Butyl Alcohol	<2	<2.3	<2.5	<2
n-Butylbenzene	<3.2	<3.6	<3.9	<3.2
sec-Butylbenzene	<3.2	<3.6	<3.9	<3.2
tert-Butylbenzene	<3.2	<3.6	<3.9	<3.2
Carbon Tetrachloride	<4	<4.5	<4.9	<4.1
Chlorobenzene	<2.4	<2.7	<2.9	<2.4
Chloroethane	<2.4	<2.7	<2.9	<2.4
Chloroform	<3.6	<4.1	<4.4	<3.7
Chloromethane	<2.8	<3.2	<3.4	<2.8
2-Chloroprene	<4.4	<5	<5.4	<4.5
3-Chloropropene	<2.8	<3.2	<3.4	<2.8
2-Chlorotoluene	<3.6	<4.1	<4.4	<3.7
alpha-Chlorotoluene	<2.8	<3.2	<3.4	<2.8
Cumene	<3.2	<3.6	<3.9	<3.2
Cyclohexane	<1.6	<1.8	<2	<1.6
o-Cymene	<3.2	<3.6	<3.9	<3.2
Dibromochloromethane	<4.8	<5.4	<5.9	<4.9
1,2-Dibromoethane (EDB)	<4.8	<5.4	<5.9	<4.9
1,2-Dichlorobenzene	<5.2	<5.9	<6.4	<5.3
1,3-Dichlorobenzene	<5.2	<5.9	<6.4	<5.3
1,4-Dichlorobenzene	<5.2	<5.9	<6.4	<5.3
1,1-Dichloroethane	<2.8	<3.2	<3.4	<2.8
1,2-Dichloroethane	<4	<4.5	<4.9	<4.1
1,1-Dichloroethene	<2.4	<2.7	<2.9	<2.4
cis-1,2-Dichloroethene	<3.2	<3.6	<3.9	<3.2
trans-1,2-Dichloroethene	<2.4	<2.7	<2.9	<2.4
1,2-Dichloropropane	<7.2	<8.1	<8.8	<7.3
cis-1,3-Dichloropropene	<2.4	<2.7	<2.9	<2.4
trans-1,3-Dichloropropene	<2.8	<3.2	<3.4	<2.8
Diisopropyl Ether	<2.8	<3.2	<3.4	<2.8
1,4-Dioxane	<2.4	<2.7	<2.9	<2.4
Ethyl Acetate	<3.2	<3.6	<3.9	<3.2
Ethyl Benzene	<2.4	<2.7	<2.9	<2.4
Ethyl tert-Butyl Ether	<2	<2.3	<2.5	<2
4-Ethyltoluene	<2.4	<2.7	<2.9	<2.4

Appendix A - Volatile Organic compounds

Location	West	North	West	North
Sample No	20-367	20-368	20-371	20-372
Start date	19/02/2020	19/02/2020	22/02/2020	22/02/2020
End date	20/02/2020	20/02/2020	23/02/2020	23/02/2020
Compound	**Concentration (µg/m^3)**		**Concentration (µg/m^3)**	
Freon 11	<1.2	2.5	<1.5	1.7
Freon 113	<4	<4.5	<4.9	<4.1
Freon 114	<1.2	<1.4	<1.5	<1.2
Freon 12	2.3	4.5	2.8	2.8
Heptane	<2.8	<3.2	<3.4	<2.8
Hexachlorobutadiene	<8.1	<9	<9.8	<8.1
Hexane	<2.4	<2.7	<2.9	<2.4
2-Hexanone	<2.4	<2.7	<2.9	<2.4
m,p-Xylene	<5.2	<5.9	<6.4	<5.3
Methyl Methacrylate	<2.8	<3.2	<3.4	<2.8
Methyl tert-butyl ether	<2.4	<2.7	<2.9	<2.4
4-Methyl-2-pentanone	<2.4	<2.7	<2.9	<2.4
Naphthalene	<8.5	<9.5	<10	<8.5
2-Propanol	<40	<45	<49	<41
Propene	<4	<4.5	<4.9	<4.1
Propylbenzene	<2.8	<3.2	<3.4	<2.8
Styrene	<2.4	<2.7	<2.9	<2.4
1,1,1,2-Tetrachloroethane	<4	<4.5	<4.9	<4.1
1,1,2,2-Tetrachloroethane	<2.8	<3.2	<3.4	<2.8
Tetrachloroethene	<4.4	<5	<5.4	<4.5
Tetrahydrofuran	<1.6	<1.8	<2	<1.6
Toluene	<2.4	<2.7	<2.9	<2.4
1,2,4-Trichlorobenzene	<14	<16	<18	<15
1,1,1-Trichloroethane	<3.2	<3.6	<3.9	<3.2
1,1,2-Trichloroethane	<3.2	<3.6	<3.9	<3.2
Trichloroethene	<3.6	<4.1	<4.4	<3.7
1,2,4-Trimethylbenzene	<3.2	<3.6	<3.9	<3.2
1,3,5-Trimethylbenzene	<2.4	<2.7	<2.9	<2.4
2,2,4-Trimethylpentane	<3.6	<4.1	<4.4	<3.7
Vinyl Acetate	<2.8	<3.2	<3.4	<2.8
Vinyl Bromide	<3.2	<3.6	<3.9	<3.2
Vinyl Chloride	<1.6	<1.8	<2	<1.6
o-Xylene	<2.4	<2.7	<2.9	<2.4

Results expressed as micrograms per cubic metre of air at 0°C and 101.325 kPa
Analysis conducted by SGS (NATA Laboratory Accreditation Number 2562).
Analysis conducted on 24/02/2020, Report No M201901 and 25/02/2020, Report No M201907

APPENDIX B

Important Information Relating to 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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