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

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【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

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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.

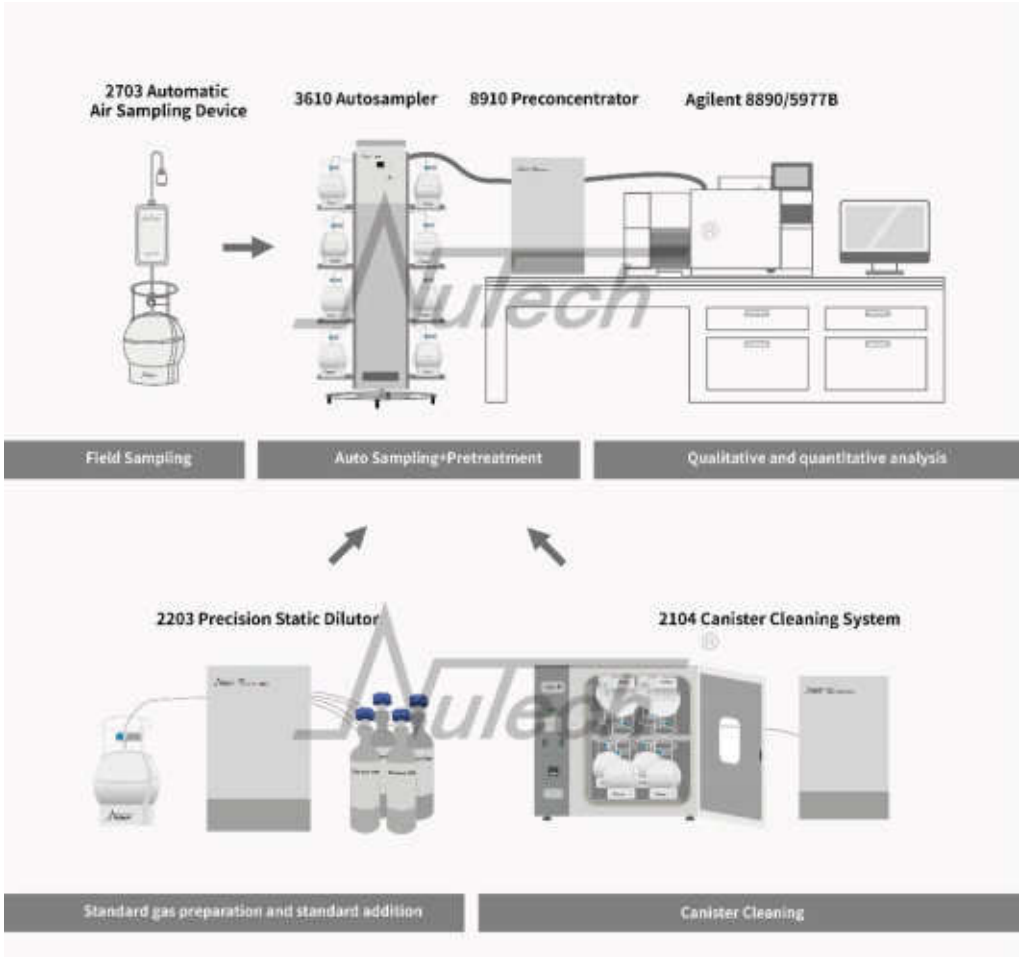
## 1 Experiment

### 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

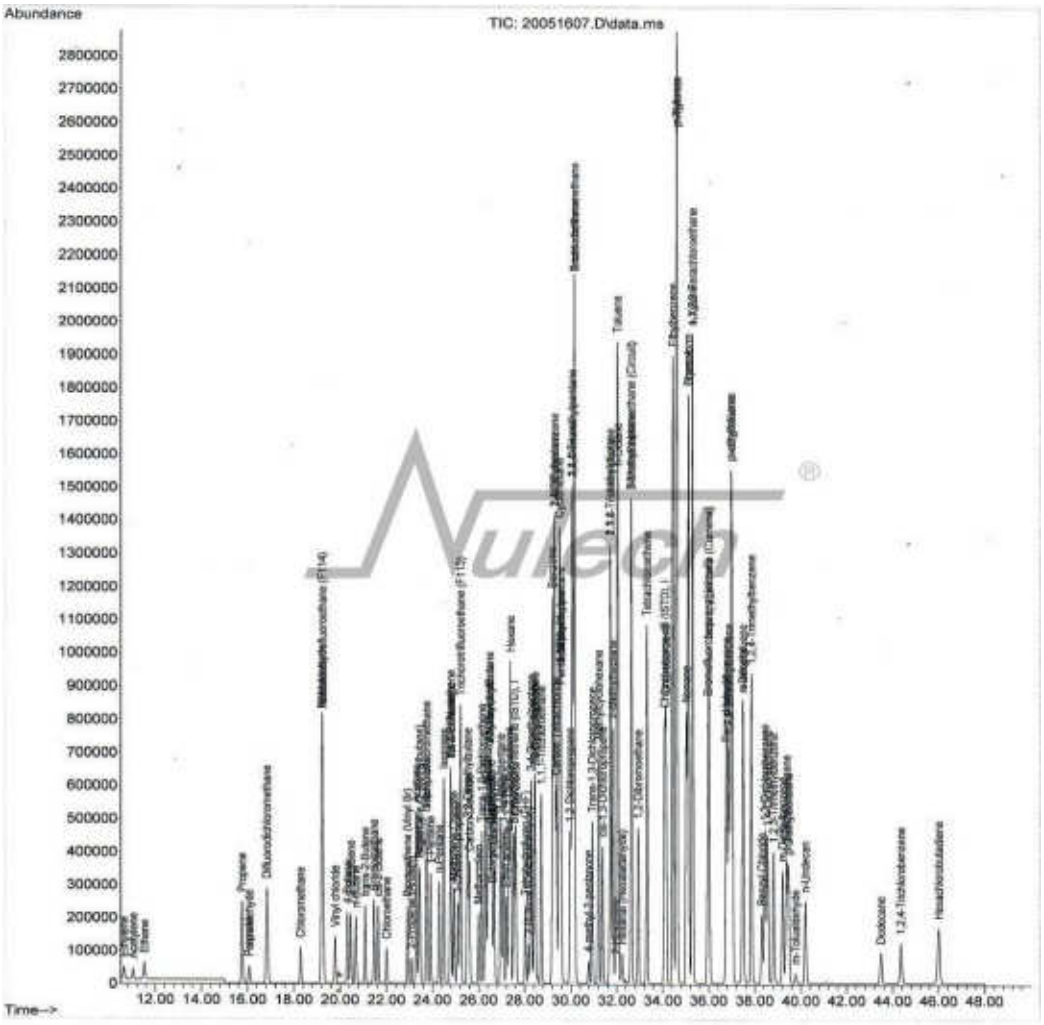
"8910/3610 loading 30ml, 60 ml, 120 ml, 240 ml, 300 ml, 600 ml. Basic volume is 300 ml.

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

TO-15+PAMS+...des-200516.M Tue May 19 15:42:57 2020

## 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 | 0.568 | 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.