Application Note by Using Nutech Preconcentraor System for 117 VOCs Lab Analysis

George Dai[1], Sirong Lin[1] , Yuanyuan Huang[2], Wenjun Zhong [2]

【Abstraction】

Using a three-stage cryogenic system + GC/MS technology without the Deans Switch option and no FID, either using Full Scan and/or SIM, 117 VOC compounds (TO15\PAMS\Aldehydes Mix) 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 the EPA TO-15 requirements. The MDL may reach 0.02ppb or lower. It works well for the TO-15 target +PAMS and most VOCs in ambient air.

Introduction

Using Summa or silica coated canister to take ambient air samples to the lab and using a three-stage cryogenic preconcentration system + GC/MS to analyze air VOCs is an approved reliable technology. US EPA published EPA TO-15 method in 1999 and has been continuously used labs in USA, from then on. The major target compounds are 65 listed VOCs. According to USA EPA. China published HJ759-2015 in 2015 and the technology is similar with US EPA. In USA the TO-15 method is also used for Photochemical fog Air Monitoring System (PAMS) which includes 56 hydrocarbon compounds. In addition, US EPA also published EPA TO-11 and listed 13 aldehyde compounds by DNPH cartridge/HPLC method. The US EPA's latest publication TO-15A is still using the preconcentration method to handle more VOCs in ambient air. The new TO-15A increased 17 targeted compounds and make it to a total of 82 target compounds. Much of the research or new instrument development is focusing on combining all targeted compounds together and analyzed them by using same method and/or technology. This research is trying to develop this kind of technique to cover all 117 VOC compounds in a single method. The Nutech teams in both USA and China tried in their labs by using Nutech preconcentration (8910) system with GC/MS. This application note is their recent results.

The recent approach by some vendors using the Deans Switch technology with GC/FID/MSD is used for testing all 117 compounds. In our approach, testing all 117 target compounds can be successfully accomplished without using the Deans Switch and FID, this is the major purpose for this application. Our results show that we achieved this and this is also a cost-effective method for the current TO-15 and

[1] Author: Nutech Instruments, Inc., 1825 Summit Ave., Suite 200, Plano, TX 75074
[2] Author: Nutech (Shenzhen) Co.,Ltd., Unit D3-2,TCL Technology Park, 1001 Zhongshangyuan Road, Shenzhen, Guangdong, China

PAMS application. Our results show that in a relative wide concentration range (0.5-10.0ppb), the analysis precision, accuracy, blank, initial calibration, continue calibration verification etc. all meet the QA/QC control requirements in EPA TO-15. That indicates for those labs who now using GC/MS without Deans Switch and FID may also do their 117 compounds combined analysis with a good data quality. The Nutech preconcentrator may be more widely used successfully in a broader range of air VOCs analysis.

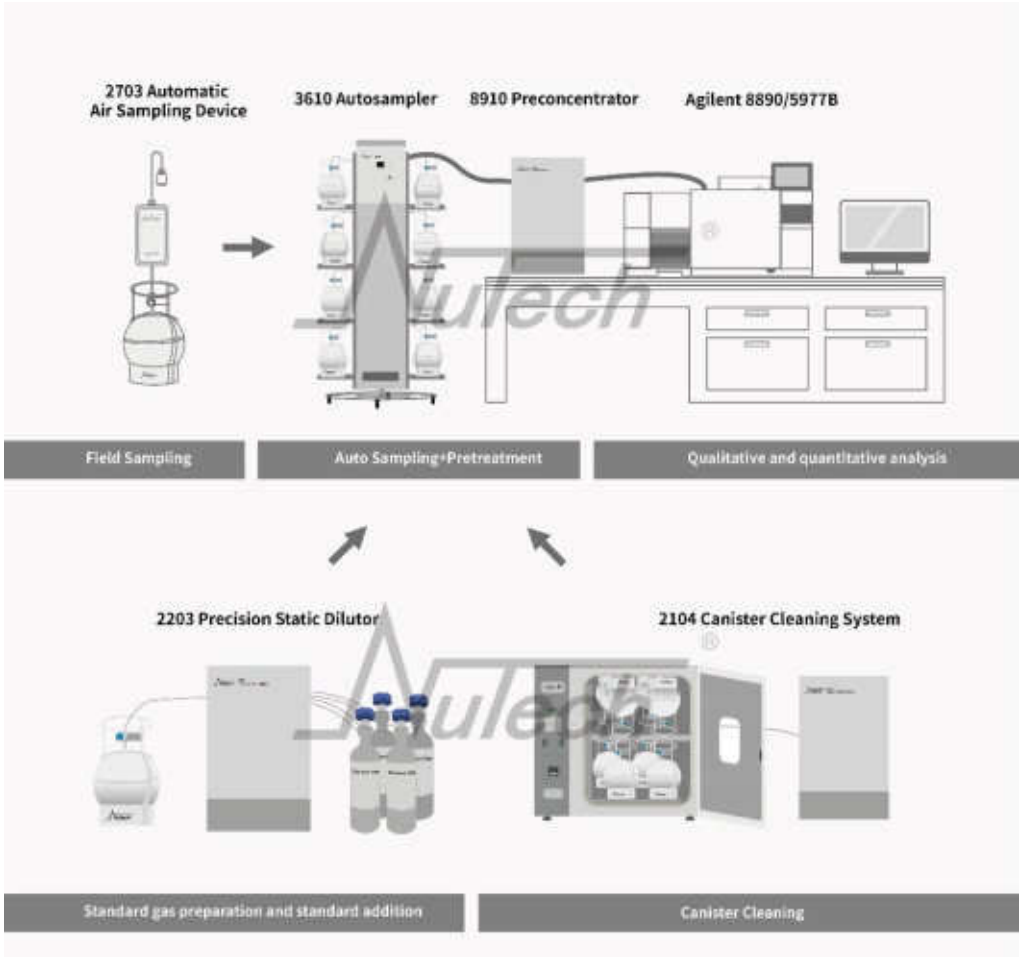
1 Experiment

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 Concentration: 1.00ppm;

65 Compounds TO-15 Standard Concentration: 1.00ppm;

13 Compounds TO-11A Aldehyde Standard Concentration: 1.00 ppm。

1.2.2 Internal Standard/Surrogate Standard

Bromochloromethane, 1,4-Difluorobenzene, Deuterichlorobenzene, 4-Bromofluorobenzene

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. Do same as internal/Surrogate standard but concentration as 100ppb. 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 Dean Switch: 2.5m×0.18mm×0μm (May not use this because the Deans Switch was not used)

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: 26,27,29,30,31,39,41,42,43, 95,128,130,114,117 amu

1.5 Initial Calibration

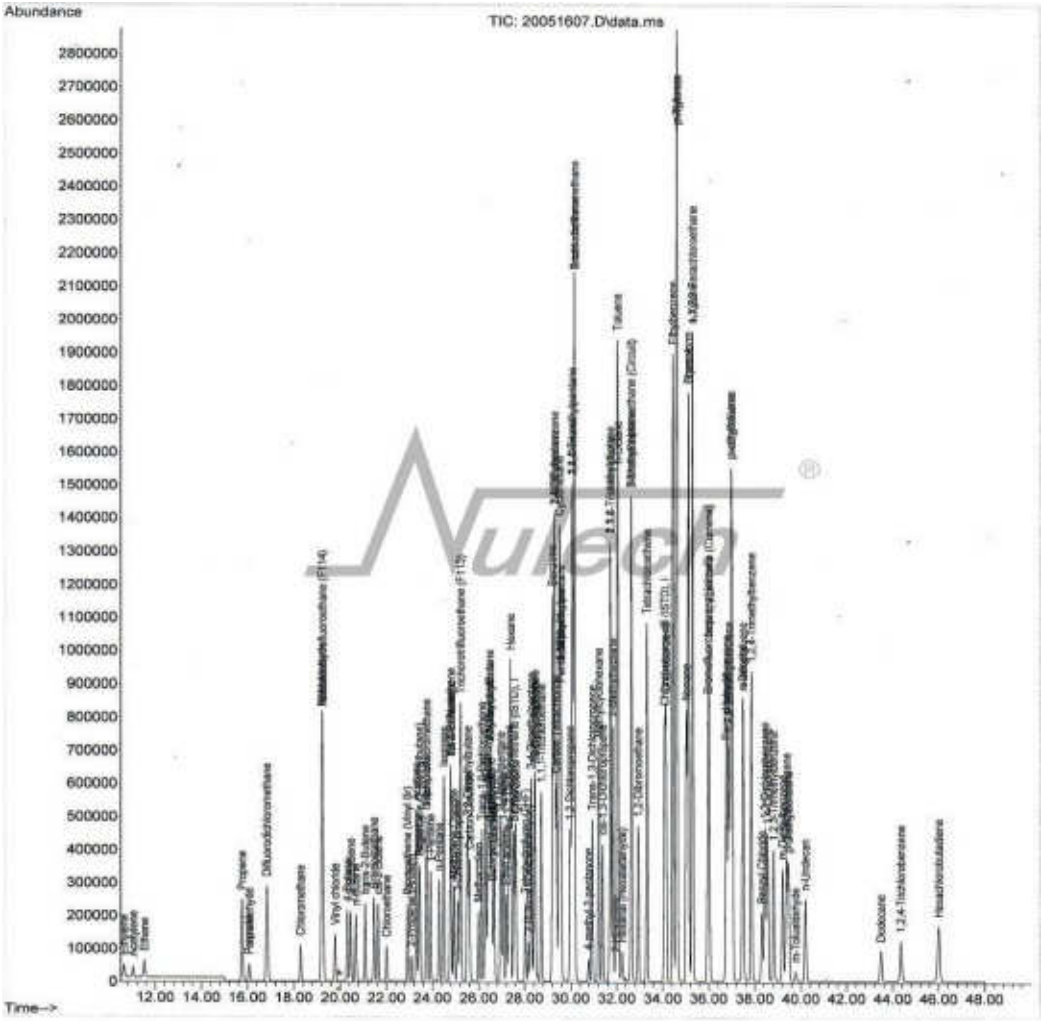
"8910/3610 loading 30ml, 60 ml, 120 ml, 240 ml, 300 ml, 600 ml. Basic volume is 300 ml.

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 20ml and the concentration is 6.67 ppb.

2 The Results

2.1 117 Compounds Chromatography[3]

[3] Nutech declare that all data in this application note are from original instrument data without any modification.The edit only optima the face looking and all original data can be obtained if you e-mail us. (USA) or service@nutechins.cn (China).



Operator: SL; Acquired: 16 May 2020 04:20 pm using Acq. Method TO-15;
Sample Name:5.0ppb Ical. 600ml-RUN Misc. Info: no FID

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:

		Compound	1	2	3	4	5	6	Avg	%RSD
1)	I	Bromochloromethane...	----------ISTD----------							
2)		Ethylene	0.146	0.217	0.175	0.144	0.113	0.122	0.153	24.96
3)		Acetylene	0.128	0.153	0.149	0.154	0.136	0.143	0.144	7.08
4)		Ethane	0.265	0.223	0.229	0.232	0.184	0.193	0.221	13.31
5)		Propene	0.252	0.289	0.271	0.286	0.257	0.273	0.271	5.49
6)		Formaldehyde	0.121	0.166	0.174	0.191	0.160	0.188	0.167	15.12
7)		Propane	0.092	0.088	0.075	0.075	0.066	0.075	0.078	12.20
8)		Difluorodichlo...	1.145	1.280	1.217	1.311	1.177	1.277	1.235	5.31
9)		Chloromethane	0.299	0.341	0.324	0.350	0.312	0.343	0.328	6.08
10)		Acetaldehyde	0.306	0.379	0.274	0.210	0.196	0.212	0.263	27.04
11)		Dichlorotetraf...	1.191	1.286	1.255	1.333	1.209	1.324	1.266	4.65
12)		Isobutane	0.954	0.886	0.755	0.751	0.649	0.704	0.783	14.67
13)		Vinyl Chloride	0.372	0.419	0.414	0.441	0.399	0.449	0.416	6.84
14)		1-Butene	0.376	0.404	0.401	0.411	0.367	0.401	0.393	4.48
15)		1,3-Butadiene	0.253	0.281	0.273	0.297	0.271	0.302	0.279	6.55
16)		n-Butane	0.456	0.488	0.472	0.504	0.453	0.529	0.484	6.08
17)		trans-2-Butene	0.313	0.334	0.327	0.359	0.320	0.352	0.334	5.41
18)		Bromomethane	0.424	0.455	0.452	0.482	0.431	0.482	0.454	5.37
19)		cis-2-Butene	0.321	0.351	0.354	0.373	0.329	0.365	0.349	5.84
20)		Chloroethane	0.185	0.202	0.202	0.217	0.196	0.219	0.204	6.20
21)		Bromoethanene ...	0.414	0.458	0.439	0.479	0.428	0.474	0.449	5.82
22)		2-Propenal (Ar...	0.158	0.155	0.145	0.153	0.138	0.150	0.150	4.81
23)		Acetone		2.109	1.367	1.118	0.864	0.947	1.281	39.14
24)		Propanal	0.203	0.229	0.195	0.227	0.199	0.222	0.212	7.16
25)		Isopentane (2-...	0.162	0.162	0.150	0.166	0.147	0.159	0.158	4.77
26)		Isopropanol	0.304	0.328	0.150	0.093	0.079	0.062	0.170	69.30
27)		Trichlorofluor...	1.060	1.225	1.159	1.241	1.101	1.192	1.163	6.10
28)		1-Pentene	0.296	0.330	0.304	0.348	0.308	0.335	0.320	6.38
29)		n-Pentane	0.456	0.477	0.566	0.498	0.424	0.478	0.483	9.84
30)		Isoprene	0.411	0.502	0.523	0.492	0.427	0.463	0.470	9.37
31)		trans-2-Pentene	0.484	0.639	0.604	0.572	0.494	0.538	0.555	11.03
32)		1,1-Dichloroet...	0.523	0.628	0.635	0.595	0.525	0.573	0.580	8.37
33)		cis-2-Pentene	0.484	0.639	0.604	0.572	0.494	0.538	0.555	11.03
34)		Methylene Chlo...	0.331	0.421	0.415	0.355	0.314	0.346	0.364	12.16
35)		3-Chloro-1-pro...	0.171	0.215	0.213	0.195	0.175	0.194	0.194	9.41
36)		Trichorotriflu...	0.779	0.964	0.972	0.909	0.869	0.862	0.893	8.07
37)		2,2-Dimethylbu...	0.469	0.592	0.582	0.530	0.556	0.504	0.539	8.77
38)		Carbon Disulfide	1.077	1.401	1.340	1.235	1.313	1.194	1.260	9.23
39)		Methacrolein	0.225	0.251	0.252	0.227	0.241	0.217	0.236	6.31
40)		trans-1,2-Dich...	0.529	0.630	0.624	0.606	0.595	0.541	0.587	7.31
41)		MTBE	1.027	1.222	1.229	1.198	1.165	1.095	1.156	6.91
42)		1,1-dichloroet...	0.666	0.802	0.795	0.745	0.733	0.652	0.732	8.58
43)		2,3-Dimethylbu...	0.535	0.653	0.648	0.600	0.592	0.570	0.600	7.56
44)		2-Methylpentane	0.856	0.964	0.966	0.864	0.880	0.872	0.900	5.65
45)		Vinyl acetate	1.309	1.478	1.490	1.336	1.382	1.292	1.381	6.18
46)		Cyclopentene	0.041	0.030	0.042	0.040	0.035	0.038	0.037	11.53
47)		Butanal (Butya...	0.207	0.206	0.190	0.155	0.149	0.170	0.180	14.06
48)		2-Butanone	0.585	0.676	0.633	0.578	0.609	0.634	0.619	5.87
49)		3-Methylpentane	0.622	0.733	0.749	0.678	0.690	0.720	0.699	6.58
50)		1-Hexene	0.174	0.204	0.206	0.191	0.188	0.203	0.195	6.38
51)		Ethyl acetate	0.600	0.693	0.704	0.664	0.687	0.739	0.681	6.89
52)		cis-1,2-Dichlo...	0.513	0.585	0.589	0.549	0.551	0.566	0.559	5.00
53)		Hexane	0.532	0.616	0.612	0.550	0.569	0.588	0.578	5.78
54)		Chloroform	0.878	0.999	0.991	0.961	0.914	0.958	0.950	4.88
55)		Tetrahydrofura...	0.273	0.324	0.324	0.361	0.321	0.351	0.326	9.45
56)		2-Butenal (Cro...	0.131	0.170	0.164	0.186	0.178	0.179	0.168	11.66
57)		2,4-Dimethylpe...	0.588	0.726	0.707	0.765	0.663	0.689	0.690	8.75
58)		1,2-Dichloroet...	0.501	0.582	0.583	0.626	0.549	0.581	0.570	7.36
59)		Methylcyclopen...	0.670	0.798	0.800	0.843	0.742	0.764	0.769	7.76
60)		1,1,1-Trichlor...	0.863	1.015	1.001	1.071	0.939	1.004	0.982	7.33
61)		Benzene	1.356	1.551	1.500	1.574	1.375	1.442	1.466	6.16
62)		2-Methylhexane	0.676	0.795	0.758	0.803	0.705	0.727	0.744	6.79
63)		1,4-Difluorobe...	3.644	3.580	3.608	3.906	3.593	3.579	3.652	3.48
64)		Carbon Tetrach...	0.812	0.945	0.965	1.020	0.924	1.011	0.946	7.99
65)		Cyclohexane	0.554	0.654	0.651	0.675	0.603	0.620	0.626	7.01
66)		2,3-Dimethylpe...	0.629	0.726	0.726	0.785	0.693	0.673	0.705	7.56
67)		3-Methylhexane	0.629	0.726	0.726	0.785	0.693	0.673	0.705	7.56
68)		Pentanal	0.415	0.440	0.417	0.464	0.404	0.407	0.425	5.48
69)		n-Heptane	0.208	0.266	0.264	0.255	0.228	0.243	0.244	9.35
70)		1,2-Dichloropr...	0.404	0.500	0.475	0.507	0.449	0.474	0.468	8.02
71)		1,4-Dioxane	0.178	0.236	0.158	0.127	0.093		0.158	34.02
72)		2,2,4-Trimethy...	1.975	2.318	2.288	2.422	2.131	2.195	2.222	7.07
73)		Trichloroethene	0.685	0.822	0.819	0.873	0.763	0.787	0.791	8.08
74)		Bromodichlorom...	0.817	1.015	1.015	1.081	0.959	1.018	0.984	9.22
75)		4-methyl-2-pen...	0.535	0.717	0.634	0.510	0.477	0.265	0.523	29.47
76)		Trans-1,3-Dich...	0.604	0.787	0.807	0.870	0.775	0.830	0.779	11.84
77)		Methylcyclohexane	0.752	0.880	0.862	0.922	0.819	0.857	0.849	6.82
78)		cis-1,3-Dichlo...	0.489	0.611	0.649	0.711	0.635	0.700	0.633	12.65

79)		2,3,4-Trimethy...	0.840	0.969	0.997	1.068	0.916	0.974	0.961	8.01
80)		1,1,2-Trichlor...	0.496	0.626	0.647	0.686	0.607	0.635	0.616	10.46
81)		2-Methylheptane	0.741	0.872	0.867	0.928	0.833	0.881	0.854	7.39
82)		2-Hexanone	0.256		0.302	0.214	0.196	0.119	0.218	31.59
83)		Toluene	1.465	1.817	1.837	1.959	1.745	1.809	1.772	9.37
84)		n-Octane	0.597	0.713	0.703	0.741	0.656	0.670	0.680	7.45
85)		Hexanal (Hexal...	0.261	0.320	0.313	0.313	0.282	0.194	0.281	17.09
86)		3-Methylheptane	0.327	0.375	0.393	0.427	0.371	0.388	0.380	8.60
87)		Dibromochlorom...	0.850	1.086	1.120	1.233	1.111	1.206	1.101	12.33
88)		1,2-Dibromoethane	0.772	0.952	1.003	1.080	0.955	1.017	0.963	10.85
89)		Tetrachloroethene	0.863	1.094	1.105	1.190	1.052	1.118	1.070	10.39
90)	I	Chlorobenzene-d5 (...	----------ISTD----------							
91)		Chlorobenzene	0.408	0.516	0.537	0.534	0.517	0.516	0.505	9.54
92)		Ethylbenzene	1.214	1.553	1.610	1.609	1.566	1.557	1.518	9.94
93)		m-Xylenes	0.930	1.201	1.242	1.241	1.203	1.192	1.168	10.16
94)		p-Xylenes	0.497	0.631	0.664	0.666	0.646	0.636	0.623	10.23
95)		Nonane	0.227	0.298	0.313	0.313	0.303	0.301	0.293	11.17
96)		Styrene	0.349	0.439	0.467	0.471	0.453	0.452	0.438	10.31
97)		Bromoform	0.698	0.878	0.934	0.941	0.905	0.903	0.877	10.31
98)		o-Xylene	0.469	0.613	0.638	0.641	0.617	0.614	0.599	10.83
99)		1,1,2,2-Terach...	0.290	0.385	0.386	0.379	0.362	0.317	0.353	11.41
100)		Bromofluoroben...	0.570	0.566	0.563	0.567	0.568	0.585	0.570	1.34
101)		isopropylbenze...	0.721	0.910	0.948	0.952	0.927	0.929	0.898	9.82
102)		Benzaldehyde	0.172	0.239	0.216	0.188	0.184	0.118	0.186	22.23
103)		n-propylbenzene	0.879	1.156	1.191	1.201	1.169	1.163	1.126	10.87
104)		1,3,5-Trimethy...	0.336	0.449	0.482	0.498	0.486	0.461	0.452	13.16
105)		m-ethyltoluene	2.487	3.212	3.351	3.370	3.236	3.133	3.131	10.47
106)		p-ethyltoluene	1.244	1.606	1.676	1.685	1.618	1.566	1.566	10.47
107)		n-Decane	0.225	0.304	0.309	0.310	0.298	0.265	0.285	11.98
108)		o-ethyltoluene	0.678	0.879	0.918	0.927	0.898	0.861	0.860	10.73
109)		1,2,4-Trimethy...	0.531	0.709	0.744	0.761	0.732	0.672	0.691	12.20
110)		Benzyl Chloride	0.270	0.390	0.424	0.464	0.461	0.430	0.407	17.70
111)		1,3-Dichlorobe...	0.404	0.524	0.542	0.533	0.517	0.497	0.503	10.12
112)		1,4-Dichlorobe...	0.380	0.495	0.500	0.501	0.477	0.463	0.469	9.84
113)		1,2,3-Trimethy...	0.543	0.742	0.774	0.784	0.760	0.672	0.713	12.94
114)		m-Diethylbenzene	0.403	0.533	0.548	0.563	0.545	0.435	0.505	13.41
115)		1,2-Dichlorobe...	0.359	0.479	0.486	0.492	0.472	0.422	0.452	11.43
116)		p-Diethylbenzene	0.413	0.566	0.587	0.583	0.567	0.451	0.528	14.30
117)		m-Tolualdehyde	0.067		0.098	0.074	0.079	0.055	0.075	21.09
118)		n-Undecan	0.269	0.403	0.371	0.352	0.346	0.276	0.336	15.90
119)		Dodecane	0.142	0.249	0.200	0.199	0.213	0.193	0.199	17.32
120)		1,2,4-Trichlor...	0.152	0.245	0.209	0.206	0.206	0.180	0.200	15.60
121)		Hexachlorobuta...	0.201	0.288	0.258	0.244	0.239	0.189	0.237	15.38

2.3 CCV

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

		Compound	AvgRF	CCRF	%Dev	Area%	Dev(min)
1	I	Bromochloromethane (ISTD)	1.000	1.000	0.0	86	0.00
2		Ethylene	0.149	0.174	-16.8	86	0.05
3		Acetylene	0.144	0.141	2.1	81	0.06
4		Ethane	0.249	0.196	21.3	72	0.06
5		Propene	0.271	0.268	1.1	85	0.02
6		Formaldehyde	0.160	0.177	-10.6	88	0.01
7		Propane	0.078	0.080	-2.6	92	0.00
8		Difluorodichloromethane	1.226	1.258	-2.6	89	0.01
9		Chloromethane	0.325	0.329	-1.2	88	0.01
10		Acetaldehyde	0.317	0.306	3.5	97	0.01
11		Dichlorotetrafluoroethane (	1.255	1.288	-2.6	89	0.00
12		Isobutane	0.799	0.766	4.1	87	0.02
13		Vinyl Chloride	0.409	0.428	-4.6	89	0.00
14		1-Butene	0.392	0.404	-3.1	87	0.00
15		1,3-Butadiene	0.275	0.284	-3.3	90	0.00
16		n-Butane	0.475	0.504	-6.1	92	0.00
17		trans-2-Butene	0.330	0.351	-6.4	93	0.00
18		Bromomethane	0.449	0.479	-6.7	91	0.00
19		cis-2-Butene	0.346	0.359	-3.8	87	0.00
20		Chloroethane	0.200	0.218	-9.0	93	0.01
21		Bromoethanene (Vinyl Br)	0.444	0.462	-4.1	91	0.00
22		2-Propenal (Arolein)	0.150	0.145	3.3	86	0.01
23		Acetone	1.733	1.398	19.3	88	0.00
24		Propanal	0.211	0.199	5.7	88	0.00
25		Isopentane (2-Methylbutane)	0.157	0.168	-7.0	96	0.01
26		Isopropanol	0.191	0.104	45.5#	60	0.02
27		Trichlorofluoromethane	1.157	1.189	-2.8	88	0.00
28		1-Pentene	0.317	0.333	-5.0	95	0.00
29		n-Pentane	0.484	0.513	-6.0	78	0.01
30		Isoprene	0.471	0.464	1.5	77	0.01
31		trans-2-Pentene	0.559	0.559	0.0	80	0.00
32		1,1-Dichloroethene	0.581	0.579	0.3	79	0.00
33		cis-2-Pentene	0.559	0.559	0.0	80	0.00
34		Methylene Chloride	0.367	0.362	1.4	75	0.00
35		3-Chloro-1-propene	0.194	0.191	1.5	77	0.00
36		Trichorotrifluoroethane (Fl	0.899	0.879	2.2	78	0.01
37		2,2-Dimethylbutane	0.546	0.510	6.6	76	0.01
38		Carbon Disulfide	1.273	1.207	5.2	78	0.01
39		Methacrolein	0.239	0.217	9.2	74	0.00
40		trans-1,2-Dichloroethene	0.597	0.552	7.5	76	0.00
41		MTBE	1.168	1.096	6.2	77	0.00
42		1,1-dichloroethane	0.748	0.697	6.8	76	0.00
43		2,3-Dimethylbutane	0.606	0.612	-1.0	81	0.00
44		2-Methylpentane	0.906	0.862	4.9	77	0.01
45		Vinyl acetate	1.399	1.405	-0.4	81	0.00
46		Cyclopentene	0.041	0.044	-7.3	92	0.00
47		Butanal (Butyaldehyde)	0.181	0.177	2.2	81	0.00
48		2-Butanone	0.616	0.614	0.3	84	0.00
49		3-Methylpentane	0.694	0.709	-2.2	82	0.00
50		1-Hexene	0.193	0.201	-4.1	84	0.01
51		Ethyl acetate	0.670	0.690	-3.0	84	0.00
52		cis-1,2-Dichloroethene	0.557	0.556	0.2	81	0.00
53		Hexane	0.576	0.589	-2.3	83	0.00
54		Chloroform	0.949	0.954	-0.5	83	0.00
55		Tetrahydrofuran (THF)	0.321	0.311	3.1	83	0.01
56		2-Butenal (Crotonaldehyde)	0.166	0.172	-3.6	90	0.00
57		2,4-Dimethylpentane	0.690	0.699	-1.3	85	0.00
58		1,2-Dichloroethane	0.568	0.599	-5.5	89	0.00
59		Methylcyclopentane	0.770	0.767	0.4	83	0.00
60		1,1,1-Trichloroethane	0.978	0.998	-2.0	86	0.00
61		Benzene	1.471	1.441	2.0	83	0.00
62		2-Methylhexane	0.747	0.730	2.3	83	0.00
63		1,4-Difluorobenzene (Circul	3.666	3.609	1.6	86	0.00
64		Carbon Tetrachloride	0.933	0.965	-3.4	86	0.00
65		Cyclohexane	0.627	0.623	0.6	83	0.01
66		2,3-Dimethylpentane	0.712	0.688	3.4	82	0.00
67		3-Methylhexane	0.712	0.688	3.4	82	0.00
68		Pentanal	0.428	0.432	-0.9	89	0.00
69		n-Heptane	0.244	0.247	-1.2	81	0.01
70		1,2-Dichloropropane	0.467	0.470	-0.6	85	0.00
71		1,4-Dioxane	0.159	0.136	14.5	74	0.00
72		2,2,4-Trimethylpentane	2.227	2.214	0.6	83	0.00

73		Trichloroethene	0.792	0.803	-1.4	85	0.00
74		Bromodichloromethane	0.977	1.008	-3.2	86	0.00
75		4-methyl-2-pentanone	0.574	0.491	14.5	67	0.00
76		Trans-1,3-Dichloropropene	0.768	0.777	-1.2	83	0.00
77		Methylcyclohexane	0.847	0.832	1.8	83	0.00
78		cis-1,3-Dichloropropene	0.619	0.650	-5.0	86	0.01
79		2,3,4-Trimethylpentane	0.958	0.972	-1.5	84	0.00
80		1,1,2-Trichloroethane	0.612	0.637	-4.1	85	0.00
81		2-Methylheptane	0.864	0.860	0.5	84	0.00
82		2-Hexanone	0.273	0.206	24.5	59	0.00
83		Toluene	1.764	1.818	-3.1	85	0.01
84		n-Octane	0.682	0.676	0.9	83	0.00
85		Hexanal (Hexaladehyde)	0.298	0.303	-1.7	84	0.01
86		3-Methylheptane	0.379	0.390	-2.9	86	0.00
87		Dibromochloromethane	1.080	1.112	-3.0	86	0.01
88		1,2-Dibromoethane	0.952	0.985	-3.5	85	0.01
89		Tetrachloroethene	1.061	1.108	-4.4	86	0.00
90	I	Chlorobenzene-d5 (ISTD)	1.000	1.000	0.0	87	0.00
91		Chlorobenzene	0.503	0.526	-4.6	86	0.01
92		Ethylbenzene	1.510	1.577	-4.4	86	0.01
93		m-Xylenes	1.163	1.226	-5.4	86	0.01
94		p-Xylenes	0.621	0.655	-5.5	86	0.01
95		Nonane	0.291	0.303	-4.1	84	0.01
96		Styrene	0.436	0.456	-4.6	85	0.00
97		Bromoform	0.871	0.912	-4.7	85	0.00
98		o-Xylene	0.596	0.630	-5.7	86	0.01
99		1,1,2,2-Terachloroethane	0.361	0.373	-3.3	84	0.02
100		Bromofluorobenzene_(circuit	0.567	0.600	-5.8	93	0.01
101		isopropylbenzene (Cumene)	0.892	0.934	-4.7	86	0.01
102		Benzaldehyde	0.200	0.187	6.5	76	0.02
103		n-propylbenzene	1.119	1.180	-5.5	87	0.01
104		1,3,5-Trimethylbenzene	0.450	0.458	-1.8	83	0.01
105		m-ethyltoluene	3.131	3.350	-7.0	87	0.01
106		p-ethyltoluene	1.566	1.675	-7.0	87	0.01
107		n-Decane	0.289	0.305	-5.5	86	0.00
108		o-ethyltoluene	0.860	0.911	-5.9	87	0.02
109		1,2,4-Trimethylbenzene	0.695	0.734	-5.6	86	0.01
110		Benzyl Chloride	0.402	0.419	-4.2	86	0.01
111		1,3-Dichlorobenzene	0.504	0.521	-3.4	84	0.01
112		1,4-Dichlorobenzene	0.470	0.530	-12.8	93	0.01
113		1,2,3-Trimethylbenzene	0.721	0.774	-7.4	87	0.01
114		m-Diethylbenzene	0.518	0.553	-6.8	88	0.01
115		1,2-Dichlorobenzene	0.458	0.492	-7.4	88	0.01
116		p-Diethylbenzene	0.543	0.573	-5.5	85	0.01
117		m-Tolualdehyde	0.093	0.066	29.0#	59	0.02
118		n-Undecan	0.348	0.360	-3.4	85	0.02
119		Dodecane	0.201	0.189	6.0	82	0.01
120		1,2,4-Trichlorobenzene	0.204	0.207	-1.5	86	0.02
121		Hexachlorobutadiene	0.246	0.258	-4.9	87	0.02

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

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2.4 Blank spike Recovery % (Accuracy %)

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

Compound	R.T.	QIon	Response	Conc	Units	Dev(Min)
Internal Standards						
1) Bromochloromethane (ISTD)	27.540	130	381347	5.00	ppbv	0.00
90) Chlorobenzene-d5 (ISTD)	34.084	117	1093535	5.00	ppbv	0.00
Target Compounds						Qvalue
2) Ethylene	10.613	28	46176	4.07	ppbv #	37
3) Acetylene	11.024	26	56049	5.10	ppbv #	69
4) Ethane	11.506	28	71741	3.78	ppbv #	65
5) Propene	15.755	41	207507	10.04	ppbv	100
6) Formaldehyde	16.070	29	65506	5.35	ppbv #	96
7) Propane	16.061	39	27192	4.59	ppbv	98
8) Difluorodichloromethane	16.834	85	462046	4.94	ppbv	99
9) Chloromethane	18.288	50	125459	5.06	ppbv	99
10) Acetaldehyde	19.216	29	85127	3.52	ppbv #	77
11) Dichlorotetrafluoroeth...	19.235	85	476243	4.98	ppbv	98
12) Isobutane	19.207	43	265312	4.35	ppbv	96
13) Vinyl Chloride	19.790	62	159090	5.10	ppbv	98
14) 1-Butene	20.316	41	150141	5.02	ppbv	98
15) 1,3-Butadiene	20.460	54	106587	5.09	ppbv	99
16) n-Butane	20.680	43	183686	5.08	ppbv	99
17) trans-2-Butene	21.082	41	128112	5.08	ppbv	98
18) Bromomethane	21.464	94	174159	5.09	ppbv	98
19) cis-2-Butene	21.646	41	133127	5.05	ppbv	98
20) Chloroethane	22.010	64	79495	5.20	ppbv	98
21) Bromoethanene (Vinyl Br)	22.919	106	172969	5.11	ppbv	99
22) 2-Propenal (Arolein)	23.091	56	54715	4.79	ppbv #	98
23) Acetone	23.301	43	773062	5.85	ppbv	99
24) Propanal	23.426	29	82340	5.13	ppbv #	58
25) Isopentane (2-Methylbu...	23.435	57	118756	9.90	ppbv	97
26) Isopropanol	23.722	45	25985	1.78	ppbv #	61
27) Trichlorofluoromethane	23.741	101	443316	5.02	ppbv	99
28) 1-Pentene	23.914	55	124454	5.15	ppbv	94
29) n-Pentane	24.296	43	172221	4.67	ppbv	98
30) Isoprene	24.468	67	171276	4.77	ppbv	96
31) trans-2-Pentene	24.784	55	196612	4.61	ppbv	99
32) 1,1-Dichloroethene	24.803	61	209250	4.72	ppbv	99
33) cis-2-Pentene	24.784	55	196612	4.61	ppbv	98
34) Methylene Chloride	24.928	49	130871	4.67	ppbv	96
35) 3-Chloro-1-propene	25.090	76	81360	5.50	ppbv	92
36) Trichorotrifluoroethan...	25.215	151	347475	5.07	ppbv	98
37) 2,2-Dimethylbutane	25.521	71	221677	5.33	ppbv	96
38) Carbon Disulfide	25.607	76	524215	5.40	ppbv #	99
39) Methacrolein	25.999	41	97411	5.33	ppbv	99
40) trans-1,2-Dichloroethene	26.143	61	236681	5.20	ppbv	98
41) MTBE	26.305	73	466598	5.24	ppbv	95
42) 1,1-dichloroethane	26.411	63	290331	5.09	ppbv #	98
43) 2,3-Dimethylbutane	26.487	71	237230	5.13	ppbv	97
44) 2-Methylpentane	26.468	42	354022	5.12	ppbv #	90
45) Vinyl acetate	26.468	43	552059	5.17	ppbv #	99
46) Cyclopentene	26.545	67	14589	4.66	ppbv #	79
47) Butanal (Butyaldehyde)	26.592	72	61480	4.44	ppbv #	84
48) 2-Butanone	26.679	43	493801	10.51	ppbv	100
49) 3-Methylpentane	26.956	57	276783	5.23	ppbv	99
50) 1-Hexene	27.061	56	154848	10.53	ppbv	95
51) Ethyl acetate	27.205	43	274346	5.37	ppbv	99
52) cis-1,2-Dichloroethene	27.310	61	212904	5.01	ppbv	97
53) Hexane	27.387	57	454584	10.35	ppbv	100
54) Chloroform	27.616	83	366159	5.06	ppbv	99
55) Tetrahydrofuran (THF)	28.037	42	126638	5.18	ppbv	99
56) 2-Butenal (Crotonaldeh...	28.171	41	66861	5.28	ppbv	89
57) 2,4-Dimethylpentane	28.286	43	269606	5.12	ppbv	98
58) 1,2-Dichloroethane	28.420	62	221048	5.10	ppbv	98
59) Methylcyclopentane	28.448	56	292381	4.98	ppbv	99
60) 1,1,1-Trichloroethane	28.716	97	375674	5.04	ppbv	99
61) Benzene	29.204	78	1106138	9.86	ppbv	98
62) 2-Methylhexane	29.290	43	282444	4.95	ppbv	99
63) 1,4-Difluorobenzene (C...	29.290	114	1378834	4.93	ppbv	99
64) Carbon Tetrachloride	29.367	117	367525	5.16	ppbv	98
65) Cyclohexane	29.510	84	476584	9.96	ppbv #	36
66) 2,3-Dimethylpentane	29.558	43	277811	5.12	ppbv #	63
67) 3-Methylhexane	29.558	43	277811	5.12	ppbv #	91
68) Pentanal	29.577	44	162945	4.99	ppbv	95
69) n-Heptane	29.568	57	182411	9.80	ppbv	92
70) 1,2-Dichloropropane	29.970	63	181742	5.10	ppbv #	91
71) 1,4-Dioxane	30.056	88	32756	2.71	ppbv #	56
72) 2,2,4-Trimethylpentane	30.056	57	1712886	10.08	ppbv	95

73)	Trichloroethene	30.161	130	307236	5.09	ppbv	98
74)	Bromodichloromethane	30.161	83	384076	5.15	ppbv	99
75)	4-methyl-2-pentanone	30.773	43	173052	3.95	ppbv	99
76)	Trans-1,3-Dichloropropene	30.926	75	304878	5.20	ppbv	99
77)	Methylcyclohexane	31.213	83	326846	5.06	ppbv	96
78)	cis-1,3-Dichloropropene	31.386	75	256181	5.42	ppbv	99
79)	2,3,4-Trimethylpentane	31.720	43	371625	5.09	ppbv	98
80)	1,1,2-Trichloroethane	31.711	97	242340	5.19	ppbv	95
81)	2-Methylheptane	31.835	57	336615	5.11	ppbv	99
82)	2-Hexanone	31.941	58	68747	3.30	ppbv	97
83)	Toluene	32.027	91	1398300	10.39	ppbv	100
84)	n-Octane	32.065	43	260411	5.01	ppbv	97
85)	Hexanal (Hexaladehyde)	32.237	56	117551	5.18	ppbv	97
86)	3-Methylheptane	32.629	57	150950	5.23	ppbv	95
87)	Dibromochloromethane	32.629	129	441203	5.36	ppbv	98
88)	1,2-Dibromoethane	32.935	107	380711	5.24	ppbv	99
89)	Tetrachloroethene	33.318	166	418058	5.17	ppbv	98
91)	Chlorobenzene	34.141	112	579978	5.28	ppbv	100
92)	Ethylbenzene	34.428	91	1756492	5.32	ppbv	99
93)	m-Xylenes	34.600	91	2707374	10.64	ppbv	99
94)	p-Xylenes	34.600	106	1435744	10.57	ppbv	98
95)	Nonane	35.021	57	342765	5.39	ppbv	98
96)	Styrene	35.117	104	1027545	10.78	ppbv	99
97)	Bromoform	35.117	104	1027545	5.39	ppbv	99
98)	o-Xylene	35.289	91	1378965	10.58	ppbv	99
99)	1,1,2,2-Terachloroethane	35.289	83	401417	5.09	ppbv	99
100)	Bromofluorobenzene_(ci...	35.959	95	628771	5.07	ppbv	97
101)	isopropylbenzene (Cumene)	36.007	105	1038636	5.33	ppbv	99
102)	Benzaldehyde	36.734	77	187593	4.29	ppbv #	81
103)	n-propylbenzene	36.782	91	1319760	5.39	ppbv	97
104)	1,3,5-Trimethylbenzene	36.868	105	998439	10.15	ppbv	98
105)	m-ethyltoluene	36.973	105	3718309	5.43	ppbv	100
106)	p-ethyltoluene	36.973	105	3718309	10.86	ppbv	93
107)	n-Decane	37.470	43	336824	5.32	ppbv	97
108)	o-ethyltoluene	37.509	105	1003701	5.34	ppbv	99
109)	1,2,4-Trimethylbenzene	37.853	105	1628629	10.71	ppbv	99
110)	Benzyl Chloride	38.312	91	499139	5.68	ppbv	100
111)	1,3-Dichlorobenzene	38.446	146	577733	5.24	ppbv	98
112)	1,4-Dichlorobenzene	38.551	146	558692	5.43	ppbv	98
113)	1,2,3-Trimethylbenzene	38.810	105	835785	5.30	ppbv	100
114)	m-Diethylbenzene	39.212	105	596671	5.26	ppbv	99
115)	1,2-Dichlorobenzene	39.374	146	520699	5.20	ppbv	98
116)	p-Diethylbenzene	39.470	119	626653	5.28	ppbv	99
117)	m-Tolualdehyde	39.776	91	74412	3.66	ppbv	95

2.5 Replicates

The duplicated 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

		Compound	1	2	3	4	5	6	7	Avg	%RSD
1)	I	Bromochloromethane...	----------ISTD----------								
2)		Ethylene	0.293	0.253	0.231	0.335	0.286	0.328	0.241	0.281	14.67
3)		Acetylene	0.158	0.163	0.198	0.182	0.197	0.184	0.220	0.186	11.46
4)		Ethane	0.302	0.352	0.325	0.328	0.344	0.264	0.444	0.337	16.44
5)		Propene	0.612	0.614	0.695	0.699	0.715	0.710	0.734	0.683	7.20
6)		Formaldehyde	0.172	0.138	0.155	0.109	0.246	0.148	0.134	0.157	27.85
7)		Propane	0.120	0.116	0.133	0.122	0.124	0.134	0.136	0.127	6.20
8)		Difluorodichlo...	1.361	1.400	1.588	1.617	1.616	1.588	1.711	1.554	8.13
9)		Chloromethane	0.380	0.383	0.450	0.427	0.426	0.435	0.450	0.422	6.94
10)		Acetaldehyde	0.626	0.596	0.374	0.362	0.329	0.406	0.479	0.453	26.00
11)		Dichlorotetraf...	1.395	1.434	1.573	1.637	1.606	1.667	1.765	1.583	8.20
12)		Isobutane	1.104	1.164	1.231	1.214	1.246	1.258	1.326	1.220	5.82
13)		Vinyl Chloride	0.443	0.454	0.536	0.522	0.519	0.503	0.553	0.504	8.16
14)		1-Butene	0.443	0.460	0.521	0.505	0.512	0.509	0.577	0.504	8.62
15)		1,3-Butadiene	0.283	0.317	0.356	0.362	0.331	0.356	0.363	0.338	8.85
16)		n-Butane	0.553	0.554	0.644	0.637	0.629	0.647	0.695	0.623	8.32
17)		trans-2-Butene	0.366	0.380	0.439	0.428	0.409	0.422	0.470	0.416	8.51
18)		Bromomethane	0.482	0.499	0.575	0.572	0.555	0.572	0.628	0.555	8.91
19)		cis-2-Butene	0.367	0.385	0.452	0.453	0.441	0.476	0.483	0.437	10.11
20)		Chloroethane	0.223	0.250	0.257	0.253	0.258	0.272	0.294	0.258	8.36
21)		Bromoethanene ...	0.456	0.496	0.539	0.555	0.557	0.548	0.605	0.536	8.93
22)		2-Propenal (Ar...	0.170	0.161	0.188	0.185	0.202	0.192	0.214	0.187	9.64
23)		Acetone	4.675	4.351	4.663	4.836	4.482	4.492	4.573	4.582	3.46
24)		Propanal	0.219	0.231	0.289	0.244	0.262	0.251	0.321	0.260	13.60
25)		Isopentane (2-...	0.382	0.364	0.438	0.436	0.407	0.438	0.436	0.414	7.44
26)		Isopropanol	0.364	0.379	0.459	0.390	0.339	0.351	0.430	0.387	11.13
27)		Trichlorofluor...	1.308	1.387	1.564	1.579	1.513	1.527	1.682	1.508	8.27
28)		1-Pentene	0.356	0.362	0.423	0.432	0.408	0.408	0.448	0.405	8.50
29)		n-Pentane	0.577	0.604	0.653	0.645	0.625	0.608	0.664	0.625	4.97
30)		Isoprene	0.523	0.503	0.589	0.575	0.603	0.577	0.601	0.567	6.87
31)		trans-2-Pentene	0.657	0.651	0.686	0.722	0.750	0.693	0.734	0.699	5.43
32)		1,1-Dichloroet...	0.675	0.670	0.747	0.749	0.802	0.729	0.797	0.738	7.07
33)		cis-2-Pentene	0.657	0.651	0.686	0.722	0.750	0.693	0.734	0.699	5.43
34)		Methylene Chlo...	0.466	0.486	0.458	0.504	0.547	0.545	0.530	0.505	7.26
35)		3-Chloro-1-pro...	0.222	0.232	0.252	0.271	0.250	0.262	0.304	0.256	10.48
36)		Trichorotriflu...	0.963	1.052	1.224	1.206	1.178	1.203	1.279	1.158	9.52
37)		2,2-Dimethylbu...	0.627	0.629	0.700	0.726	0.718	0.708	0.777	0.698	7.70
38)		Carbon Disulfide	1.474	1.547	1.743	1.787	1.720	1.705	1.885	1.694	8.29
39)		Methacrolein	0.268	0.284	0.297	0.325	0.300	0.324	0.314	0.302	6.98
40)		trans-1,2-Dich...	0.686	0.678	0.788	0.790	0.775	0.796	0.851	0.766	8.14
41)		MTBE	1.268	1.335	1.481	1.509	1.514	1.488	1.632	1.461	8.31
42)		1,1-dichloroet...	0.843	0.876	1.013	0.995	1.007	1.005	1.081	0.974	8.64
43)		2,3-Dimethylbu...	0.630	0.704	0.747	0.766	0.766	0.760	0.819	0.742	8.04
44)		2-Methylpentane	1.127	0.966	1.253	1.200	1.320	1.224	1.308	1.200	10.20
45)		Vinyl acetate	1.604	1.672	1.863	1.845	1.847	1.884	2.004	1.817	7.44
46)		Cyclopentene	0.045	0.055	0.067	0.073	0.067	0.079	0.066	0.065	17.41
47)		Butanal (Butya...	0.241	0.233	0.231	0.268	0.270	0.234	0.290	0.253	9.22
48)		2-Butanone	1.460	1.488	1.789	1.761	1.668	1.686	1.868	1.674	9.09
49)		3-Methylpentane	0.768	0.841	0.905	0.971	0.899	0.890	1.035	0.901	9.55
50)		1-Hexene	0.435	0.436	0.514	0.494	0.473	0.490	0.523	0.481	7.24
51)		Ethyl acetate	0.774	0.812	0.880	0.937	0.911	0.891	0.979	0.883	8.00
52)		cis-1,2-Dichlo...	0.587	0.650	0.736	0.723	0.758	0.729	0.786	0.710	9.66
53)		Hexane	1.293	1.338	1.496	1.507	1.511	1.508	1.644	1.471	8.05
54)		Chloroform	1.061	1.146	1.271	1.311	1.249	1.266	1.409	1.245	9.04
55)		Tetrahydrofura...	0.339	0.354	0.405	0.419	0.386	0.400	0.438	0.391	8.98
56)		2-Butenal (Cro...	0.177	0.174	0.212	0.191	0.212	0.210	0.262	0.205	14.47
57)		2,4-Dimethylpe...	0.757	0.791	0.896	0.898	0.871	0.867	0.962	0.863	8.01
58)		1,2-Dichloroet...	0.621	0.679	0.768	0.751	0.768	0.791	0.800	0.740	8.87
59)		Methylcyclopen...	0.814	0.853	0.975	0.988	0.956	0.982	1.027	0.942	8.28
60)		1,1,1-Trichlor...	1.062	1.128	1.285	1.285	1.222	1.265	1.391	1.234	8.87
61)		Benzene	3.254	3.384	3.845	3.797	3.753	3.772	4.117	3.703	7.89
62)		2-Methylhexane	0.871	0.894	1.001	1.020	1.021	1.014	1.071	0.985	7.46
63)		1,4-Difluorobe...	3.571	3.552	3.602	3.606	3.580	3.651	3.599	3.594	0.87
64)		Carbon Tetrach...	1.036	1.073	1.223	1.189	1.209	1.215	1.315	1.180	8.06
65)		Cyclohexane	1.363	1.422	1.639	1.674	1.595	1.635	1.772	1.586	9.06
66)		2,3-Dimethylpe...	0.775	0.784	0.944	0.931	0.821	0.915	0.997	0.881	9.86
67)		3-Methylhexane	0.775	0.784	0.944	0.931	0.821	0.915	0.997	0.881	9.86
68)		Pentanal	0.486	0.512	0.550	0.546	0.572	0.516	0.584	0.538	6.50
69)		n-Heptane	0.554	0.599	0.637	0.617	0.643	0.667	0.726	0.635	8.51
70)		1,2-Dichloropr...	0.502	0.545	0.600	0.607	0.599	0.607	0.667	0.590	8.84
71)		1,4-Dioxane	0.277	0.284	0.339	0.344	0.296	0.321	0.363	0.318	10.35
72)		2,2,4-Trimethy...	4.857	5.188	5.808	5.877	5.768	5.798	6.239	5.648	8.25
73)		Trichloroethene	0.867	0.932	0.993	1.018	1.052	1.051	1.119	1.005	8.33
74)		Bromodichlorom...	1.070	1.165	1.301	1.265	1.284	1.275	1.389	1.250	8.22

75)		4-methyl-2-pen...	0.731	0.759	0.877	0.896	0.825	0.837	0.945	0.839	9.00
76)		Trans-1,3-Dich...	0.777	0.843	0.994	0.965	0.940	0.946	1.014	0.926	9.23
77)		Methylcyclohexane	0.863	0.953	1.028	1.044	1.026	1.052	1.123	1.013	8.17
78)		cis-1,3-Dichlo...	0.667	0.682	0.753	0.759	0.917	0.769	0.822	0.767	11.01
79)		2,3,4-Trimethy...	1.001	1.115	1.176	1.223	1.226	1.230	1.334	1.187	8.84
80)		1,1,2-Trichlor...	0.690	0.739	0.814	0.823	0.812	0.812	0.893	0.798	8.14
81)		2-Methylheptane	0.926	0.928	1.029	1.054	1.005	1.052	1.091	1.012	6.29
82)		2-Hexanone	0.395	0.413	0.493	0.475	0.417	0.464	0.509	0.452	9.69
83)		Toluene	3.943	4.073	4.555	4.562	4.539	4.635	4.954	4.466	7.74
84)		n-Octane	0.735	0.780	0.841	0.909	0.837	0.900	0.943	0.849	8.73
85)		Hexanal (Hexal...	0.330	0.353	0.407	0.407	0.384	0.385	0.431	0.385	8.96
86)		3-Methylheptane	0.405	0.419	0.468	0.471	0.450	0.466	0.519	0.457	8.23
87)		Dibromochlorom...	1.150	1.207	1.373	1.317	1.326	1.355	1.445	1.310	7.68
88)		1,2-Dibromoethane	1.027	1.092	1.241	1.243	1.215	1.252	1.352	1.203	9.04
89)		Tetrachloroethene	1.155	1.246	1.387	1.360	1.364	1.387	1.505	1.344	8.35
90)	I	Chlorobenzene-d5 (...	----------ISTD----------								
91)		Chlorobenzene	0.557	0.589	0.660	0.640	0.649	0.647	0.697	0.634	7.34
92)		Ethylbenzene	1.615	1.743	1.908	1.895	1.892	1.921	2.061	1.862	7.67
93)		m-Xylenes	2.497	2.658	3.011	2.969	2.906	2.993	3.179	2.888	8.04
94)		p-Xylenes	1.340	1.434	1.584	1.578	1.545	1.605	1.680	1.538	7.44
95)		Nonane	0.300	0.318	0.366	0.353	0.352	0.364	0.391	0.349	8.86
96)		Styrene	0.921	0.979	1.097	1.082	1.057	1.087	1.182	1.058	8.02
97)		Bromoform	0.921	0.979	1.097	1.082	1.057	1.087	1.182	1.058	8.02
98)		o-Xylene	1.296	1.388	1.515	1.516	1.514	1.528	1.652	1.487	7.64
99)		1,1,2,2-Terach...	0.413	0.430	0.512	0.497	0.474	0.491	0.530	0.478	8.98
100)		Bromofluoroben...	0.603	0.605	0.609	0.602	0.603	0.603	0.608	0.605	0.49
101)		isopropylbenze...	0.986	1.035	1.170	1.148	1.132	1.185	1.270	1.132	8.41
102)		Benzaldehyde	0.249	0.264	0.310	0.299	0.272	0.291	0.308	0.285	8.30
103)		n-propylbenzene	1.184	1.271	1.420	1.395	1.394	1.414	1.524	1.372	8.08
104)		1,3,5-Trimethy...	0.964	1.015	1.115	1.105	1.057	1.113	1.200	1.081	7.15
105)		m-ethyltoluene	3.299	3.541	4.078	4.001	3.971	3.966	4.334	3.884	8.97
106)		p-ethyltoluene	3.299	3.541	4.078	4.001	3.971	3.966	4.334	3.884	8.97
107)		n-Decane	0.316	0.335	0.377	0.373	0.373	0.383	0.403	0.366	8.14
108)		o-ethyltoluene	0.938	0.999	1.117	1.112	1.078	1.102	1.193	1.077	7.80
109)		1,2,4-Trimethy...	1.464	1.549	1.786	1.752	1.713	1.753	1.858	1.696	8.21
110)		Benzyl Chloride	0.379	0.387	0.456	0.451	0.426	0.430	0.465	0.428	7.82
111)		1,3-Dichlorobe...	0.567	0.566	0.668	0.664	0.620	0.658	0.697	0.634	8.10
112)		1,4-Dichlorobe...	0.492	0.567	0.621	0.618	0.620	0.613	0.668	0.600	9.28
113)		1,2,3-Trimethy...	0.756	0.797	0.900	0.886	0.879	0.892	0.970	0.869	8.15
114)		m-Diethylbenzene	0.529	0.566	0.669	0.622	0.638	0.640	0.698	0.623	9.34
115)		1,2-Dichlorobe...	0.510	0.540	0.628	0.608	0.588	0.601	0.656	0.590	8.54
116)		p-Diethylbenzene	0.568	0.613	0.694	0.660	0.663	0.696	0.734	0.661	8.44
117)		m-Tolualdehyde	0.103	0.106	0.167	0.142	0.105	0.122	0.146	0.127	19.47
118)		n-Undecan	0.380	0.401	0.502	0.464	0.417	0.453	0.496	0.445	10.56
119)		Dodecane	0.205	0.226	0.329	0.243	0.236	0.245	0.266	0.250	15.70
120)		1,2,4-Trichlor...	0.220	0.233	0.314	0.285	0.246	0.258	0.294	0.264	13.02
121)		Hexachlorobuta...	0.283	0.305	0.386	0.345	0.318	0.322	0.373	0.333	11.08

2.5.2 Duplicated Data, 2.0 ppb Level

		Compound	1	2	3	4	5	6	7	Avg		%RSD
1)	I	Bromochloromethane...	----------ISTD----------									
2)		Ethylene	0.541	0.863	0.529	0.603	0.597	0.580	0.509	0.603		19.88
3)		Acetylene	0.583	0.609	0.578	0.603	0.614	0.710	0.672	0.624		7.83
4)		Ethane	0.963	0.824	1.008	0.811	0.874	0.969	1.193	0.949		13.87
5)		Propene	2.090	2.294	2.197	2.282	2.248	2.504	2.556	2.310		7.15
6)		Formaldehyde	0.720	0.754	0.721	0.687	0.696	0.761	0.682	0.717		4.38
7)		Propane	0.300	0.332	0.317	0.347	0.323	0.376	0.371	0.338		8.30
8)		Difluorodichlo...	4.858	5.315	5.064	5.271	5.219	5.651	5.677	5.294		5.58
9)		Chloromethane	1.274	1.411	1.366	1.409	1.361	1.546	1.501	1.410		6.45
10)		Acetaldehyde	0.916	1.003	1.176	0.934	1.368	1.300	1.317	1.145		16.78
11)		Dichlorotetraf...	4.945	5.445	5.176	5.318	5.287	5.814	5.809	5.399		5.94
12)		Isobutane	2.956	3.199	3.112	3.150	3.127	3.580	3.529	3.236		7.12
13)		Vinyl Chloride	1.625	1.788	1.686	1.704	1.702	1.949	1.914	1.767		6.93
14)		1-Butene	1.518	1.660	1.557	1.599	1.641	1.825	1.787	1.655		6.90
15)		1,3-Butadiene	1.080	1.183	1.082	1.168	1.146	1.270	1.300	1.176		7.22
16)		n-Butane	1.866	2.042	1.972	1.986	1.972	2.246	2.249	2.048		7.14
17)		trans-2-Butene	1.325	1.400	1.364	1.428	1.382	1.566	1.548	1.431		6.45
18)		Bromomethane	1.741	1.902	1.816	1.873	1.843	2.078	2.112	1.909		7.18
19)		cis-2-Butene	1.367	1.482	1.404	1.469	1.427	1.615	1.576	1.477		6.11
20)		Chloroethane	0.798	0.881	0.838	0.843	0.817	0.955	0.947	0.868		7.14
21)		Bromoethanene ...	1.791	1.878	1.806	1.878	1.825	2.067	2.049	1.899		5.97
22)		2-Propenal (Ar...	0.556	0.588	0.582	0.588	0.565	0.665	0.671	0.602		7.72
23)		Acetone	9.726	9.924	9.374	9.324	8.581	9.418	9.866	9.459		4.83
24)		Propanal	0.838	0.955	0.930	0.877	0.823	1.013	0.980	0.917		7.89
25)		Isopentane (2-...	1.225	1.300	1.234	1.294	1.291	1.456	1.411	1.316		6.60
26)		Isopropanol	0.861	0.835	0.793	0.617	0.570	0.493	0.543	0.673		22.59
27)		Trichlorofluor...	4.765	5.056	4.873	4.993	4.958	5.424	5.401	5.067		5.00
28)		1-Pentene	1.333	1.377	1.409	1.347	1.301	1.455	1.494	1.388		4.97
29)		n-Pentane	2.029	2.131	2.046	1.933	2.076	2.202	2.145	2.080		4.26
30)		Isoprene	1.842	2.062	1.920	1.918	1.987	2.006	1.998	1.962		3.72
31)		trans-2-Pentene	2.202	2.382	2.258	2.564	2.463	2.397	2.462	2.390		5.22
32)		1,1-Dichloroet...	2.329	2.501	2.418	2.683	2.566	2.618	2.646	2.537		5.07
33)		cis-2-Pentene	2.202	2.382	2.258	2.564	2.463	2.397	2.462	2.390		5.22
34)		Methylene Chlo...	1.424	1.577	1.471	1.758	1.726	1.897	1.631	1.641		10.15
35)		3-Chloro-1-pro...	0.756	0.852	0.806	0.890	0.895	0.933	0.907	0.863		7.22
36)		Trichorotriflu...	3.586	3.759	3.604	3.971	3.916	4.251	3.987	3.868		6.11
37)		2,2-Dimethylbu...	2.103	2.276	2.163	2.484	2.469	2.573	2.327	2.342		7.46
38)		Carbon Disulfide	4.826	5.234	4.952	5.728	5.663	6.266	5.879	5.507		9.48
39)		Methacrolein	0.941	1.130	1.027	1.076	1.068	1.114	1.142	1.071		6.52
40)		trans-1,2-Dich...	2.391	2.698	2.553	2.661	2.595	2.855	2.840	2.656		6.14
41)		MTBE	4.884	5.300	5.017	5.167	5.218	5.464	5.515	5.223		4.35
42)		1,1-dichloroet...	3.134	3.343	3.189	3.250	3.212	3.497	3.529	3.308		4.67
43)		2,3-Dimethylbu...	2.490	2.688	2.565	2.697	2.683	2.831	2.777	2.676		4.37
44)		2-Methylpentane	3.935	3.833	3.642	4.046	4.288	4.725	4.076	4.078		8.58
45)		Vinyl acetate	5.903	6.406	6.065	6.209	6.155	6.702	6.721	6.309		4.98
46)		Cyclopentene	0.147	0.193	0.176	0.176	0.138	0.211	0.174	0.174		14.52
47)		Butanal (Butya...	0.734	0.740	0.711	0.732	0.759	0.817	0.757	0.750		4.48
48)		2-Butanone	5.243	5.729	5.374	5.536	5.482	6.051	6.072	5.641		5.73
49)		3-Methylpentane	2.947	3.178	3.008	3.173	3.124	3.225	3.283	3.134		3.80
50)		1-Hexene	1.624	1.763	1.670	1.736	1.727	1.848	1.744	1.730		4.09
51)		Ethyl acetate	2.881	3.114	3.008	3.069	3.013	3.288	3.295	3.095		4.90
52)		cis-1,2-Dichlo...	2.365	2.482	2.391	2.493	2.344	2.623	2.651	2.479		4.93
53)		Hexane	4.809	5.238	4.953	5.073	5.065	5.476	5.491	5.158		4.99
54)		Chloroform	4.000	4.274	3.995	4.154	4.153	4.515	4.448	4.220		4.83
55)		Tetrahydrofura...	1.349	1.442	1.415	1.396	1.404	1.580	1.553	1.448		5.91
56)		2-Butenal (Cro...	0.736	0.800	0.761	0.734	0.740	0.841	0.844	0.780		6.22
57)		2,4-Dimethylpe...	2.827	3.036	2.952	2.951	2.951	3.252	3.253	3.032		5.36
58)		1,2-Dichloroet...	2.378	2.543	2.433	2.497	2.506	2.676	2.687	2.532		4.57
59)		Methylcyclopen...	3.111	3.381	3.159	3.320	3.297	3.566	3.576	3.344		5.41
60)		1,1,1-Trichlor...	4.012	4.287	4.049	4.235	4.236	4.514	4.508	4.263		4.63
61)		Benzene	1.189	1.281	1.212	1.242	1.239	1.340	1.346	1.264	E1	4.81
62)		2-Methylhexane	3.013	3.310	3.111	3.209	3.233	3.559	3.506	3.277		6.06
63)		1,4-Difluorobe...	3.605	3.588	3.577	3.590	3.624	3.604	3.613	3.600		0.45
64)		Carbon Tetrach...	3.891	4.146	3.846	4.133	4.153	4.366	4.459	4.142		5.41
65)		Cyclohexane	5.146	5.577	5.232	5.394	5.364	5.826	5.764	5.472		4.74
66)		2,3-Dimethylpe...	2.842	3.018	3.040	2.983	3.011	3.367	3.187	3.064		5.47
67)		3-Methylhexane	2.842	3.018	3.040	2.983	3.011	3.367	3.187	3.064		5.47
68)		Pentanal	1.746	1.868	1.820	1.739	1.773	1.901	2.000	1.836		5.17
69)		n-Heptane	2.060	2.216	2.048	2.196	2.152	2.188	2.306	2.167		4.16
70)		1,2-Dichloropr...	1.896	2.082	1.949	2.021	1.983	2.209	2.165	2.044		5.60
71)		1,4-Dioxane	0.811	0.847	0.788	0.727	0.696	0.726	0.768	0.766		6.94
72)		2,2,4-Trimethy...	1.818	1.955	1.860	1.915	1.901	2.075	2.071	1.942	E1	5.10

73)		Trichloroethene	3.310	3.541	3.318	3.476	3.394	3.617	3.689	3.478		4.21
74)		Bromodichlorom...	4.072	4.364	4.072	4.294	4.288	4.570	4.638	4.329		5.08
75)		4-methyl-2-pen...	2.933	3.238	3.012	2.864	2.841	2.566	2.676	2.876		7.65
76)		Trans-1,3-Dich...	3.130	3.456	3.230	3.359	3.372	3.635	3.650	3.405		5.69
77)		Methylcyclohexane	3.482	3.709	3.468	3.604	3.670	3.916	3.798	3.664		4.44
78)		cis-1,3-Dichlo...	2.624	2.845	2.688	2.793	2.729	2.964	2.990	2.805		4.90
79)		2,3,4-Trimethy...	3.940	4.309	4.004	4.080	4.128	4.492	4.381	4.191		4.92
80)		1,1,2-Trichlor...	2.534	2.804	2.591	2.748	2.710	2.942	2.946	2.754		5.78
81)		2-Methylheptane	3.298	3.540	3.406	3.612	3.679	3.842	3.816	3.599		5.60
82)		2-Hexanone	1.624	1.703	1.597	1.429	1.345	1.111	1.172	1.426		16.09
83)		Toluene	1.461	1.591	1.497	1.546	1.538	1.651	1.668	1.565	E1	4.90
84)		n-Octane	2.776	2.957	2.809	2.912	2.883	3.183	3.123	2.949		5.19
85)		Hexanal (Hexal...	1.227	1.307	1.283	1.382	1.278	1.320	1.352	1.307		3.90
86)		3-Methylheptane	1.554	1.658	1.614	1.652	1.589	1.786	1.791	1.663		5.56
87)		Dibromochlorom...	4.436	4.874	4.464	4.735	4.766	5.037	5.135	4.778		5.54
88)		1,2-Dibromoethane	4.018	4.422	4.039	4.212	4.235	4.484	4.488	4.271		4.66
89)		Tetrachloroethene	4.410	4.808	4.496	4.688	4.662	4.969	4.942	4.711		4.50
90)	I	Chlorobenzene-d5 (...	----------ISTD----------									
91)		Chlorobenzene	2.057	2.292	2.114	2.159	2.118	2.330	2.190	2.180		4.55
92)		Ethylbenzene	6.172	6.984	6.390	6.516	6.437	6.940	6.554	6.570		4.48
93)		m-Xylenes	0.956	1.072	0.990	1.003	0.982	1.071	1.011	1.012	E1	4.36
94)		p-Xylenes	5.059	5.689	5.244	5.380	5.268	5.730	5.371	5.391		4.49
95)		Nonane	1.171	1.349	1.238	1.253	1.229	1.343	1.263	1.264		5.03
96)		Styrene	3.592	4.020	3.673	3.773	3.688	4.021	3.777	3.792		4.44
97)		Bromoform	3.592	4.020	3.673	3.773	3.688	4.021	3.777	3.792		4.44
98)		o-Xylene	4.862	5.499	5.103	5.171	5.051	5.476	5.189	5.193		4.39
99)		1,1,2,2-Terach...	1.545	1.701	1.588	1.594	1.559	1.721	1.645	1.622		4.25
100)		Bromofluoroben...	0.591	0.600	0.598	0.597	0.595	0.617	0.629	0.604		2.28
101)		isopropylbenze...	3.641	4.142	3.788	3.895	3.761	4.102	3.877	3.886		4.68
102)		Benzaldehyde	0.928	1.086	0.975	0.932	0.897	0.919	0.894	0.947		7.06
103)		n-propylbenzene	4.559	5.211	4.793	4.881	4.768	5.220	4.868	4.900		4.90
104)		1,3,5-Trimethy...	3.638	4.098	3.874	3.887	3.785	4.311	3.861	3.922		5.59
105)		m-ethyltoluene	1.301	1.469	1.333	1.367	1.325	1.445	1.375	1.374	E1	4.56
106)		p-ethyltoluene	1.301	1.469	1.333	1.367	1.325	1.445	1.375	1.374	E1	4.56
107)		n-Decane	1.209	1.383	1.251	1.278	1.253	1.406	1.305	1.298		5.59
108)		o-ethyltoluene	3.560	4.030	3.723	3.758	3.707	4.047	3.804	3.804		4.66
109)		1,2,4-Trimethy...	5.778	6.576	6.064	6.155	5.932	6.523	6.119	6.164		4.75
110)		Benzyl Chloride	1.703	1.968	1.752	1.813	1.752	1.819	1.766	1.796		4.76
111)		1,3-Dichlorobe...	2.130	2.412	2.255	2.219	2.130	2.324	2.262	2.247		4.51
112)		1,4-Dichlorobe...	2.014	2.306	2.076	2.094	1.972	2.294	2.089	2.121		6.14
113)		1,2,3-Trimethy...	3.020	3.474	3.151	3.175	3.123	3.359	3.163	3.209		4.80
114)		m-Diethylbenzene	2.197	2.514	2.294	2.309	2.217	2.428	2.284	2.320		4.88
115)		1,2-Dichlorobe...	1.959	2.180	2.035	2.030	1.976	2.141	2.045	2.052		3.96
116)		p-Diethylbenzene	2.325	2.685	2.449	2.418	2.364	2.561	2.444	2.464		4.98
117)		m-Tolualdehyde	0.614	0.632	0.559	0.442	0.416	0.327	0.362	0.479		25.61
118)		n-Undecan	1.580	1.808	1.643	1.565	1.495	1.614	1.570	1.611		6.11
119)		Dodecane	1.038	1.166	0.998	0.865	0.809	0.827	0.822	0.932		14.70
120)		1,2,4-Trichlor...	0.981	1.106	1.003	0.943	0.873	0.896	0.876	0.954		8.79
121)		Hexachlorobuta...	1.145	1.306	1.157	1.067	1.033	1.110	1.059	1.125		8.16

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 117 VOC Compounds MDL res

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

Number	Compund	Spike Conc. (ppbv)	Avg. Conc. (ppbv)	% RSD	MDL
1	Bromochloromethane (ISTD)	5	5.00		
2	Ethylene	0.5	0.41	14.67	0.09
3	Acetylene	0.5	0.53	11.46	0.10
4	Ethane	0.5	0.55	16.44	0.14
5	Propene	0.5	0.51	7.20	0.06
6	Formaldehyde	0.5	0.45	27.85	0.20
7	Propane	0.5	0.53	6.20	0.05
8	Difluorodichloromethane	0.5	0.51	8.13	0.07
9	Chloromethane	0.5	0.53	6.94	0.06
10	Acetaldehyde	0.5	0.41	26.00	0.17
11	Dichlorotetrafluoroethane (F114)	0.5	0.50	8.20	0.06
12	Isobutane	0.5	0.50	5.82	0.05
13	Vinyl Chloride	0.5	0.53	8.16	0.07
14	1-Butene	0.5	0.52	8.62	0.07
15	1,3, -Butadiene	0.5	0.53	8.85	0.07
16	n-Butane	0.5	0.52	8.32	0.07
17	trans-2-Butene	0.5	0.53	8.51	0.07
18	Bromomethane	0.5	0.52	8.91	0.07
19	cis-2-Butene	0.5	0.52	10.11	0.08
20	Chloroethane	0.5	0.50	8.36	0.07
21	Bromoethene (Vinyl Br)	0.5	0.50	8.93	0.07
22	2-Propenal (Arolein)	0.5	0.50	9.64	0.08
23	Acetone	0.5	0.51	3.46	0.03
24	Propanal	0.5	0.56	13.60	0.12
25	Isopentane (2-Methylbutane)	0.5	0.53	7.44	0.06
26	Isopropanol	0.5	0.59	11.13	0.10
27	Trichlorofluoromethane	0.5	0.52	8.27	0.07
28	1-Pentene	0.5	0.52	8.50	0.07
29	n-Pentane	0.5	0.52	4.97	0.04
30	Isoprene	0.5	0.52	6.87	0.06
31	trans-2-Pentene	0.5	0.49	5.43	0.04
32	1,1-Dichloroet	0.5	0.51	7.07	0.06
33	cis-2-Pentene	0.5	0.49	5.43	0.04
34	Methylene Chloride	0.5	0.45	7.26	0.05
35	3-Chloro-1-propene	0.5	0.49	10.48	0.08
36	Trichorotrifluoroethane (F113)	0.5	0.53	9.52	0.08
37	2,2-Dimethylbu	0.5	0.50	7.70	0.06
38	Carbon Disulfide	0.5	0.51	8.29	0.07
39	Methacrolein	0.5	0.49	6.98	0.05
40	trans-1,2-Dichloroethene	0.5	0.51	8.14	0.07
41	MTBE	0.5	0.51	8.31	0.07
42	1,1-dichloroethane	0.5	0.52	8.64	0.07
43	2,3-Dimethylbutane	0.5	0.50	8.04	0.06
44	2-Methylpentane	0.5	0.52	10.20	0.08
45	Vinyl acetate	0.5	0.51	7.44	0.06
46	Cyclopentene	0.5	0.58	17.41	0.16
47	Butanal (Butyaldehyde)	0.5	0.46	9.22	0.07
48	2-Butanone	0.5	0.53	9.09	0.08
49	3-Methylpentane	0.5	0.50	9.55	0.07
50	1-Hexene	0.5	0.53	7.24	0.06
51	Ethyl acetate	0.5	0.50	8.00	0.06
52	cis-1,2-Dichloroethene	0.5	0.51	9.66	0.08
53	Hexane	0.5	0.51	8.05	0.06
54	Chloroform	0.5	0.52	9.04	0.07
55	Tetrahydrofuran (THF)	0.5	0.52	8.98	0.07
56	2-Butenal (Crotonaldehyde)	0.5	0.52	14.47	0.12
57	2,4-Dimethylpentane	0.5	0.52	8.01	0.07
58	1,2-Dichloroethane	0.5	0.52	8.87	0.07
59	Methylcyclopentane	0.5	0.52	8.28	0.07
60	1,1,1-Trichloroethane	0.5	0.52	8.87	0.07
61	Benzene	0.5	0.52	7.89	0.06
62	2-Methylhexane	0.5	0.51	7.46	0.06
63	1,4-Difluorobenzene (Circuit)	5	5.01	0.87	0.07
64	Carbon Tetrachloride	0.5	0.52	8.06	0.07

65	Cyclohexane	0.5	0.52	9.06	0.07
66	2,3-Dimethylpentane	0.5	0.54	9.86	0.08
67	3-Methylhexane	0.5	0.54	9.86	0.08
68	Pentanal	0.5	0.51	6.50	0.05
69	n-Heptane	0.5	0.50	8.51	0.07
70	1,2-Dichloropropane	0.5	0.51	8.84	0.07
71	1,4-Dioxane	0.5	0.53	10.35	0.09
72	2,2,4-Trimethylpentane	0.5	0.51	8.25	0.07
73	Trichloroethene	0.5	0.49	8.33	0.06
74	Bromodichloromethane	0.5	0.52	8.22	0.07
75	4-methyl-2-pentanone	0.5	0.52	9.00	0.07
76	Trans-1,3-Dichloropropene	0.5	0.54	9.23	0.08
77	Methylcyclohexane	0.5	0.51	8.17	0.07
78	cis-1,3-Dichloropropene	0.5	0.49	11.01	0.08
79	2,3,4-Trimethylpentane	0.5	0.05	8.84	0.01
80	1,1,2-Trichloroethane	0.5	0.51	8.14	0.07
81	2-Methylheptane	0.5	0.51	6.29	0.05
82	2-Hexanone	0.5	0.54	9.69	0.08
83	Toluene	0.5	0.51	7.74	0.06
84	n-Octane	0.5	0.50	8.73	0.07
85	Hexanal (Hexaladehyde)	0.5	0.53	8.96	0.07
86	3-Methylheptane	0.5	0.51	8.23	0.07
87	Dibromochloromethane	0.5	0.52	7.68	0.06
88	1,2-Dibromoethane	0.5	0.52	9.04	0.07
89	Tetrachloroethene	0.5	0.52	8.35	0.07
90	Chlorobenzene-d5 (ISTD)	5	5.00		
91	Chlorobenzene	0.5	0.52	7.34	0.06
92	Ethylbenzene	0.5	0.51	7.67	0.06
93	m-Xylenes	0.5	0.52	8.04	0.07
94	p-Xylenes	0.5	0.52	7.44	0.06
95	Nonane	0.5	0.52	8.86	0.07
96	Styrene	0.5	0.52	8.02	0.07
97	Bromoform	0.5	0.52	8.02	0.07
98	o-Xylene	0.5	0.51	7.64	0.06
99	1,1,2,2-Terach	0.5	0.54	8.98	0.08
100	Bromofluorobenzene (circuit)	5	5.04	0.49	0.04
101	isopropylbenzene (Cumene)	0.5	0.52	8.41	0.07
102	Benzaldehyde	0.5	0.55	8.30	0.07
103	n-propylbenzene	0.5	0.52	8.08	0.07
104	1,3,5-Trimethylbenzene	0.5	0.52	7.15	0.06
105	m-ethyltoluene	0.5	0.52	8.97	0.07
106	p-ethyltoluene	0.5	0.52	8.97	0.07
107	n-Decane	0.5	0.52	8.14	0.07
108	o-ethyltoluene	0.5	0.52	7.80	0.06
109	1,2,4-Trimethylbenzene	0.5	0.53	8.21	0.07
110	Benzyl Chloride	0.5	0.53	7.82	0.07
111	1,3-Dichlorobenzene	0.5	0.53	8.10	0.07
112	1,4-Dichlorobenzene	0.5	0.52	9.28	0.08
113	1,2,3-Trimethylbenzene	0.5	0.52	8.15	0.07
114	m-Diethylbenzene	0.5	0.54	9.34	0.08
115	1,2-Dichlorobenzene	0.5	0.53	8.54	0.07
116	p-Diethylbenzene	0.5	0.52	8.44	0.07
117	m-Tolualdehyde	0.5	0.66	19.47	0.20
118	n-Undecan	0.5	0.56	10.56	0.09
119	Dodecane	0.5	0.66	15.70	0.16
120	1,2,4-Trichlorrobenzene	0.5	0.59	13.02	0.12
121	Hexachlorobutadiene	0.5	0.58	11.08	0.10

2.7 The Blank

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.

3 Calculation

3.1 Using Nutech 8910 preconcentrator system with GC/MS full Scan and/or SIM the 117 target compounds (TO-15 + PAMS + Aldehydes) can be tested at one time successfully meeting all QA/QC EPA TO-15 requirements. ,

3.2 The method and instrument configuration needs are just GC/MS and no Deans Switch with FID is necessary. That allows labs to using existing instruments which is a good example of the 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.