Application Note by Using Nutech Preconcentrator System for TX 85 Target Compounds in Lab Analysis

Abstract

preconcentration system + GC/MS technology (Full Scan and/or SIM) 85 TX (TCEQ)
By Using three stage cryogenic target VOC compounds (PAMS+TO-15 Mix by Linde anddiluted by our lab) in air will be analyzed in a single run.
The results show that in 0.5-10.0ppb range the calibration, precision, accuracy, blank etc. all meet EPA TO-15 requirements.
The MDL may reach 0.02ppb or lower. It is good for the TX (TCEQ) 85 targeted VOCs in ambient air.

Introduction

Using Summa or silica coated canister to take ambient air samples to the lab and using three stage cryogenic preconcentration system + GC/MS to analyze air VOCs is an approved good technology.
The US EPA published EPA TO-15 method which includes 65 target compounds in 1999 and has been continuously used in USA labs from then.
In USA, TO-15 method is also used for Photochemical Air Monitoring System (PAMS) which includes 56 hydrocarbon compounds.

The Texas (TECQ) requires 85 target compounds to be analyzed and reported to the State of Texas. Scientific all the targeted compounds together and analyzed them by using the same method and/or technology.
This application note is trying to develop a method to cover 85 VOC compounds listed by TX (TCEQ) in a single sample run. Nutech team in both the USA and China's applications air Lab and instrument R&D department in USA tried by using Nutech preconcentration system with GC/MS to achieve this goal.
This application note is their recent results.

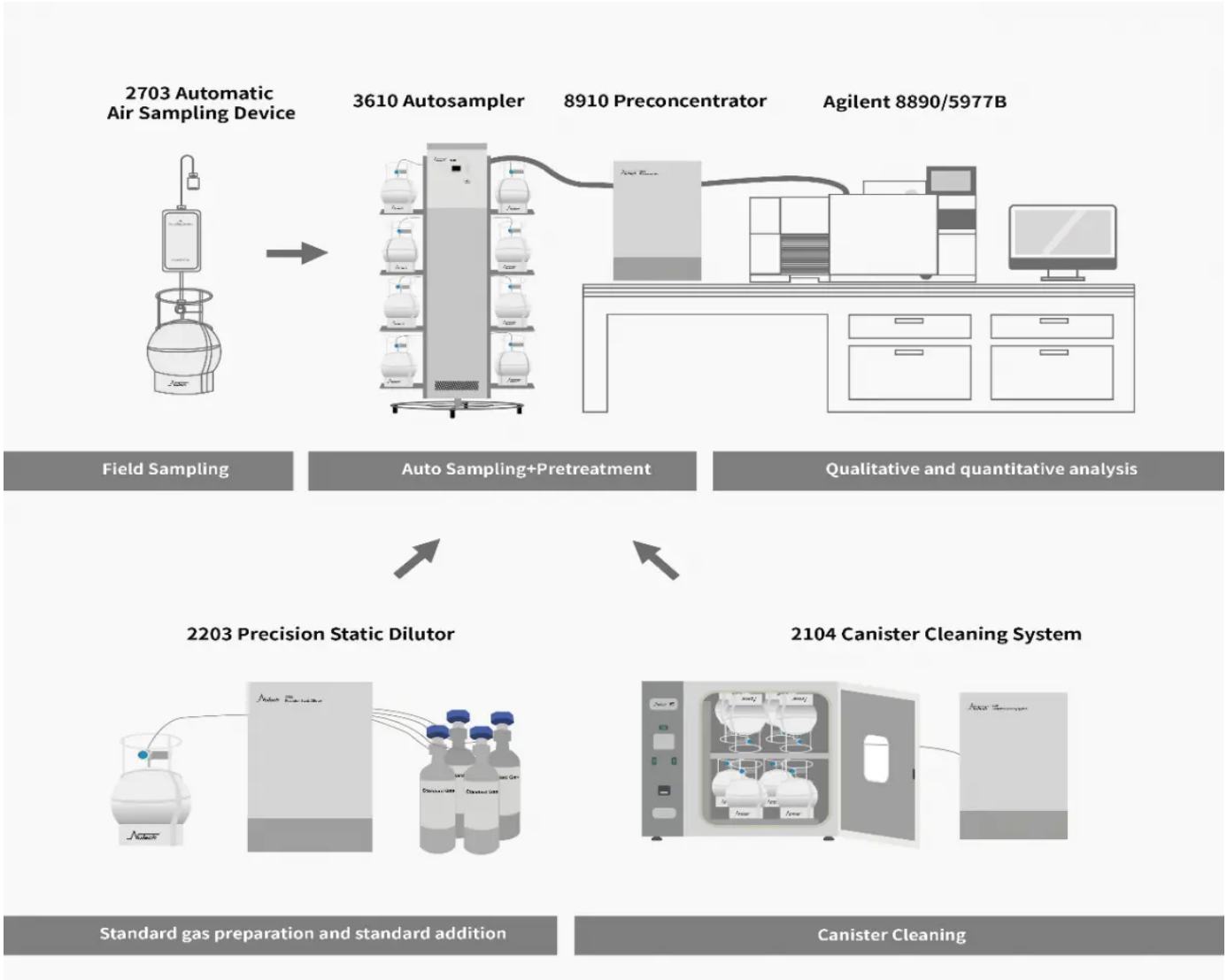
1 Experiment

1-1 Configuration of Used Instruments

Preconcentration System Nutech 8910/3610 Preconcentrator with autosampler, Nutech 2203 Static Dilutor, Nutech 2104 Canister Clean System and 6 L Summa or Silica coated Canisters.

GC/FID/MS：Agilent 8890/5977B（Optional Deans Switch with FID but not used in this application)

As Shown as flowing：



1.2 Standard Gases

The standard gases are all from Linde. ：

1.2.1 VOC Standards

57 Compounds PAMS Standard (Linde) ，
Concentration: 1.00ppm；
65 Compounds TO-15 Standard Linde) ，
Concentration: 1.00ppm
8 Compounds TCEQ Special (By Liquid),
Concentration: 1.00ppm,

1.2.2 Internal Standard/Surrogate Standard

Bromochloromethane, 1,4-Difluorobenzene, Deuterichlorobenzene, 4-Bromofluorobenzene，IS/SS Standard (Linde) Concentration: 1.00ppm

1.3 Making Working Standard

Connect 3 high concentration standard and certified clean 6-liter Summa canister to Nutech 2203 and set up 5 ppb as working standard to make working standard.
Do same as internal/Surrogate standard but concentration as 10.0 ppb.
The canisters were humidified with 50% humidity.

1.4 Instruments Parameters

1.4.1 8910 Method Set:

Trap 1: -170℃，Trap 2: -40℃，Transfer from Trap 1 to Trap to: 20°C, Trap 2 Desorption: 230℃. Focuser:
-170°C，Focuser Injection impulse: 80℃，Transfer line: 40℃。

1.4.2 8890GC Set

Injection：250℃

Split Split/Splitless Column Restek Rtx-1，60m×0.32mm×3.0μm
Buffer Column for Deans Switch： 2.5m×0.18mm×0μm
(Not use as no Deans Switch was needed）

Temperature program：-50℃（ 5 min）- 10℃/min – 220℃（18min）
Carrier Gas Constant flow at: 1.8 ml/m
1.4.3 5977B MS
Ion Source：320 ℃
Connect temperature：250 ℃

Scan Full Scan/SIM
Scan range Full Scan: 25-300 amu
SIM: 26, 27,41,42,43, 95,128,130,114,117 amu

1.5 Initial Calibration

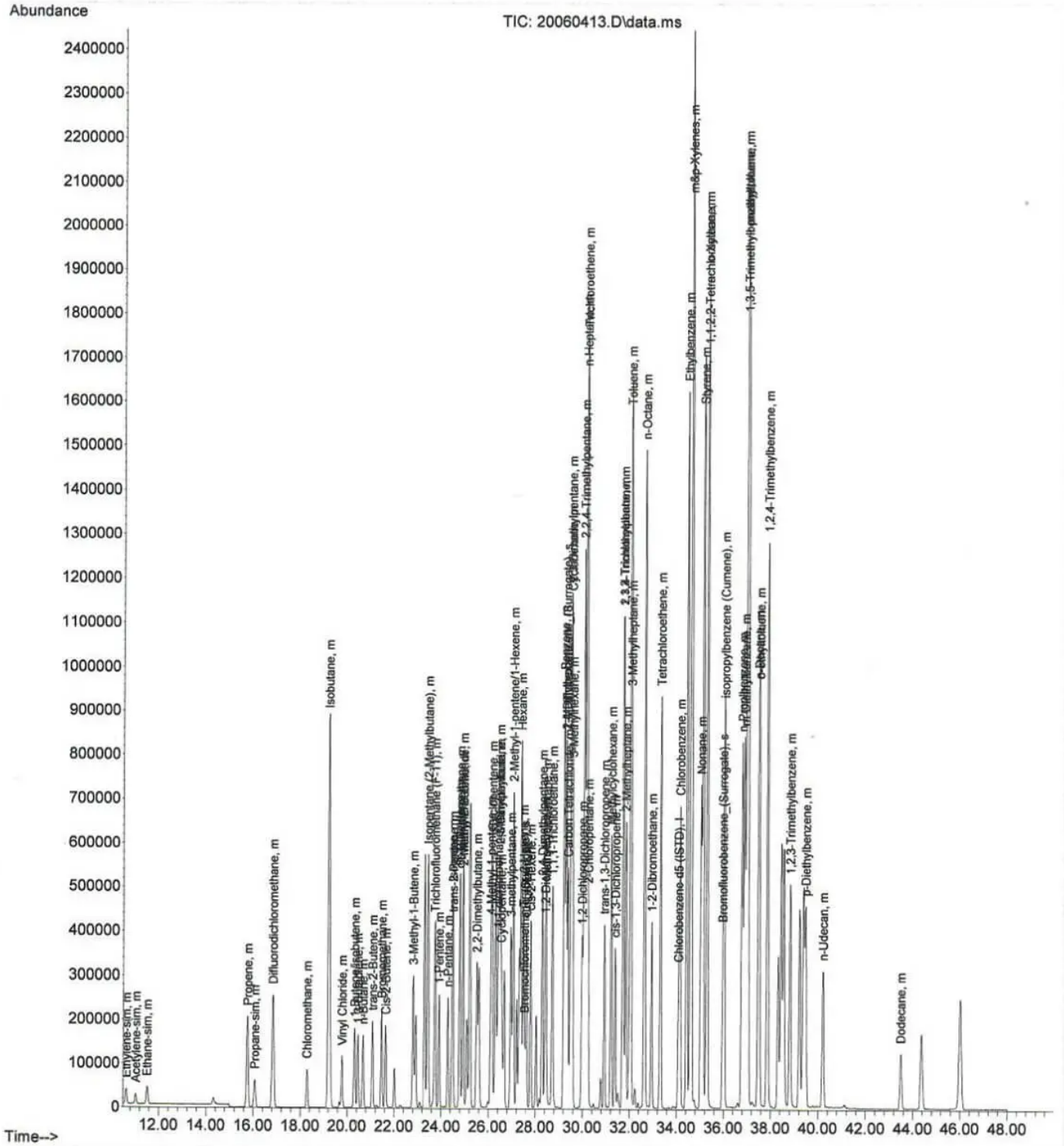
“8910/3610 loading 30ml, 60 ml, 120 ml, 240 ml, 300 ml, 600 ml Basic volume is 300 ml.

Using 5 ppb working standard gas the related concentration will be: 0.5 ppb, 1.0 ppb, 2.0 ppb, 4.0 ppb
5.0 ppb, 10.0ppb，the curve will be concentration ppb vs. Responses (Peak area).
The internal/surrogate standard is loaded 30ml and the concentration is 1.00 ppb.

2 The Results

2.1 85 Compounds Chromatography
(with mixed 65 TO-15 compound and 13 aldehydes)

```
File        :D:\MassHunter\GCMS\1\data\200604\20060413.D
Operator    : SL
Acquired    : 05 Jun 2020  01:46 pm using AcqMethod TO-15-AECOM-C2.M
Instrument :   Nutech Deans Switch
Sample Name: 5.0ppb iCal 600mL
Misc Info   : TO15-AECOMM
Vial Number: 31
```



2.2 Ical

Using 0.5 ppb, 1.0 ppb, 2.0 ppb, 4.0 ppb, 5.0 ppb, 10.0ppbto set up an initial calibration the linear range is 1.20

By using Bromochloromethane and Duterochlorobenzene as internal standard (IS),

Difluorobenzene and bromofluorobenzene as surrogate standard (SS), The calibration data shown as follows:

Response Factor Report Nutech Deans Switch

Method Path : D:\MassHunter\GCMS\1\
Method File : AECOM_C2_200604_iCal.M
Title : AECOM_C2
Last Update : Mon Jun 08 09:53:13 2020
Response Via : Initial Calibration

Calibration Files
1 =20060409.D 2 =20060402.D 3 =20060403.D 4 =20060404.D 5 =20060405.D 6 =20

		Compound	1	2	3	4	5	6	Avg	%RSD
1)	I	Chlorobenzene-d5 (...	----------ISTD----------							
2)	m	Ethylene-sim	0.028	0.023	0.023	0.027	0.025	0.027	0.026	8.01
3)	m	Acetylene-sim	0.051	0.050	0.052	0.052	0.049	0.053	0.051	2.90
4)	m	Ethane-sim	0.023	0.022	0.022	0.022	0.021	0.022	0.022	2.93
5)	m	Propane-sim	0.061	0.060	0.061	0.060	0.058	0.061	0.060	2.06
6)	s	Bromochloromet...	0.337	0.332	0.331	0.322	0.322	0.316	0.327	2.38
7)	s	1,4-Difluorobe...	1.226	1.216	1.216	1.216	1.202	1.187	1.211	1.13
8)	s	Bromofluoroben...	0.584	0.594	0.594	0.599	0.597	0.578	0.591	1.36
9)	I	Chlorobenzene-d5 (...	----------ISTD----------							
10)	m	Propene	0.116	0.108	0.117	0.115	0.114	0.118	0.115	3.15
11)	m	Difluorodichlo...	0.590	0.619	0.613	0.611	0.598	0.602	0.605	1.81
12)	m	Chloromethane	0.153	0.143	0.145	0.148	0.140	0.150	0.146	3.21
13)	m	Isobutane	0.536	0.494	0.496	0.478	0.469	0.474	0.491	4.98
14)	m	Vinyl Chloride	0.197	0.192	0.186	0.196	0.183	0.197	0.192	3.08
15)	m	1-Butene/isobu...	0.176	0.184	0.180	0.183	0.175	0.181	0.180	2.04
16)	m	1,3-Butadiene	0.120	0.125	0.121	0.127	0.120	0.124	0.123	2.56
17)	m	n-Butane	0.219	0.218	0.217	0.215	0.215	0.219	0.217	0.73
18)	m	trans-2-Butene	0.149	0.147	0.149	0.144	0.141	0.146	0.146	2.16
19)	m	Bromomethane	0.225	0.227	0.224	0.228	0.220	0.225	0.225	1.34
20)	m	Cis-2-Butene	0.150	0.153	0.149	0.153	0.147	0.153	0.151	1.68
21)	m	3-Methyl-1-Butene	0.337	0.365	0.363	0.360	0.355	0.354	0.356	2.79
22)	m	Isopentane (2-...	0.152	0.150	0.150	0.150	0.145	0.145	0.149	1.98
23)	m	Trichlorofluor...	0.586	0.620	0.601	0.584	0.566	0.566	0.587	3.61
24)	m	1-Pentene	0.156	0.152	0.148	0.151	0.149	0.149	0.151	1.80
25)	m	n-Pentane	0.224	0.224	0.230	0.218	0.209	0.209	0.219	3.83
26)	m	Isoprene	0.205	0.222	0.218	0.209	0.213	0.211	0.213	2.78
27)	m	trans-2-Pentene	0.266	0.286	0.292	0.278	0.275	0.273	0.278	3.32
28)	m	cis-2-Pentene	0.240	0.253	0.251	0.246	0.237	0.235	0.244	3.10
29)	m	1,1-Dichloroet...	0.270	0.271	0.273	0.267	0.260	0.258	0.267	2.38
30)	m	Methylene Chlo...	0.154	0.164	0.164	0.158	0.158	0.155	0.159	2.70
31)	m	2-Methyl-2-Butene	0.315	0.324	0.322	0.317	0.311	0.306	0.316	2.22
32)	m	2,2-Dimethylbu...	0.256	0.248	0.254	0.245	0.242	0.232	0.246	3.50
33)	m	4-Methyl-1-pen...	0.067	0.075	0.066	0.063	0.074	0.063	0.068	7.73
34)	m	Cyclopentene	0.488	0.559	0.454	0.440	0.514	0.440	0.482	9.89
35)	m	1,1-dichloroet...	0.348	0.379	0.337	0.311	0.351	0.351	0.346	6.39
36)	m	2,3-Dimethylbu...	0.295	0.309	0.298	0.249	0.293	0.286	0.288	7.19
37)	m	2-Methylpentane	0.645	0.703	0.649	0.522	0.633	0.632	0.631	9.39
38)	m	Cyclopentane	0.170	0.183	0.188	0.150	0.171	0.173	0.173	7.70
39)	m	3-methylpentane	0.294	0.343	0.344	0.263	0.322	0.332	0.316	10.06
40)	m	2-Methyl-1-pen...	0.204	0.239	0.226	0.184	0.226	0.219	0.216	9.07
41)	m	Hexane	0.257	0.300	0.293	0.224	0.278	0.277	0.271	10.17
42)	m	Trans-2-Hexene	0.287	0.323	0.316	0.260	0.298	0.301	0.297	7.59
43)	s	Bromochloromet...	0.346	0.345	0.334	0.331	0.332	0.325	0.335	2.54
44)	m	Chloroform	0.476	0.512	0.493	0.477	0.457	0.458	0.479	4.41
45)	m	cis-2-Hexene	0.251	0.292	0.295	0.290	0.281	0.282	0.282	5.64
46)	m	2,4-Dimethylpe...	0.112	0.127	0.120	0.121	0.118	0.116	0.119	4.16
47)	m	1,2-Dichloroet...	0.266	0.292	0.286	0.285	0.269	0.268	0.278	3.98
48)	m	Methylcyclopen...	0.161	0.184	0.186	0.181	0.175	0.176	0.177	5.05
49)	m	1,1,1-Trichlor...	0.480	0.526	0.506	0.500	0.484	0.490	0.498	3.44
50)	m	Benzene	0.688	0.745	0.728	0.702	0.677	0.681	0.703	3.89
51)	m	2-Methylhexane	0.400	0.445	0.439	0.435	0.413	0.365	0.416	7.34
52)	s	1,4-Difluorobe...	1.219	1.228	1.220	1.212	1.205	1.177	1.210	1.49
53)	m	Carbon Tetrach...	0.481	0.533	0.517	0.511	0.498	0.493	0.505	3.74
54)	m	2,3-Dimethylpe...	0.996	1.066	1.058	1.021	0.984	0.985	1.018	3.56

62)	m	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
63)	m	Methylcyclohexane	0.394	0.437	0.437	0.433	0.419	0.424	0.424	3.90
64)	m	cis-1,3-Dichlo...	0.261	0.305	0.313	0.310	0.306	0.311	0.301	6.58
65)	m	1,1,2-Trichlor...	0.304	0.327	0.321	0.316	0.301	0.306	0.312	3.34
66)	m	2,3,4-Trimethy...	0.406	0.439	0.439	0.437	0.412	0.430	0.427	3.42
67)	m	2-Methylheptane	0.374	0.435	0.422	0.412	0.409	0.402	0.409	5.04
68)	m	Toluene	0.860	0.936	0.915	0.888	0.855	0.860	0.886	3.83
69)	m	3-Methylheptane	0.280	0.330	0.322	0.311	0.299	0.302	0.307	5.81
70)	m	n-Octane	0.331	0.366	0.370	0.362	0.344	0.356	0.355	4.15
71)	m	1-2-Dibromoethane	0.455	0.495	0.488	0.487	0.470	0.481	0.479	3.02
72)	m	Tetrachloroethene	0.494	0.563	0.547	0.539	0.527	0.521	0.532	4.45
73)	m	Chlorobenzene	0.714	0.761	0.756	0.734	0.712	0.728	0.734	2.81
74)	m	Ethylbenzene	0.990	1.112	1.107	1.088	1.056	1.067	1.070	4.18
75)	m	m&p-Xylenes	0.767	0.854	0.849	0.834	0.804	0.810	0.820	4.01
76)	m	Nonane	0.342	0.399	0.402	0.403	0.392	0.390	0.388	5.98
77)	m	Styrene	0.533	0.613	0.613	0.607	0.588	0.580	0.589	5.22
78)	m	o-Xylene	0.395	0.448	0.438	0.428	0.410	0.415	0.422	4.63
79)	m	1,1,2,2-Tetrac...	0.508	0.587	0.580	0.539	0.507	0.406	0.521	12.64
80)	s	Bromofluoroben...	0.585	0.595	0.597	0.597	0.601	0.582	0.593	1.28
81)	m	isopropylbenze...	1.102	1.228	1.230	1.207	1.177	1.174	1.186	4.02
82)	m	n-Proplbenzene	1.191	1.367	1.390	1.374	1.325	1.328	1.329	5.45
83)	m	m-ethyltoluene	1.017	1.146	1.187	1.195	1.079	1.106	1.122	6.06
84)	m	p-ethyltoluene	1.156	1.554	1.544	1.550	1.434	1.217	1.409	12.73
85)	m	1,3,5-Trimethy...	0.873	0.749	0.735	0.879	0.735	0.771	0.790	8.57
86)	m	n-Decane	0.308	0.364	0.361	0.347	0.334	0.296	0.335	8.32
87)	m	o-ethyltoluene	1.026	1.141	1.141	1.119	1.072	0.993	1.082	5.78
88)	m	1,2,4-Trimethy...	0.801	0.935	0.940	0.933	0.887	0.780	0.879	8.14
89)	m	1,2,3-Trimethy...	0.693	0.854	0.857	0.860	0.819	0.663	0.791	11.28
90)	m	m-Diethylbenzene	1.017	1.146	1.187	1.195	1.089	1.106	1.123	5.95
91)	m	p-Diethylbenzene	0.550	0.652	0.671	0.634	0.614	0.361	0.580	19.84
92)	m	n-Udecan	0.344	0.430	0.454	0.384	0.356	0.234	0.367	21.16
93)	m	Dodecane	0.127	0.233	0.241	0.152	0.140	0.101	0.166	34.95

(#) = Out of Range

AECOM_C2_200604_iCal.M Mon Jun 08 09:53:17 2020

2.3 CCV

Using 5ppb working standard loading 120 ml concentration is 2.0ppb. The CCV results is shown in the flowing table:

Evaluate Continuing Calibration Report

Data Path : D:\MassHunter\GCMS\1\data\200604\
Data File : 20060414.D
Acq On : 05 Jun 2020 02:44 pm
Operator : SL
Sample : 5.0ppb CCV 120mL
Misc : TO15-AECOMM
ALS Vial : 31 Sample Multiplier: 1

Quant Time: Jun 05 18:07:41 2020
Quant Method : D:\MassHunter\GCMS\1\AECOM_C2_200604_iCal.M
Quant Title : AECOM_C2
QLast Update : Fri Jun 05 18:00:30 2020
Response via : Initial Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 25% Max. Rel. Area : 150%

		Compound	AvgRF	CCRF	%Dev	Area%	Dev(min)
1	I	Chlorobenzene-d5 (ISTD)-sim	1.000	1.000	0.0	105	-0.01
2	m	Ethylene-sim	0.026	0.026	0.0	117	0.00
3	m	Acetylene-sim	0.051	0.052	-2.0	106	0.00
4	m	Ethane-sim	0.022	0.022	0.0	108	-0.01
5	m	Propane-sim	0.060	0.062	-3.3	107	-0.01
6	s	Bromochloromethane_sim(Surr	0.327	0.327	0.0	104	0.00
7	s	1,4-Difluorobenzene_sim(Sur	1.211	1.210	0.1	104	0.01
8	s	Bromofluorobenzene_sim(Surr	0.591	0.602	-1.9	106	0.00
9	I	Chlorobenzene-d5 (ISTD)	1.000	1.000	0.0	105	0.00
10	m	Propene	0.115	0.125	-8.7	111	-0.01
11	m	Difluorodichloromethane	0.605	0.635	-5.0	108	0.00
12	m	Chloromethane	0.146	0.150	-2.7	108	0.00
13	m	Isobutane	0.491	0.526	-7.1	111	0.01
14	m	Vinyl Chloride	0.192	0.207	-7.8	116	0.00
15	m	1-Butene/isobutene	0.180	0.188	-4.4	109	0.00
16	m	1,3-Butadiene	0.123	0.131	-6.5	113	0.01
17	m	n-Butane	0.217	0.226	-4.1	109	0.00
18	m	trans-2-Butene	0.146	0.153	-4.8	107	0.00
19	m	Bromomethane	0.225	0.235	-4.4	110	0.00
20	m	Cis-2-Butene	0.151	0.156	-3.3	109	0.00
21	m	3-Methyl-1-Butene	0.356	0.357	-0.3	103	0.00
22	m	Isopentane (2-Methylbutane)	0.149	0.153	-2.7	106	0.00
23	m	Trichlorofluoromethane (F-1	0.587	0.593	-1.0	103	0.00
24	m	1-Pentene	0.151	0.150	0.7	105	0.00
25	m	n-Pentane	0.219	0.217	0.9	99	0.00
26	m	Isoprene	0.213	0.213	0.0	102	0.00
27	m	trans-2-Pentene	0.278	0.280	-0.7	100	0.01
28	m	cis-2-Pentene	0.244	0.238	2.5	99	0.00
29	m	1,1-Dichloroethene	0.267	0.263	1.5	101	0.00
30	m	Methylene Chloride	0.159	0.156	1.9	100	0.00
31	m	2-Methyl-2-Butene	0.316	0.309	2.2	100	0.01
32	m	2,2-Dimethylbutane	0.246	0.242	1.6	99	0.00
33	m	4-Methyl-1-pentene	0.068	0.062	8.8	97	0.00
34	m	Cyclopentene	0.482	0.419	13.1	97	0.00
35	m	1,1-dichloroethane	0.346	0.294	15.0	91	0.00
36	m	2,3-Dimethylbutane	0.288	0.248	13.9	87	0.00
37	m	2-Methylpentane	0.631	0.501	20.6	81	0.00
38	m	Cyclopentane	0.173	0.144	16.8	80	0.00
39	m	3-methylpentane	0.316	0.333	-5.4	101	0.00
40	m	2-Methyl-1-pentene/1-Hexene	0.216	0.222	-2.8	103	0.00
41	m	Hexane	0.271	0.286	-5.5	102	0.00
42	m	Trans-2-Hexene	0.297	0.309	-4.0	102	0.00
43	s	Bromochloromethane_(Surroga	0.335	0.337	-0.6	105	0.00
44	m	Chloroform	0.479	0.483	-0.8	102	0.00
45	m	cis-2-Hexene	0.282	0.284	-0.7	101	0.00
46	m	2,4-Dimethylpentane	0.119	0.118	0.8	102	0.00
47	m	1,2-Dichloroethane	0.278	0.283	-1.8	104	0.01
48	m	Methylcyclopentane	0.177	0.182	-2.8	103	0.00
49	m	1,1,1-Trichloroethane	0.498	0.489	1.8	101	0.00
50	m	Benzene	0.703	0.702	0.1	101	0.00
51	m	2-Methylhexane	0.416	0.441	-6.0	105	0.00
52	s	1,4-Difluorobenzene_(Surrog	1.210	1.206	0.3	103	0.00
53	m	Carbon Tetrachloride	0.505	0.497	1.6	100	-0.01
54	m	2,3-Dimethylpentane	1.018	1.032	-1.4	102	0.00
55	m	Cyclohexane	0.312	0.310	0.6	100	0.00
56	m	3-Methylhexane	0.295	0.296	-0.3	104	0.01
57	m	1,2-Dichloropropane	0.220	0.222	-0.9	104	0.00
58	m	2,2,4-Trimethylpentane	0.905	0.932	-3.0	106	0.00
59	m	n-Heptane	0.276	0.267	3.3	98	0.01
60	m	Trichloroethene	0.391	0.392	-0.3	100	0.00
61	m	2-Chloropentane	0.287	0.293	-2.1	105	0.01
62	m	trans-1,3-Dichloropropene	0.369	0.362	1.9	98	0.00
63	m	Methylcyclohexane	0.424	0.423	0.2	101	0.00
64	m	cis-1,3-Dichloropropene	0.301	0.294	2.3	98	-0.01
65	m	1,1,2-Trichloroethane	0.312	0.311	0.3	102	0.00
66	m	2,3,4-Trimethylpentane	0.427	0.453	-6.1	108	0.01
67	m	2-Methylheptane	0.409	0.421	-2.9	104	0.00
68	m	Toluene	0.886	0.883	0.3	101	0.00
69	m	3-Methylheptane	0.307	0.307	0.0	100	0.00
70	m	n-Octane	0.355	0.354	0.3	100	0.00
71	m	1-2-Dibromoethane	0.479	0.484	-1.0	104	0.01
72	m	Tetrachloroethene	0.532	0.532	0.0	102	0.00
73	m	Chlorobenzene	0.734	0.728	0.8	101	0.00
74	m	Ethylbenzene	1.070	1.080	-0.9	102	0.00
75	m	m&p-Xylenes	0.820	0.826	-0.7	102	0.00
76	m	Nonane	0.388	0.391	-0.8	102	0.00
77	m	Styrene	0.589	0.587	0.3	100	0.00
78	m	o-Xylene	0.422	0.426	-0.9	102	0.00
79	m	1,1,2,2-Tetrachloroethane	0.521	0.580	-11.3	105	0.00
80	s	Bromofluorobenzene_(Surroga	0.593	0.615	-3.7	108	0.00
81	m	isopropylbenzene (Cumene)	1.186	1.166	1.7	99	0.00
82	m	n-Proplbenzene	1.329	1.330	-0.1	100	-0.01
83	m	m-ethyltoluene	1.122	1.114	0.7	98	0.00
84	m	p-ethyltoluene	1.409	1.471	-4.4	100	-0.01

85 m	1,3,5-Trimethylbenzene	0.790	0.750	5.1	107	0.00
86 m	n-Decane	0.335	0.349	-4.2	101	0.00
87 m	o-ethyltoluene	1.082	1.105	-2.1	101	-0.01
88 m	1,2,4-Trimethylbenzene	0.879	0.918	-4.4	102	0.00
89 m	1,2,3-Trimethylbenzene	0.791	0.842	-6.4	103	0.00
90 m	m-Diethylbenzene	1.123	1.114	0.8	98	0.00
91 m	p-Diethylbenzene	0.580	0.635	-9.5	99	0.00
92 m	n-Udecan	0.367	0.429	-16.9	99	0.00
93 m	Dodecane	0.166	0.229	-38.0#	99	0.00

(#) = Out of Range SPCC's out = 0 CCC's out = 0

AECOM_C2_200604_iCal.M Mon Jun 08 09:56:10 2020

2.4 BD/BSD % Accuracy %

Spike 5.0 ppb into a canister as a blank spike evaluation standard to performed by the instrument the recovery as shown as follows: (10ppb is due to some compounds are replicate in standard.):

Spike Recovery and RPD Summary Report - WATER

Method Path : D:\MassHunter\GCMS\1\
Method File : AECOM_C2_200604_iCal.M
Title : AECOM_C2
Last Update : Mon Jun 08 10:50:25 2020
Response Via : Initial Calibration

Datafile Path: D:\MassHunter\GCMS\1\data\200604\

------Sample-------
File : 20060407.D
Name : Blank 300mL N2 Acq Time: 05 Jun 2020 12:05 am

------Spike--------
File : 20060415.D
Name : 5.0ppbBS120mL Acq Time: 05 Jun 2020 03:42 pm

--Spike Duplicate--
File : 20060416.D
Name : 5.0ppbBSD120mL Acq Time: 05 Jun 2020 04:40 pm

Compound	Sample Conc	Spike Added	Spike Res	Dup Res	Spike %Rec	Dup %Rec	RPD	QC Limits RPD	QC Limits % Rec
Ethylene-sim	0.0	2	2	2	103	101	2	30	70-130
Acetylene-sim	0.0	2	2	2	105	106	2	30	70-130
Ethane-sim	0.0	2	2	2	102	104	2	30	70-130
Propane-sim	0.1	2	2	2	101	103	2	30	70-130
Propene	0.0	4	4	4	104	107	2	30	70-130
Difluorodichlorometh	0.0	2	2	2	103	105	2	30	70-130
Chloromethane	0.0	2	2	2	106	107	1	30	70-130
Isobutane	0.1	2	2	2	102	102	0	30	70-130
Vinyl Chloride	0.0	2	2	2	104	103	1	30	70-130
1-Butene/isobutene	0.0	2	2	2	101	104	3	30	70-130
1,3-Butadiene	0.0	2	2	2	104	106	2	30	70-130
n-Butane	0.0	2	2	2	105	107	2	30	70-130
trans-2-Butene	0.0	2	2	2	104	102	1	30	70-130
Bromomethane	0.0	2	2	2	103	100	2	30	70-130
Cis-2-Butene	0.0	2	2	2	104	102	3	30	70-130
3-Methyl-1-Butene	0.0	2	2	2	102	100	1	30	70-130
Isopentane (2-Methyl	0.0	4	4	4	103	102	1	30	70-130
Trichlorofluorometha	0.0	2	2	2	101	102	1	30	70-130
1-Pentene	0.0	2	2	2	100	105	5	30	70-130
n-Pentane	0.0	2	2	2	[illegible]	[illegible]	3	30	[illegible]

n-Pentane	0.0	2	2	2	97	99	3	30	70-130
Isoprene	0.0	2	2	2	100	100	0	30	70-130
trans-2-Pentene	0.0	2	2	2	99	99	1	30	70-130
cis-2-Pentene	0.0	2	2	2	101	102	0	30	70-130
1,1-Dichloroethene	0.0	2	2	2	100	99	1	30	70-130
Methylene Chloride	0.0	2	2	2	99	103	4	30	70-130
2-Methyl-2-Butene	0.0	2	2	2	100	102	2	30	70-130
2,2-Dimethylbutane	0.0	2	2	2	95	98	4	30	70-130
4-Methyl-1-pentene	0.0	2	2	2	93	100	8	30	70-130
Cyclopentene	0.0	2	2	2	89	94	5	30	70-130
1,1-dichloroethane	0.0	2	2	2	88	97	10	30	70-130
2,3-Dimethylbutane	0.0	2	2	2	85	96	12	30	70-130
2-Methylpentane	0.0	2	2	2	81	94	15	30	70-130
Cyclopentane	0.0	2	2	2	88	93	5	30	70-130
3-methylpentane	0.0	2	2	2	108	104	4	30	70-130
2-Methyl-1-pentene/1	0.0	4	4	4	111	107	4	30	70-130
Hexane	0.0	4	4	4	105	110	4	30	70-130
Trans-2-Hexene	0.0	2	2	2	106	104	1	30	70-130
Chloroform	0.0	2	2	2	104	102	2	30	70-130
cis-2-Hexene	0.0	2	2	2	101	107	5	30	70-130
2,4-Dimethylpentane	0.0	2	2	2	98	99	1	30	70-130
1,2-Dichloroethane	0.0	2	2	2	102	105	4	30	70-130
Methylcyclopentane	0.0	2	2	2	103	105	2	30	70-130
1,1,1-Trichloroethan	0.0	2	2	2	99	105	6	30	70-130
Benzene	0.0	4	4	4	101	103	3	30	70-130
2-Methylhexane	0.0	2	2	2	108	111	2	30	70-130
Carbon Tetrachloride	0.0	2	2	2	101	102	1	30	70-130
2,3-Dimethylpentane	0.0	2	2	2	102	105	3	30	70-130
Cyclohexane	0.0	4	4	4	101	106	4	30	70-130
3-Methylhexane	0.0	2	2	2	106	98	8	30	70-130
1,2-Dichloropropane	0.0	2	2	2	100	104	4	30	70-130
2,2,4-Trimethylpenta	0.0	4	4	4	108	110	2	30	70-130
n-Heptane	0.0	4	4	4	99	105	6	30	70-130
Trichloroethene	0.0	2	2	2	102	105	3	30	70-130
2-Chloropentane	0.0	2	2	2	104	102	2	30	70-130
trans-1,3-Dichloropr	0.0	2	2	2	99	104	4	30	70-130
Methylcyclohexane	0.0	2	2	2	102	104	2	30	70-130
cis-1,3-Dichloroprop	0.0	2	2	2	103	103	0	30	70-130
1,1,2-Trichloroethan	0.0	2	2	2	101	103	2	30	70-130
2,3,4-Trimethylpenta	0.0	2	2	2	104	106	2	30	70-130
2-Methylheptane	0.0	2	2	2	105	106	2	30	70-130
Toluene	0.0	4	4	4	101	103	2	30	70-130
3-Methylheptane	0.0	2	2	2	100	105	4	30	70-130
n-Octane	0.0	2	2	2	104	106	2	30	70-130
1-2-Dibromoethane	0.0	2	2	2	103	104	2	30	70-130
Tetrachloroethene	0.0	2	2	2	100	104	4	30	70-130
Chlorobenzene	0.0	2	2	2	100	103	3	30	70-130
Ethylbenzene	0.0	4	4	4	102	105	3	30	70-130
m&p-Xylenes	0.0	8	8	8	102	104	2	30	70-130
Nonane	0.0	2	2	2	104	106	2	30	70-130
Styrene	0.0	4	4	4	102	104	3	30	70-130
o-Xylene	0.0	4	4	4	104	106	2	30	70-130
1,1,2,2-Tetrachloroe	0.0	2	2	2	110	114	3	30	70-130
isopropylbenzene (Cu	0.0	2	2	2	102	104	2	30	70-130
n-Proplbenzene	0.0	2	2	2	102	106	4	30	70-130
m-ethyltoluene	0.0	2	2	2	111	115	4	30	70-130
p-ethyltoluene	0.0	4	5	4	114	102	12	30	70-130
1,3,5-Trimethylbenze	0.0	4	4	4	103	105	3	30	70-130
n-Decane	0.0	2	2	2	106	112	5	30	70-130
o-ethyltoluene	0.0	2	2	2	102	108	5	30	70-130
1,2,4-Trimethylbenze	0.0	4	4	4	105	108	3	30	70-130
1,2,3-Trimethylbenze	0.0	2	2	2	107	112	5	30	70-130
m-Diethylbenzene	0.0	2	2	2	111	101	9	30	70-130
p-Diethylbenzene	0.0	2	2	2	112	115	3	30	70-130
n-Udecan	0.0	2	2	2	116	123	6	30	70-130
Dodecane	0.0	2	3	3	126	143#	12	30	70-130

- Fails Limit Check

AECOM_C2_200604_iCal.M Mon Jun 08 10:52:14 2020

2.5 Replicates

The replicates are selected 0.5ppb and 2.0ppb with 7 points .
The data shows that the RSD% of most compounds are less than 10%.

2.5.1 Replicate Data, 0.5 ppb Level

Response Factor Report Nutech Deans Switch

Method Path : D:\MassHunter\GCMS\1\
Method File : AECOM_C2_200604_iCal_Replicate.M
Title : AECOM_C2
Last Update : Tue Jun 09 11:32:07 2020
Response Via : Initial Calibration

Calibration Files
1 =20060422.D 2 =20060423.D 3 =20060424.D 4 =20060425.D 5 =20060426.D 6 =20

		Compound	1	2	3	4	5	6	7	Avg	%RSD
1)	I	Chlorobenzene-d5 (...	----------ISTD----------								
2)	m	Ethylene-sim	0.030	0.027	0.031	0.030	0.028	0.030	0.031	0.030	4.98
3)	m	Acetylene-sim	0.054	0.053	0.058	0.055	0.053	0.056	0.056	0.055	3.29
4)	m	Ethane-sim	0.024	0.023	0.026	0.024	0.023	0.025	0.025	0.024	3.88
5)	m	Propane-sim	0.065	0.065	0.069	0.066	0.064	0.069	0.066	0.066	3.15
6)	s	Bromochloromet...	0.337	0.335	0.340	0.338	0.335	0.339	0.337	0.337	0.55
7)	s	1,4-Difluorobe...	1.217	1.211	1.220	1.218	1.205	1.213	1.212	1.214	0.44
8)	s	Bromofluoroben...	0.591	0.593	0.592	0.593	0.594	0.594	0.595	0.593	0.24
9)	I	Chlorobenzene-d5 (...	----------ISTD----------								
10)	m	Propene	0.233	0.245	0.252	0.247	0.228	0.254	0.245	0.244	3.92
11)	m	Difluorodichlo...	0.650	0.627	0.658	0.606	0.628	0.640	0.648	0.637	2.77
12)	m	Chloromethane	0.161	0.156	0.156	0.150	0.147	0.154	0.160	0.155	3.34
13)	m	Isobutane	0.546	0.552	0.580	0.548	0.535	0.572	0.573	0.558	3.01
14)	m	Vinyl Chloride	0.198	0.191	0.204	0.198	0.185	0.204	0.210	0.198	4.28
15)	m	1-Butene/isobu...	0.203	0.187	0.200	0.183	0.182	0.188	0.189	0.190	4.37
16)	m	1,3-Butadiene	0.129	0.125	0.130	0.122	0.119	0.126	0.123	0.125	3.24
17)	m	n-Butane	0.225	0.223	0.232	0.217	0.220	0.238	0.227	0.226	3.17
18)	m	trans-2-Butene	0.158	0.149	0.148	0.146	0.147	0.150	0.151	0.150	2.56
19)	m	Bromomethane	0.242	0.232	0.240	0.214	0.226	0.239	0.224	0.231	4.42
20)	m	Cis-2-Butene	0.155	0.158	0.160	0.156	0.154	0.159	0.144	0.155	3.41
21)	m	3-Methyl-1-Butene	0.360	0.351	0.381	0.339	0.343	0.348	0.347	0.353	3.94
22)	m	Isopentane (2-...	0.315	0.314	0.311	0.290	0.304	0.309	0.295	0.305	3.22
23)	m	Trichlorofluor...	0.600	0.577	0.617	0.587	0.578	0.590	0.589	0.591	2.37
24)	m	1-Pentene	0.142	0.143	0.156	0.140	0.153	0.145	0.150	0.147	4.21
25)	m	n-Pentane	0.222	0.222	0.234	0.211	0.218	0.214	0.216	0.220	3.40
26)	m	Isoprene	0.198	0.203	0.217	0.222	0.207	0.208	0.206	0.209	3.97
27)	m	trans-2-Pentene	0.266	0.275	0.274	0.294	0.257	0.267	0.265	0.271	4.33
28)	m	cis-2-Pentene	0.271	0.231	0.278	0.267	0.225	0.279	0.272	0.261	8.64
29)	m	1,1-Dichloroet...	0.287	0.261	0.320	0.272	0.252	0.295	0.288	0.282	8.05
30)	m	Methylene Chlo...	0.190	0.185	0.195	0.188	0.145	0.181	0.188	0.182	9.13
31)	m	2-Methyl-2-Butene	0.359	0.351	0.372	0.348	0.298	0.359	0.355	0.349	6.86
32)	m	2,2-Dimethylbu...	0.262	0.262	0.301	0.278	0.242	0.287	0.271	0.272	7.06
33)	m	4-Methyl-1-pen...	0.073	0.070	0.072	0.076	0.058	0.071	0.074	0.071	8.63
34)	m	Cyclopentene	0.495	0.520	0.535	0.487	0.486	0.530	0.511	0.509	3.96
35)	m	1,1-dichloroet...	0.356	0.378	0.392	0.357	0.362	0.380	0.377	0.372	3.67
36)	m	2,3-Dimethylbu...	0.294	0.282	0.314	0.284	0.288	0.317	0.300	0.297	4.62
37)	m	2-Methylpentane	0.655	0.632	0.702	0.657	0.622	0.683	0.648	0.657	4.22
38)	m	Cyclopentane	0.187	0.173	0.186	0.178	0.173	0.188	0.187	0.182	3.75
39)	m	3-methylpentane	0.328	0.307	0.320	0.317	0.308	0.343	0.329	0.322	3.96
40)	m	2-Methyl-1-pen...	0.434	0.422	0.460	0.403	0.414	0.442	0.442	0.431	4.50
41)	m	Hexane	0.559	0.554	0.578	0.541	0.535	0.575	0.559	0.557	2.87
42)	m	Trans-2-Hexene	0.290	0.294	0.291	0.301	0.285	0.302	0.295	0.294	2.03
43)	s	Bromochloromet...	0.347	0.347	0.345	0.345	0.344	0.350	0.345	0.346	0.59
44)	m	Chloroform	0.497	0.484	0.501	0.467	0.483	0.494	0.489	0.488	2.32
45)	m	cis-2-Hexene	0.268	0.264	0.291	0.261	0.254	0.276	0.283	0.271	4.81
46)	m	2,4-Dimethylpe...	0.116	0.110	0.126	0.116	0.123	0.117	0.119	0.118	4.53
47)	m	1,2-Dichloroet...	0.286	0.272	0.299	0.275	0.283	0.284	0.283	0.283	3.06
48)	m	Methylcyclopen...	0.181	0.172	0.174	0.174	0.172	0.179	0.171	0.175	2.18
49)	m	1,1,1-Trichlor...	0.483	0.499	0.536	0.472	0.466	0.511	0.491	0.494	4.89
50)	m	Benzene	1.418	1.417	1.476	1.417	1.373	1.472	1.415	1.427	2.51
51)	m	2-Methylhexane	0.438	0.425	0.474	0.429	0.431	0.445	0.448	0.441	3.78
52)	s	1,4-Difluorobe...	1.208	1.216	1.204	1.202	1.214	1.216	1.209	1.210	0.49
53)	m	Carbon Tetrach...	0.498	0.485	0.515	0.473	0.468	0.492	0.494	0.489	3.28

54)	m	2,3-Dimethylpe...	1.007	1.023	1.088	1.018	0.992	1.044	1.025	1.028	3.02
55)	m	Cyclohexane	0.612	0.610	0.661	0.607	0.621	0.618	0.633	0.623	3.01
56)	m	3-Methylhexane	0.291	0.278	0.319	0.291	0.246	0.295	0.254	0.282	8.94
57)	m	1,2-Dichloropr...	0.224	0.215	0.228	0.218	0.212	0.225	0.226	0.221	2.84
58)	m	2,2,4-Trimethy...	1.858	1.765	1.971	1.778	1.861	1.961	1.888	1.869	4.29
59)	m	n-Heptane	0.557	0.569	0.530	0.562	0.558	0.586	0.571	0.562	3.07
60)	m	Trichloroethene	0.385	0.403	0.416	0.387	0.364	0.397	0.393	0.392	4.13
61)	m	2-Chloropentane	0.285	0.296	0.294	0.274	0.276	0.286	0.295	0.286	3.15
62)	m	trans-1,3-Dich...	0.357	0.336	0.363	0.346	0.339	0.353	0.356	0.350	2.85
63)	m	Methylcyclohexane	0.405	0.385	0.419	0.390	0.403	0.410	0.406	0.403	2.89
64)	m	cis-1,3-Dichlo...	0.273	0.267	0.303	0.275	0.267	0.283	0.280	0.278	4.42
65)	m	1,1,2-Trichlor...	0.312	0.323	0.327	0.309	0.320	0.331	0.321	0.320	2.40
66)	m	2,3,4-Trimethy...	0.417	0.429	0.431	0.415	0.410	0.418	0.422	0.420	1.81
67)	m	2-Methylheptane	0.404	0.404	0.425	0.417	0.386	0.401	0.419	0.408	3.28
68)	m	Toluene	1.780	1.767	1.861	1.715	1.705	1.785	1.786	1.771	2.93
69)	m	3-Methylheptane	0.307	0.287	0.319	0.298	0.283	0.305	0.313	0.302	4.33
70)	m	n-Octane	0.344	0.328	0.352	0.325	0.321	0.334	0.351	0.336	3.77
71)	m	1-2-Dibromoethane	0.472	0.460	0.496	0.462	0.460	0.474	0.479	0.472	2.80
72)	m	Tetrachloroethene	0.559	0.519	0.567	0.514	0.502	0.555	0.543	0.537	4.67
73)	m	Chlorobenzene	0.727	0.730	0.774	0.717	0.728	0.749	0.746	0.739	2.60
74)	m	Ethylbenzene	2.065	2.006	2.157	1.950	1.992	2.054	2.089	2.045	3.36
75)	m	m&p-Xylenes	3.189	3.169	3.353	3.099	3.069	3.241	3.228	3.193	2.97
76)	m	Nonane	0.364	0.340	0.371	0.355	0.350	0.358	0.377	0.359	3.47
77)	m	Styrene	1.085	1.075	1.153	1.065	1.073	1.122	1.112	1.098	2.92
78)	m	o-Xylene	0.836	0.804	0.858	0.824	0.784	0.833	0.842	0.826	2.98
79)	m	1,1,2,2-Tetrac...	0.546	0.541	0.590	0.546	0.553	0.547	0.563	0.555	3.02
80)	s	Bromofluoroben...	0.590	0.597	0.601	0.599	0.602	0.593	0.606	0.598	0.90
81)	m	isopropylbenze...	1.200	1.157	1.223	1.114	1.113	1.172	1.165	1.163	3.49
82)	m	n-Proplbenzene	1.290	1.259	1.285	1.257	1.266	1.259	1.271	1.270	1.04
83)	m	m-ethyltoluene	1.137	1.148	1.254	1.039	1.111	0.981	1.092	1.109	7.80
84)	m	p-ethyltoluene	2.609	2.964	2.383	2.418	2.829	3.102	2.891	2.742	10.11
85)	m	1,3,5-Trimethy...	1.618	1.459	1.870	1.259	1.182	1.235	1.243	1.409	18.09
86)	m	n-Decane	0.334	0.313	0.352	0.309	0.323	0.334	0.325	0.327	4.41
87)	m	o-ethyltoluene	1.080	1.051	1.098	1.019	1.043	1.074	1.083	1.064	2.56
88)	m	1,2,4-Trimethy...	1.697	1.662	1.752	1.620	1.604	1.694	1.676	1.672	2.98
89)	m	1,2,3-Trimethy...	0.755	0.734	0.794	0.730	0.730	0.765	0.754	0.752	3.09
90)	m	m-Diethylbenzene	1.137	1.022	1.106	1.026	1.111	0.993	1.103	1.071	5.23
91)	m	p-Diethylbenzene	0.580	0.553	0.589	0.537	0.544	0.563	0.564	0.562	3.32
92)	m	n-Udecan	0.365	0.344	0.371	0.341	0.346	0.349	0.355	0.353	3.20
93)	m	Dodecane	0.153	0.162	0.169	0.158	0.150	0.152	0.159	0.158	4.32

(#) = Out of Range

AECOM_C2_20..._Replicate.M Tue Jun 09 11:32:12 2020

2.6 The MDL Study

The data shows that the MDL of all 117compounds are <0.1 ppb, and some compounds may go as low as < 0.01 ppb,

Nutech 8910/Agilent 8890/5977 TX 85 VOC Compounds MDL Study

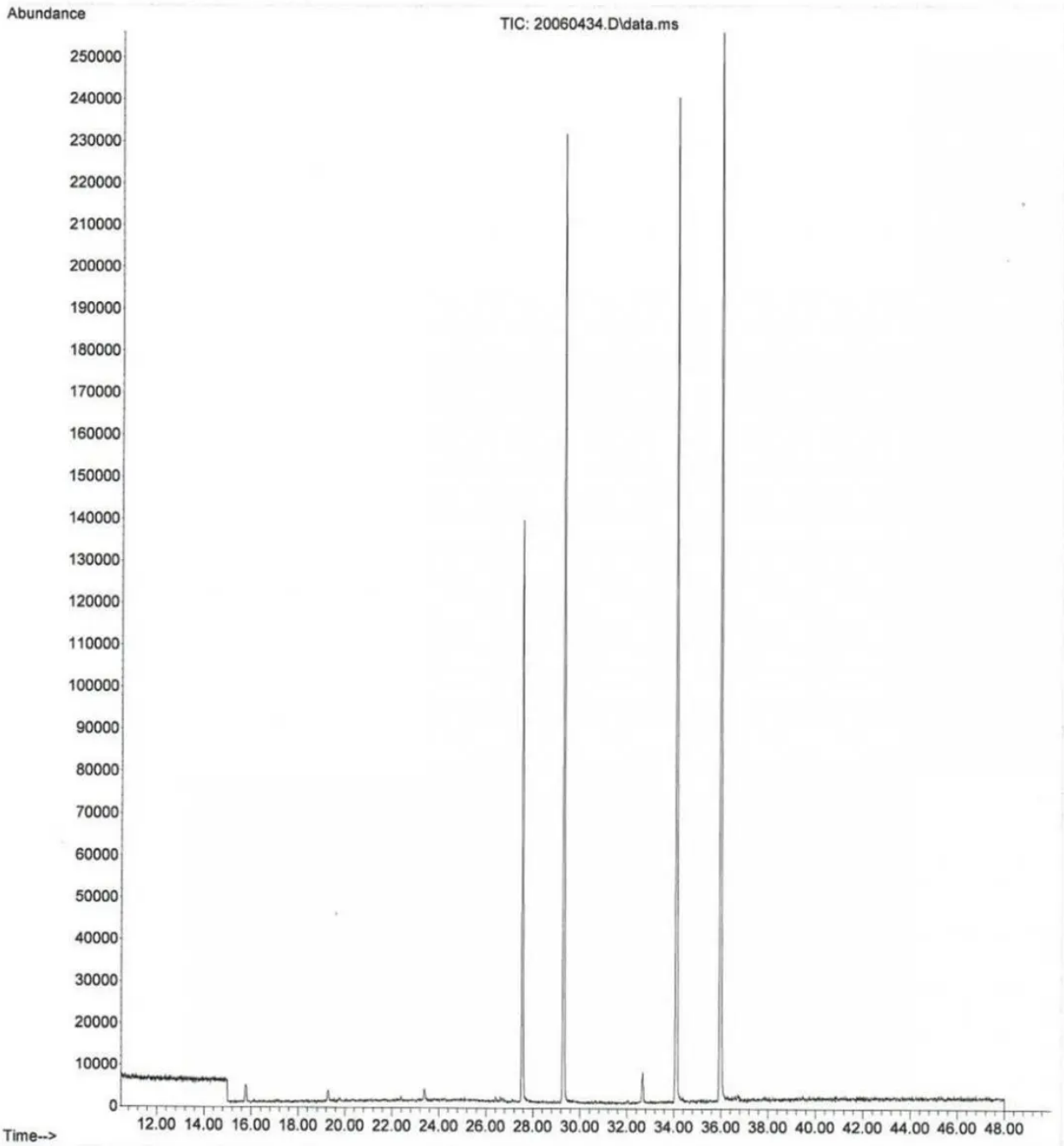
MDL is based on 600mL Loading Volume with 7 replicate Run

Number	Compund	Spike Conc. (ppbv)	Avg. Conc. (ppbv)	SD	MDL
1	Chlorobenzene-d5 (ISTD)-sim	**3.00**	3.00		
2	Ethylene-sim	**0.50**	0.58	0.03	0.09
3	Acetylene-sim	**0.50**	0.54	0.02	0.06
4	Ethane-sim	**0.50**	0.56	0.02	0.06
5	Propane-sim	**0.50**	0.55	0.02	0.05
6	Propene	**1.00**	1.06	0.04	0.14
7	Difluorodichloromethane	**0.50**	0.53	0.01	0.04
8	Chloromethane	**0.50**	0.53	0.02	0.06
9	Isobutane	**0.50**	0.57	0.02	0.05
10	Vinyl Chloride	**0.50**	0.52	0.02	0.07

10	Vinyl Chloride	**0.50**	0.52	0.02	0.07
11	1-Butene/isobutene	**0.50**	0.53	0.02	0.08
12	1,3-Butadiene	**0.50**	0.51	0.02	0.06
13	n-Butane	**0.50**	0.52	0.02	0.05
14	trans-2-Butene	**0.50**	0.51	0.01	0.04
15	Bromomethane	**0.50**	0.51	0.02	0.07
16	Cis-2-Butene	**0.50**	0.51	0.02	0.05
17	3-Methyl-1-Butene	**0.50**	0.50	0.02	0.07
18	Isopentane (2-Methylbutane)	**1.00**	1.03	0.04	0.11
19	Trichlorofluoromethane (F-11)	**0.50**	0.50	0.01	0.04
20	1-Pentene	**0.50**	0.49	0.02	0.07
21	n-Pentane	**0.50**	0.50	0.02	0.05
22	Isoprene	**0.50**	0.49	0.02	0.06
23	trans-2-Pentene	**0.50**	0.49	0.02	0.07
24	cis-2-Pentene	**0.50**	0.53	0.05	0.15
25	1,1-Dichloroethene	**0.50**	0.53	0.04	0.13
26	Methylene Chloride	**0.50**	0.57	0.05	0.16
27	2-Methyl-2-Butene	**0.50**	0.55	0.04	0.12
28	2,2-Dimethylbutane	**0.50**	0.55	0.04	0.12
29	4-Methyl-1-pentene	**0.50**	0.52	0.05	0.14
30	Cyclopentene	**0.50**	0.53	0.02	0.07
31	1,1-dichloroethane	**0.50**	0.54	0.02	0.07
32	2,3-Dimethylbutane	**0.50**	0.51	0.02	0.07
33	2-Methylpentane	**1.50**	0.52	0.02	0.07
34	Cyclopentane	**0.50**	0.52	0.02	0.06
35	3-methylpentane	**0.50**	0.51	0.02	0.06
36	2-Methyl-1-pentene/1-Hexene	**1.00**	0.99	0.04	0.14
37	Hexane	**1.00**	1.03	0.03	0.09
38	Trans-2-Hexene	**0.50**	0.50	0.01	0.04
39	Bromochloromethane_(Surrogate)	**3.00**	3.10	0.02	0.06
40	Chloroform	**0.50**	0.51	0.01	0.04
41	cis-2-Hexene	**0.50**	0.48	0.02	0.08
42	2,4-Dimethylpentane	**0.50**	0.50	0.02	0.07
43	1,2-Dichloroethane	**0.50**	0.51	0.02	0.05
44	Methylcyclopentane	**0.50**	0.49	0.01	0.03
45	1,1,1-Trichloroethane	**0.50**	0.50	0.02	0.08
46	Benzene	**1.00**	1.02	0.02	0.08
47	2-Methylhexane	**0.50**	0.53	0.02	0.06
48	1,4-Difluorobenzene_(Surrogate)	**3.00**	3.00	0.02	0.05
49	Carbon Tetrachloride	**0.50**	0.48	0.02	0.05
50	2,3-Dimethylpentane	**0.50**	0.50	0.01	0.04
51	Cyclohexane	**1.00**	1.00	0.03	0.10
52	3-Methylhexane	**0.50**	0.48	0.04	0.13
53	1,2-Dichloropropane	**0.50**	0.50	0.01	0.04
54	2,2,4-Trimethylpentane	**1.00**	1.02	0.04	0.12
55	n-Heptane	**1.00**	1.02	0.03	0.10
56	Trichloroethene	**0.50**	0.50	0.02	0.06
57	2-Chloropentane	**0.50**	0.50	0.02	0.05
58	trans-1,3-Dichloropropene	**0.50**	0.47	0.01	0.04
59	Methylcyclohexane	**0.50**	0.47	0.01	0.04
60	cis-1,3-Dichloropropene	**0.50**	0.46	0.02	0.07
61	1,1,2-Trichloroethane	**0.50**	0.51	0.01	0.03
62	2,3,4-Trimethylpentane	**0.50**	0.49	0.01	0.02
63	2-Methylheptane	**0.50**	0.50	0.02	0.05
64	Toluene	**1.00**	1.00	0.029	0.09
65	3-Methylheptane	**0.50**	0.49	0.021	0.07
66	n-Octane	**0.50**	0.47	0.018	0.06
67	1-2-Dibromoethane	**0.50**	0.49	0.015	0.05
68	Tetrachloroethene	**0.50**	0.50	0.024	0.08
69	Chlorobenzene	**0.50**	0.51	0.013	0.04
70	Ethylbenzene	**0.50**	0.96	0.034	0.11
71	m&p-Xylenes	**2.00**	1.95	0.060	0.19
72	Nonane	**3.00**	0.46	0.017	0.05
73	Styrene	**1.00**	0.93	0.028	0.09
74	o-Xylene	**1.00**	0.98	0.031	0.10
75	1,1,2,2-Tetrachloroethane	**0.50**	0.53	0.019	0.06
76	Bromofluorobenzene_(Surrogate)	**3.00**	3.03	0.028	0.09
77	isopropylbenzene (Cumene)	**0.50**	0.49	0.019	0.06
78	n-Proplbenzene	**0.50**	0.48	0.005	0.02
79	m-ethyltoluene	**0.50**	0.49	0.039	0.12
80	p-ethyltoluene	**1.00**	1.03	0.083	0.26
81	1,3,5-Trimethylbenzene	**1.00**	0.89	0.121	0.38
82	n-Decane	**0.50**	0.49	0.023	0.07

After analyzed 600ml 10 ppb standard gas immediately load 300ml nitrogen blank and there is no compound tested above MDL.
The blank chromatography shows as following.

```
File        :D:\MassHunter\GCMS\1\data\200604\20060434.D
Operator    : SL
Acquired    : 06 Jun 2020  11:20 am using AcqMethod TO-15-AECOM-C2.M
Instrument :   Nutech Deans Switch
Sample Name: Blank 300mL N2
Misc Info   : Blank
Vial Number: 11
```



3 Conclusion

3.1 Using Nutech 8910 preconcentrator system with GC/MS full

Scan and/or SIM the 85 TX (TCEQ) target compounds can be tested at one run performance. All QA/QC meets EPA TO-15 and TECQ requirements.

3.2 The method and instrument configuration needs are just GC/MS and no Deans Switch with FID is necessary. That give the lab to using existing instruments a good example of this application. The analysis cost can be saved by not using necessary gases supply for FID operation.

3.3 The results also show that the linear range can be from 0.5ppb to 10ppb and is better than similar application (1.25-10ppb). The performance is stable and no carry over is another advantage.

Air Lab Sample Prep Products

8910 Preconcentrator

3610 Autosampler

2104 Canister Cleaning System

2203 Precision Static Dilutor

7000 NMHC Analyzer

Air/Gas Sampling Products

2703 Automatic Air Sampling Device

2600ST Multifunctional Automatic Air Sampling System

2600GT Carry-on Automatic Multifunctional Sampling System

Online VOCs Analysis Products

6000-C NMHC Online Analyzer

6000-5D VOCs Online Analyzer

PCGC-TOF VOCs Online Analysis System

N20 TVOC Online Analyzer

7000 NMHC Analyzer

Portable VOCs Analysis Products

3000 Portable NMHC Analyzer

Accessories & Consumables

SUMMA Sampling Canister & Standard Gas & Tedlar Bag

Nutech's Product Lines

We offer the most comprehensive VOCs analysis products on the market.

Air Lab Products | Air / Gas Sampling Products | Online VOCs Analysis Products | Portable VOCs Analysis Products | Accessories & Consumables