



Certificate of Analysis

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Client: Watercare Services Limited	Lab No: 2217855	SUPV1
Contact: Phil Dobson	Date Received: 01-Aug-2019	
C/- Watercare Services Limited	Date Reported: 13-Dec-2019	
PO Box 107028	Quote No: 90106	
Airport Oaks	Order No: 4500135195	
Auckland 2150	Client Reference: Y-1410-AP-020	
	Submitted By: Phil Dobson	

Sample Type: Air Sampling Canister 6 Litre

Sample Name: Astrolabe [2165411.1 5362] 13-Jun-2019 2:30 pm			
Lab Number: 2217855.1			

Whole Air Sampling Volatile Compounds

Canister Sample Volume	L	0.390	-	-	-
1,1,1-Trichloroethane	ppbv	< 30 ± 4.3	-	-	-
1,1,2,2-Tetrachloroethane	ppbv	< 30 ± 3.2	-	-	-
1,1,2-Trichloroethane	ppbv	< 30 ± 3.1	-	-	-
1,1-Dichloroethane	ppbv	< 30 ± 5.2	-	-	-
1,1-Dichloroethene	ppbv	< 30 ± 6.0	-	-	-
1,2,4-Trichlorobenzene	ppbv	< 30 ± 5.2	-	-	-
1,2,4-Trimethylbenzene	ppbv	< 30 ± 3.0	-	-	-
1,2-Dibromoethane	ppbv	< 30 ± 3.7	-	-	-
1,2-Dichlorobenzene	ppbv	< 30 ± 3.3	-	-	-
1,2-Dichloroethane	ppbv	< 30 ± 6.2	-	-	-
1,2-Dichloropropane	ppbv	< 30 ± 4.7	-	-	-
1,3,5-Trimethylbenzene	ppbv	< 30 ± 2.7	-	-	-
1,3-Dichlorobenzene	ppbv	< 30 ± 3.4	-	-	-
1,4-Dichlorobenzene	ppbv	< 30 ± 3.4	-	-	-
1,4-Dioxane	ppbv	< 50 ± 14	-	-	-
2,2,4-Trimethylpentane	ppbv	< 30 ± 4.6	-	-	-
2-Butanone	ppbv	< 40 ± 5.8	-	-	-
2-Chlorotoluene	ppbv	< 30 ± 3.2	-	-	-
2-Hexanone	ppbv	< 30 ± 5.4	-	-	-
4-Ethyltoluene	ppbv	< 30 ± 3.0	-	-	-
4-Methyl-2-pentanone	ppbv	< 30 ± 6.1	-	-	-
Acetone	ppbv	< 100 ± 20	-	-	-
Acrolein	ppbv	< 30 ± 4.6	-	-	-
Allyl chloride	ppbv	< 30 ± 4.0	-	-	-
Benzene	ppbv	< 30 ± 4.1	-	-	-
Benzyl chloride	ppbv	< 30 ± 5.1	-	-	-
Bromodichloromethane	ppbv	< 30 ± 4.1	-	-	-
Bromoethene	ppbv	< 30 ± 3.9	-	-	-
Bromoform	ppbv	< 30 ± 3.6	-	-	-
Bromomethane	ppbv	1,040 ± 160	-	-	-
Carbon disulfide	ppbv	< 50 ± 7.9	-	-	-
Carbon tetrachloride	ppbv	< 30 ± 4.0	-	-	-
Chlorobenzene	ppbv	< 30 ± 2.9	-	-	-
Chloroethane	ppbv	< 30 ± 3.7	-	-	-
Chloroform	ppbv	< 30 ± 5.1	-	-	-
Chloromethane	ppbv	< 30 ± 8.4	-	-	-



Sample Type: Air Sampling Canister 6 Litre

Sample Name:	Astrolabe [2165411.1 5362] 13-Jun-2019 2:30 pm				
Lab Number:	2217855.1				
Whole Air Sampling Volatile Compounds					
cis-1,2-Dichloroethene	ppbv	< 30 ± 4.9	-	-	-
cis-1,3-Dichloropropene	ppbv	< 30 ± 5.0	-	-	-
Cyclohexane	ppbv	< 30 ± 3.3	-	-	-
Dichlorodifluoromethane	ppbv	< 30 ± 4.9	-	-	-
Dichlorotetrafluoroethane	ppbv	< 30 ± 6.4	-	-	-
Ethyl acetate	ppbv	< 30 ± 15	-	-	-
Ethylbenzene	ppbv	< 30 ± 2.6	-	-	-
Heptane	ppbv	< 30 ± 4.9	-	-	-
Hexachlorobutadiene	ppbv	< 30 ± 4.4	-	-	-
Hexane	ppbv	< 30 ± 4.9	-	-	-
Cumene (Isopropylbenzene)	ppbv	< 30 ± 2.9	-	-	-
Methyl methacrylate	ppbv	< 50 ± 8.8	-	-	-
Methyl tert-butyl ether	ppbv	< 30 ± 4.3	-	-	-
Methylene chloride	ppbv	< 150 ± 25	-	-	-
Naphthalene	ppbv	< 30 ± 5.6	-	-	-
n-Propylbenzene	ppbv	< 30 ± 3.3	-	-	-
o-Xylene	ppbv	< 30 ± 2.6	-	-	-
m,p-Xylene	ppbv	< 30 ± 5.0	-	-	-
Propene	ppbv	< 30 ± 5.4	-	-	-
Styrene	ppbv	< 30 ± 3.2	-	-	-
tert-Butyl alcohol	ppbv	< 30 ± 7.0	-	-	-
Tetrachloroethene	ppbv	< 30 ± 3.0	-	-	-
Tetrahydrofuran	ppbv	< 30 ± 4.9	-	-	-
Toluene	ppbv	< 30 ± 3.3	-	-	-
trans-1,2-Dichloroethene	ppbv	< 30 ± 5.5	-	-	-
trans-1,3-Dichloropropene	ppbv	< 30 ± 4.4	-	-	-
Trichloroethene	ppbv	< 30 ± 3.1	-	-	-
Trichlorofluoromethane	ppbv	< 30 ± 3.9	-	-	-
Trichlorotrifluoroethane	ppbv	< 30 ± 3.7	-	-	-
Vinyl acetate	ppbv	< 30 ± 6.1	-	-	-
Vinyl chloride	ppbv	< 100 ± 35	-	-	-
Whole Air Sampling Volatile Compounds ug/m3					
1,1,1-Trichloroethane	µg/m ³	< 130 ± 24	-	-	-
1,1,2,2-Tetrachloroethane	µg/m ³	< 170 ± 22	-	-	-
1,1,2-Trichloroethane	µg/m ³	< 130 ± 17	-	-	-
1,1-Dichloroethane	µg/m ³	< 100 ± 21	-	-	-
1,1-Dichloroethene	µg/m ³	< 100 ± 24	-	-	-
1,2,4-Trichlorobenzene	µg/m ³	< 180 ± 39	-	-	-
1,2,4-Trimethylbenzene	µg/m ³	< 120 ± 15	-	-	-
1,2-Dibromoethane	µg/m ³	< 180 ± 29	-	-	-
1,2-Dichlorobenzene	µg/m ³	< 150 ± 20	-	-	-
1,2-Dichloroethane	µg/m ³	< 100 ± 25	-	-	-
1,2-Dichloropropane	µg/m ³	< 110 ± 22	-	-	-
1,3,5-Trimethylbenzene	µg/m ³	< 120 ± 14	-	-	-
1,3-Dichlorobenzene	µg/m ³	< 150 ± 21	-	-	-
1,4-Dichlorobenzene	µg/m ³	< 150 ± 21	-	-	-
1,4-Dioxane	µg/m ³	< 170 ± 49	-	-	-
2,2,4-Trimethylpentane	µg/m ³	< 110 ± 22	-	-	-
2-Butanone	µg/m ³	< 100 ± 17	-	-	-
2-Chlorotoluene	µg/m ³	< 130 ± 17	-	-	-
2-Hexanone	µg/m ³	< 100 ± 22	-	-	-
4-Ethyltoluene	µg/m ³	< 120 ± 15	-	-	-
4-Methyl-2-pentanone	µg/m ³	< 100 ± 25	-	-	-
Acetone	µg/m ³	< 300 ± 47	-	-	-

Sample Type: Air Sampling Canister 6 Litre

Sample Name:	Astrolabe [2165411.1 5362] 13-Jun-2019 2:30 pm				
Lab Number:	2217855.1				
Whole Air Sampling Volatile Compounds ug/m3					
Acrolein	µg/m ³	< 60 ± 11	-	-	-
Allyl chloride	µg/m ³	< 80 ± 13	-	-	-
Benzene	µg/m ³	< 80 ± 13	-	-	-
Benzyl chloride	µg/m ³	< 130 ± 27	-	-	-
Bromodichloromethane	µg/m ³	< 160 ± 27	-	-	-
Bromoethene	µg/m ³	< 110 ± 17	-	-	-
Bromoform	µg/m ³	< 300 ± 38	-	-	-
Bromomethane	µg/m ³	4,050 ± 620	-	-	-
Carbon disulfide	µg/m ³	< 150 ± 25	-	-	-
Carbon tetrachloride	µg/m ³	< 150 ± 25	-	-	-
Chlorobenzene	µg/m ³	< 110 ± 14	-	-	-
Chloroethane	µg/m ³	< 70 ± 10	-	-	-
Chloroform	µg/m ³	< 120 ± 25	-	-	-
Chloromethane	µg/m ³	< 50 ± 18	-	-	-
cis-1,2-Dichloroethene	µg/m ³	< 100 ± 20	-	-	-
cis-1,3-Dichloropropene	µg/m ³	< 110 ± 23	-	-	-
Cyclohexane	µg/m ³	< 90 ± 12	-	-	-
Dichlorodifluoromethane	µg/m ³	< 120 ± 24	-	-	-
Dichlorotetrafluoroethane	µg/m ³	< 170 ± 45	-	-	-
Ethyl acetate	µg/m ³	< 90 ± 54	-	-	-
Ethylbenzene	µg/m ³	< 110 ± 12	-	-	-
Heptane	µg/m ³	< 100 ± 20	-	-	-
Hexachlorobutadiene	µg/m ³	< 300 ± 47	-	-	-
Hexane	µg/m ³	< 90 ± 18	-	-	-
Cumene (Isopropylbenzene)	µg/m ³	< 120 ± 14	-	-	-
Methyl methacrylate	µg/m ³	< 200 ± 36	-	-	-
Methyl tert-butyl ether	µg/m ³	< 90 ± 16	-	-	-
Methylene chloride	µg/m ³	< 500 ± 87	-	-	-
Naphthalene	µg/m ³	< 130 ± 29	-	-	-
n-Propylbenzene	µg/m ³	< 120 ± 16	-	-	-
o-Xylene	µg/m ³	< 110 ± 12	-	-	-
m,p-Xylene	µg/m ³	< 300 ± 43	-	-	-
Propene	µg/m ³	< 50 ± 10	-	-	-
Styrene	µg/m ³	< 100 ± 14	-	-	-
tert-Butyl alcohol	µg/m ³	< 80 ± 22	-	-	-
Tetrachloroethene	µg/m ³	< 160 ± 20	-	-	-
Tetrahydrofuran	µg/m ³	< 70 ± 15	-	-	-
Toluene	µg/m ³	< 90 ± 13	-	-	-
trans-1,2-Dichloroethene	µg/m ³	< 100 ± 22	-	-	-
trans-1,3-Dichloropropene	µg/m ³	< 100 ± 18	-	-	-
Trichloroethene	µg/m ³	< 130 ± 17	-	-	-
Trichlorofluoromethane	µg/m ³	< 140 ± 22	-	-	-
Trichlorotrifluoroethane	µg/m ³	< 180 ± 28	-	-	-
Vinyl acetate	µg/m ³	< 90 ± 22	-	-	-
Vinyl chloride	µg/m ³	< 300 ± 89	-	-	-
Whole Air Sampling Canister Processing					
Received Canister Pressure	psia	0.94	-	-	-
Canister Sample Volume	L	0.390	-	-	-
Final Canister Pressure	psia	43.96	-	-	-
Date Prepared		02-Aug-2019	-	-	-
Date Analysed		06-Aug-2019	-	-	-
Whole Air Sampling Sample Internal Standard Recoveries					
1,4-Difluorobenzene	% recovery	84 ± 18	-	-	-
Bromochloromethane	% recovery	86 ± 17	-	-	-

Sample Type: Air Sampling Canister 6 Litre

Sample Name:	Astrolabe [2165411.1 5362] 13-Jun-2019 2:30 pm			
Lab Number:	2217855.1			
Whole Air Sampling Sample Internal Standard Recoveries				
Chlorobenzene-d5	% recovery	84 ± 15	-	-

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

Analyst's Comments

The detection limit for methyl methacrylate and Vinyl chloride were increased to 1 ppbv, and 2 ppbv respectively. Dibromochloromethane, and 1,3-Butadiene, could not be reported as they did not meet US EPA performance criteria.

Appendix No.1 - 2217855 Total VOCs as Toluene Results

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Air Sampling Canister 6 Litre

Test	Method Description	Default Detection Limit	Sample No
Whole Air Sampling Volatile Compounds	Whole air analysed by active SPME-GC-MS. Sample diluted with zero air by a factor of 2. $\mu\text{g}/\text{m}^3 = (\text{ppbv} * \text{Mr})/24.45$. Assumes STP (25°C 1 atm pressure). US EPA TO-15.	-	1
Canister Received Pressure	Canister pressure measured onsite with pressure gauge.	0 psia	1
Canister Final Pressure	Canister pressure measured onsite with pressure gauge.	0 psia	1
Canister Date Prepared	.	-	1
Canister Date Analysed	.	-	1
1,4-Difluorobenzene	Percent recovery as calculated against calibrating standards.	0.13 % recovery	1
Bromochloromethane	Percent recovery as calculated against calibrating standards.	0.13 % recovery	1
Chlorobenzene-d5	Percent recovery as calculated against calibrating standards.	0.13 % recovery	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Dates of testing are available on request. Please contact the laboratory for more information.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Estimation of Volatile Organic Compounds (VOCs) in Air by Active Solid Phase Micro Extraction-Gas Chromatography-Mass Spectrometry (ASPME-GC-MS)

Aim

The client has asked for the VOCs present in a whole air sample be quantified as toluene equivalents.

Summary of Experimental Method

Integration of total ion current chromatograms: Total ion current (TIC) chromatograms were integrated using the Chemstation integrator of MSD Chemstation E.02.01.117 (Agilent Technologies Inc., Santa Clara, CA). Baseline and peak selection was performed manually. Internal standard peaks were not integrated.

Mass spectral interpretation: This was performed manually by an experienced analyst with reference to the NIST 2005 Mass Spectral Library containing 190,825 mass spectra of 163,198 different chemical compounds.

Calculation and reporting of VOCs as toluene: The response factor to convert total ion current peak area for non-target VOCs to a toluene ppbv (parts per billion by volume) equivalent value was determined by one point external calibration of total ion current for toluene from the daily check standard (nominally 10 ppbv) as defined by US EPA method TO-15.

The raw ppbv VOC area count for each sample was determined by integrating major peaks present in the total ion current, internal standard peak areas removed and multiplied by the preparation factor to give final ppbv as toluene. The preparation factor is derived from the dilution of the air sample on receipt at the laboratory and the volume of prepared sample introduced to the instrument.

VOCs as toluene ($\mu\text{g}/\text{m}^3$) at standard temperature and pressure (STP) were then calculated from the final ppbv VOC as toluene using $\mu\text{g}/\text{m}^3$ as toluene = (ppbv x Mr)/24.45. This assumes STP (25 °C 1 atm pressure) where 92.13 was used for the Mr (relative molecular mass) of toluene.

No formal detection limit study was carried out, but the reporting limit was set at the average level determined for daily blank analyses over the analyses.

Disclaimer: Owing to the non-routine nature of the requested work, the method used was not validated using our standard validation process based on ISO Standard 17025 requirements. All results are supplied on the basis that the customer assumes responsibility for approval of the fitness for purpose prior to using the results for decision making purposes. Further validation work may be performed on request.

Results

The total ion current chromatogram of a 125 mL injection of sample Astrolabe [2165411.1 5362] (2217855.1) is shown in Figure 1.

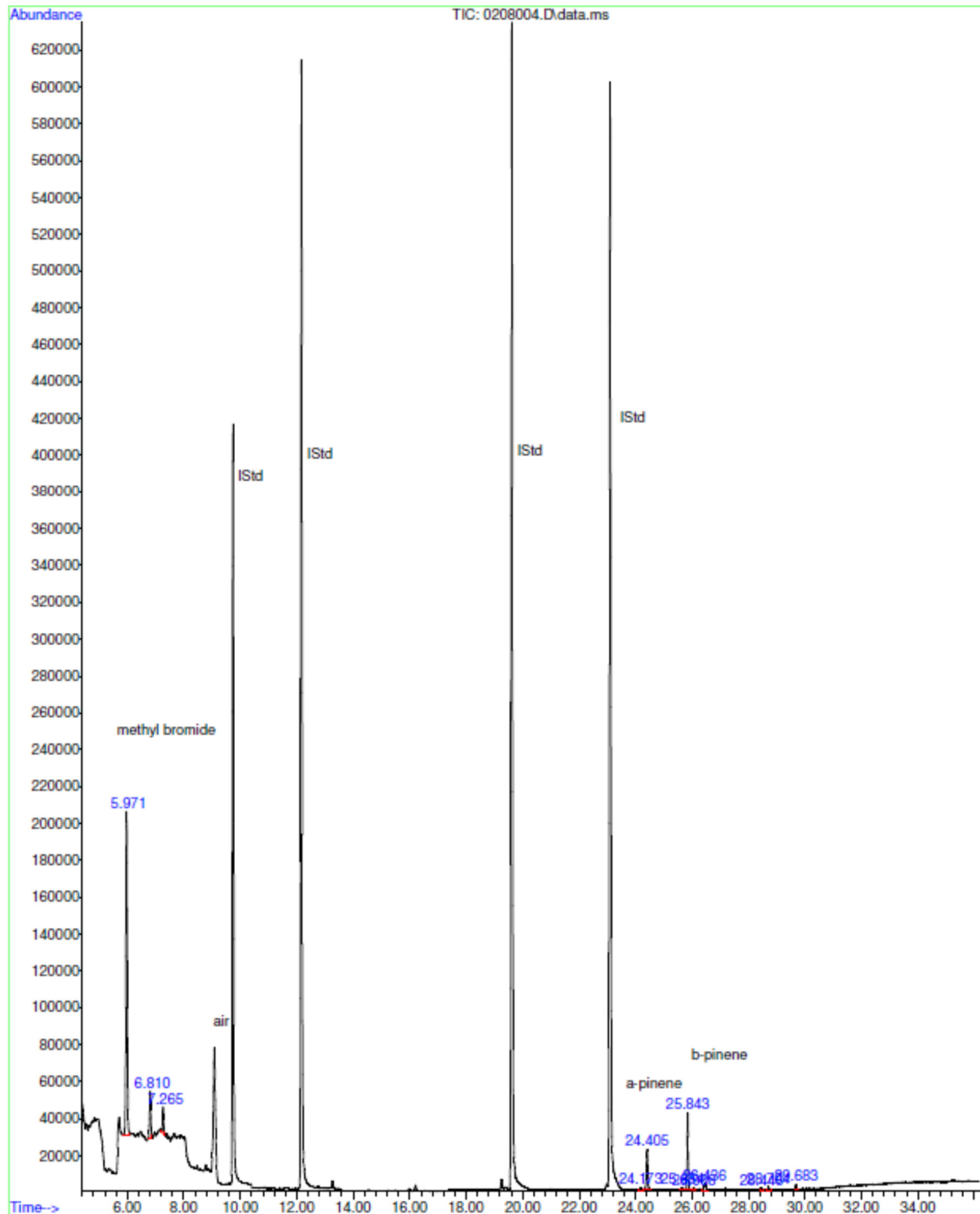


Figure 1. Total ion current chromatogram of a 125 mL injection of sample Astrolabe [2165411.1 5362] (2217855.1), IStd = internal standard.

Volatile organic compounds reported as toluene equivalent $\mu\text{g}/\text{m}^3$ are shown in Table 1 (see Appendix A for summary of calculations).

Table 1. Volatile organic compounds reported as toluene equivalent $\mu\text{g}/\text{m}^3$ (see Appendix A for summary of calculations).

Lab Number	Sample Name	Total VOCs as toluene (ppbv)	Total VOCs as toluene ($\mu\text{g}/\text{m}^3$)
2217855.1	Astrolabe [2165411.1 5362]	480	1800

Appendix A – Total volatile organic compounds as toluene calculation summary

TIC: 0208004.D\data.ms		Astrolabe [2165411.1 5362]								Prep factor accan 641	
pcCan3.499.3										46.766	
Peak #	Ret Time	Type	Width	Area	Start Time	End Time	ppbv as toluene raw	ppbv as toluene final			
1	5.971	M	0.057	5980721	5.866	6.077	6.5	302	methyl bromide		
2	6.81	M	0.053	808501	6.741	6.863	0.9	41			
3	7.265	M	0.046	392822	7.218	7.316	0.4	20			
4	24.173	M	0.063	48772	24.112	24.249	0.1	2			
5	24.405	M	0.058	758185	24.315	24.576	0.8	38	alpha-pinene		
6	25.654	M	0.08	56466	25.57	25.737	0.1	3			
7	25.843	M	0.044	1094212	25.751	25.925	1.2	55	beta-pinene		
8	26.068	M	0.076	36785	25.983	26.128	0.0	2			
9	26.436	M	0.076	157100	26.331	26.578	0.2	8			
10	28.446	M	0.055	32700	28.407	28.53	0.0	2			
11	28.704	M	0.051	51367	28.661	28.827	0.1	3			
12	29.683	M	0.035	59055	29.632	29.77	0.1	3			
Total								479	ppbv		
TIC: 0208002.D\data.ms		10 ppbv daily check standard									
pcCan3.499.1											
Peak #	Ret Time	Type	Width	Area	Start Time	End Time	ppbv cancompd 87	CF			
1	16.191	M	0.053	9158984	16.107	16.532	9.89	1.07981E-06			
No formal detection limit has been determined for this test											
				Total VOCs as toluene (ppbv)	Total VOCs as toluene (ug/m3)						
1	2217855.1	5362]	Astrolabe [2165411.1	479	1803						