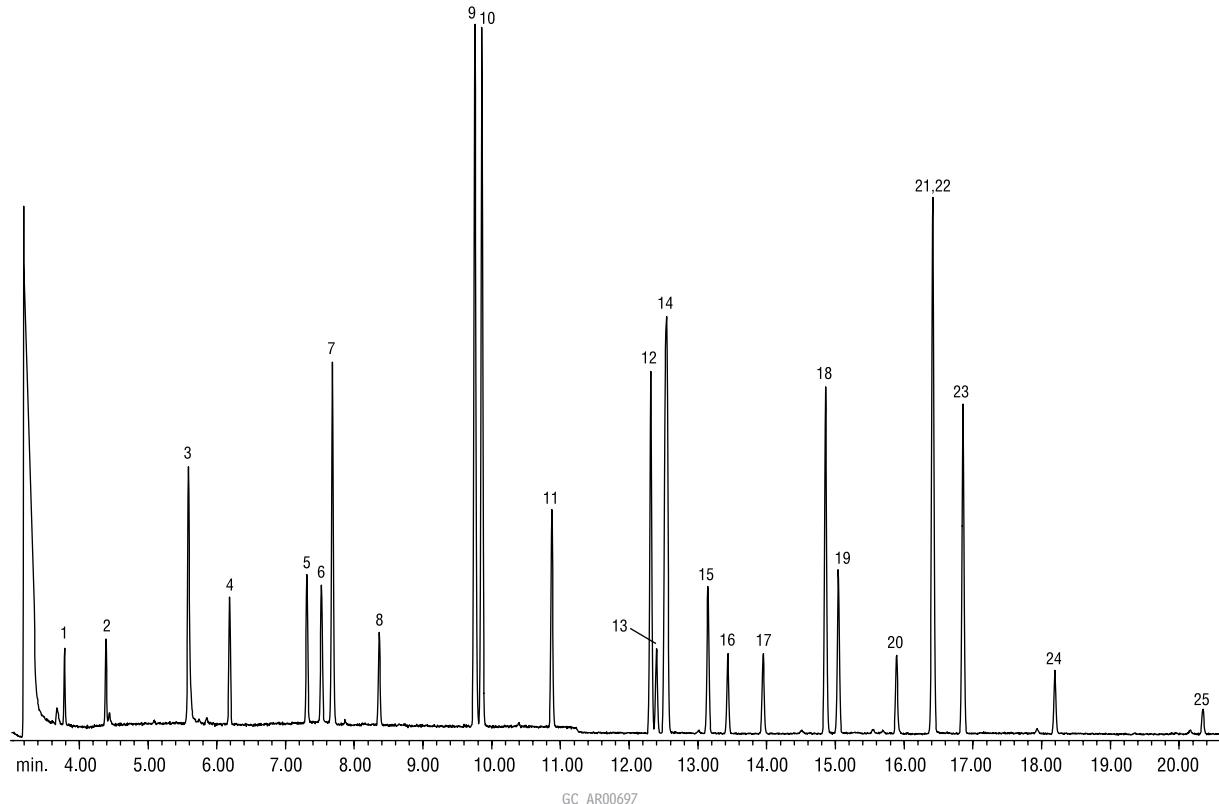


**Massachusetts APH Mix**  
**Rtx®-1**



Rtx®-1 60m, 0.32mm ID, 1.0 $\mu$ m (cat.# 10157)

Sample: Massachusetts APH Mix, (cat.# 34446)

Concentrator: Nutech 3550A Air Preconcentrator, 100mL of a 40ppbv standard concentrated at -160°C, thermally desorbed at 150°C and cryofocused at -185°C.

Carrier gas: helium  
Flow rate: 1mL/min.

Oven temp.: 35°C (hold 1 min.) to 220°C @ 8°C/min.

Det: MS, HP5971

Transfer line temp.: 250°C

Scan range: 35-280amu

Ionization: EI

Mode: scan

1. 1,3-butadiene

2. isopentane

3. methyl *tert*-butyl ether

4. hexane

5. benzene

6. cyclohexane

7. 2,3-dimethylpentane

8. heptane

9. toluene-D8

10. toluene

11. octane

12. ethylbenzene

13. 2,3-dimethylheptane

14a. *m*-xylene

14b. *p*-xylene

15. *o*-xylene

16. nonane

17. isopropylbenzene

18. 1-methyl-3-ethylbenzene

19. 1,3,5-trimethylbenzene

20. decane

21. 1,2,3-trimethylbenzene

22. *p*-isopropyltoluene

23. butylcyclohexane

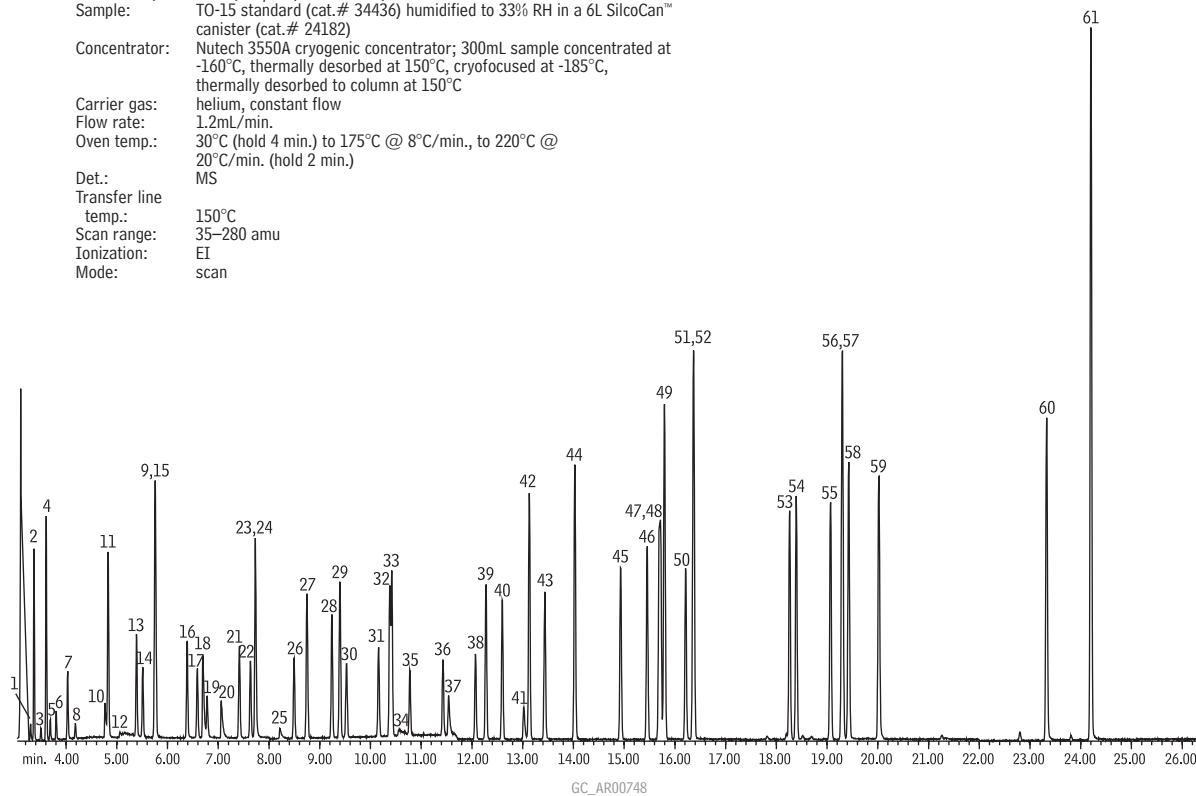
24. undecane

25. dodecane

## US EPA TO-15 Compounds

Rtx<sup>®</sup>-1

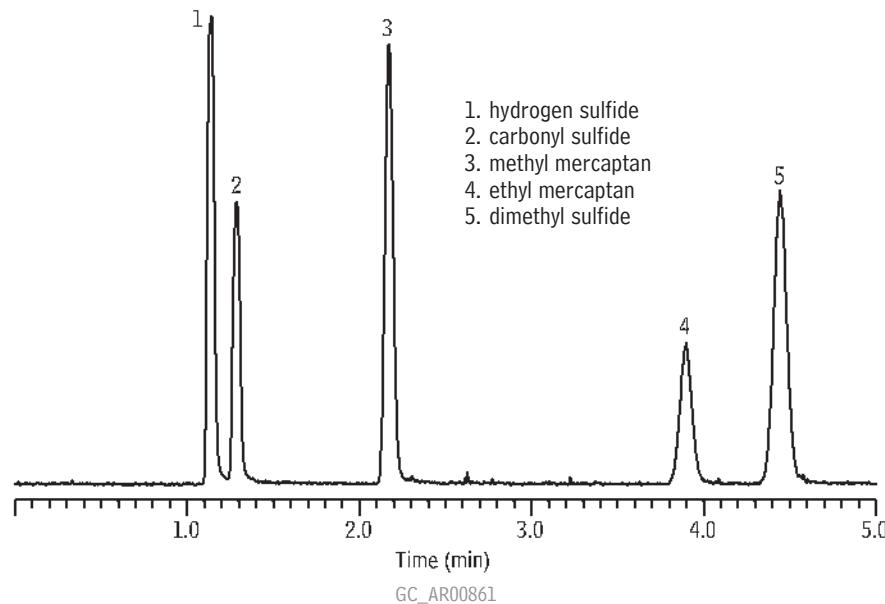
Rtx<sup>®</sup>-1 60m, 0.32mm ID, 1.0 $\mu$ m (cat.# 10157)  
 Sample: TO-15 standard (cat.# 34436) humidified to 33% RH in a 6L SilcoCan™ canister (cat.# 24182)  
 Concentrator: Nutech 3550A cryogenic concentrator; 300mL sample concentrated at -160°C, thermally desorbed at 150°C, cryofocused at -185°C, thermally desorbed to column at 150°C  
 Carrier gas: helium, constant flow  
 Flow rate: 1.2mL/min.  
 Oven temp.: 30°C (hold 4 min.) to 175°C @ 8°C/min., to 220°C @ 20°C/min. (hold 2 min.)  
 Det.: MS  
 Transfer line temp.: 150°C  
 Scan range: 35–280 amu  
 Ionization: EI  
 Mode: scan



- |   |                                       |                               |
|---|---------------------------------------|-------------------------------|
| 1. propylene  | 22. hexane                            | 43. 1,2-dibromoethane         |
| 2. Freon <sup>®</sup> -12 (dichlorodifluoromethane)                 | 23. chloroform                        | 44. tetrachloroethylene       |
| 3. chloromethane  | 24. ethyl acetate                     | 45. chlorobenzene             |
| 4. Freon <sup>®</sup> -114 (dichlorotetrafluoroethane)              | 25. tetrahydrofuran                   | 46. ethylbenzene              |
| 5. vinyl chloride   | 26. 1,2-dichloroethane                | 47. <i>p</i> -xylene          |
| 6. 1,3-butadiene  | 27. 1,1,1-trichloroethane             | 48. <i>m</i> -xylene          |
| 7. bromomethane   | 28. benzene                           | 49. bromoform                 |
| 8. chloroethane   | 29. carbon tetrachloride              | 50. styrene                   |
| 9. carbon disulfide   | 30. cyclohexane                       | 51. <i>o</i> -xylene          |
| 10. acetone   | 31. 1,2-dichloropropane               | 52. 1,1,2,2-tetrachloroethane |
| 11. Freon <sup>®</sup> -11 (trichlorofluoromethane)                 | 32. trichloroethylene                 | 53. 4-ethyltoluene            |
| 12. isopropyl alcohol   | 33. bromodichloromethane              | 54. 1,3,5-trimethylbenzene    |
| 13. 1,1-dichloroethene  | 34. 1,4-dioxane                       | 55. 1,2,4-trimethylbenzene    |
| 14. methylene chloride  | 35. heptane                           | 56. 1,3-dichlorobenzene       |
| 15. Freon <sup>®</sup> -113 (1,1,2-trichloro-1,2,2-trifluoroethane) | 36. <i>cis</i> -1,3-dichloropropene   | 57. benzyl chloride           |
| 16. <i>trans</i> -1,2-dichloroethene                                | 37. methyl isobutyl ketone            | 58. 1,4-dichlorobenzene       |
| 17. 1,1-dichloroethane  | 38. <i>trans</i> -1,3-dichloropropene | 59. 1,2-dichlorobenzene       |
| 18. methyl <i>tert</i> -butyl ether                                 | 39. 1,1,2-trichloroethane             | 60. 1,2,4-trichlorobenzene    |
| 19. vinyl acetate   | 40. toluene                           | 61. hexachloro-1,3-butadiene  |
| 20. methyl ethyl ketone   | 41. methyl butyl ketone               |                               |
| 21. <i>cis</i> -1,2-dichloroethene                                  | 42. dibromochloromethane              |                               |

## Sulfur Compounds

### Rxi™-1ms



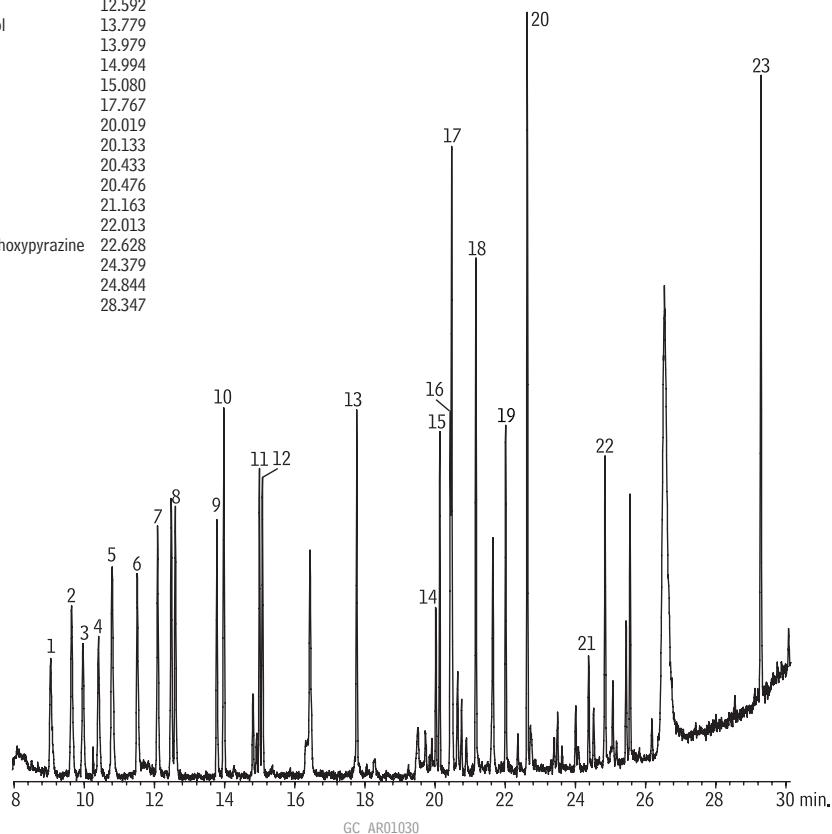
Column: Rxi™-1ms, 30m, 0.32mm ID, 4.00 $\mu$ m (cat.# 13396)  
Sample: hydrogen sulfide, carbonyl sulfide, methyl mercaptan,  
ethyl mercaptan, dimethyl sulfide, 100 ppbv each in helium  
Inj.: 1.0mL splitless, direct  
Sample loop temp.: 30°C  
Carrier gas: helium, constant pressure  
Linear velocity: 48cm/sec. @ 30°C  
Oven temp.: 30°C  
Det.: sulfur chemiluminescence detector  
Det. temp.: 800°C

Sample storage & transfer:  
SilcoCan™ air monitoring canister with Siltek® treated 1/4" valve (cat.# 24182-650); Sulfinert® treated gas sample loop, 1cc (cat.# 22848); Sulfinert® treated gas sample loop, 10cc (custom order)

**Microbial VOCs**  
**Rxi®-1ms**

Compound	Rt (min.)
1. 2-butanone	9.047
2. 2-methyl-furan	9.640
3. 3-methyl-furan	9.962
4. 2-methyl-1-propanol	10.405
5. 2-methyl-2-butanol	10.791
6. 1-butanol	11.506
7. 3-methyl-2-butanol	12.092
8. 2-pentanol	12.592
9. 2-methyl-1-butanol	13.779
10. dimethyl-disulfide	13.979
11. 3-hexanone	14.994
12. 2-hexanone	15.080
13. 2-heptanone	17.767
14. 1-octen-3-ol	20.019
15. 3-octanone	20.133
16. 3-octanol	20.433
17. 2-pentyl-furan	20.476
18. 2-ethyl-1-hexanol	21.163
19. 1-octanol	22.013
20. 2-isopropyl-3-methoxypyrazine	22.628
21. isoborneol	24.379
22. $\alpha$ -terpineol	24.844
23. geosmin	28.347

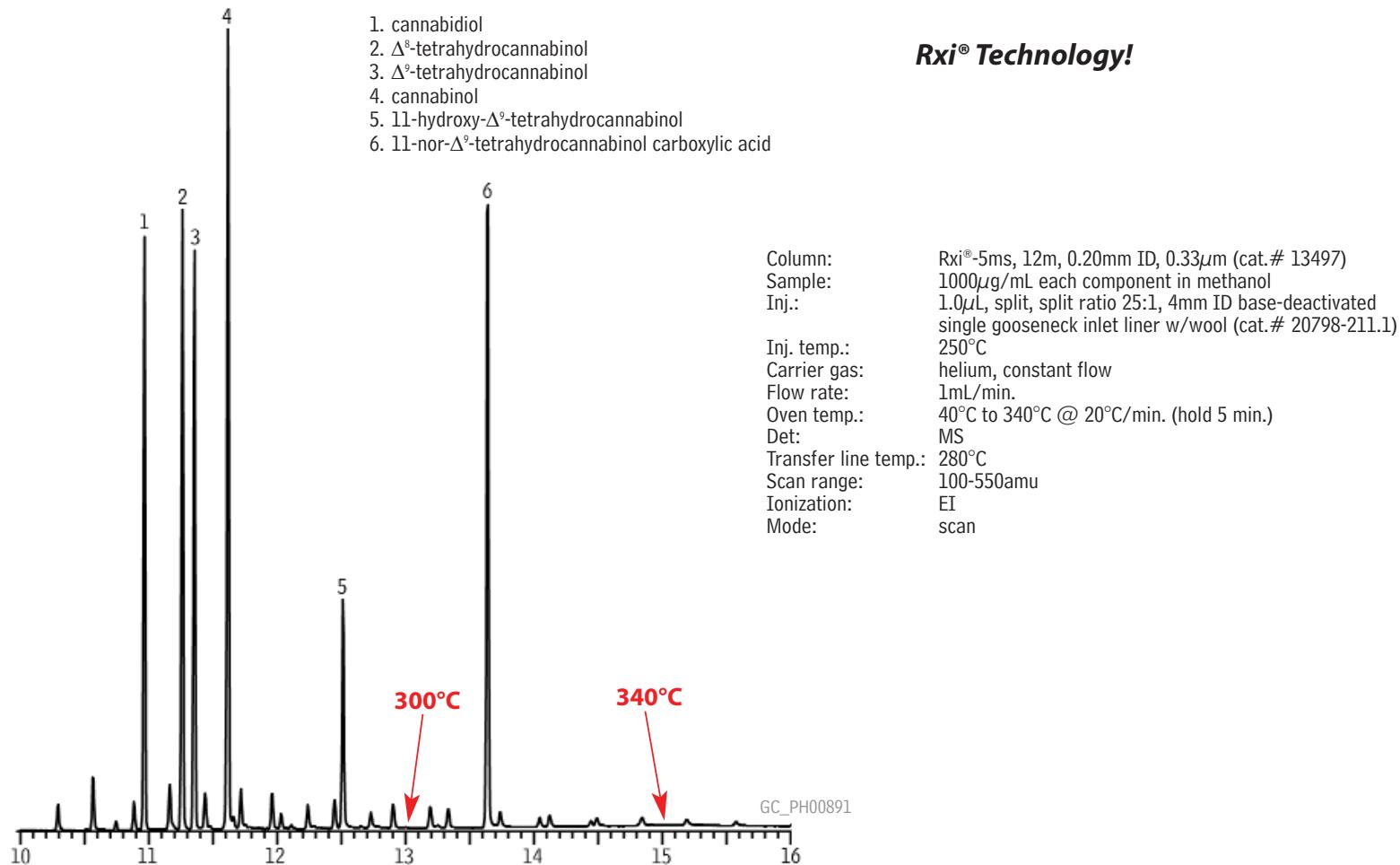
**Early detection of MVOCs  
allows faster treatment!**



Column: Rxi®-1ms, 60m, 0.25mm ID, 1.00 $\mu$ m (cat.# 13356)  
 Sample: microbial volatile organic compounds, 2ppbv, 60% RH  
 Inj.: 1.0 $\mu$ L split (split ratio 1:1),  
 1mm split inlet liner (cat.# 20972)  
 Inj. temp.: 200°C  
 Carrier gas: helium, constant flow  
 Flow rate: 1.5mL/min.  
 Oven temp.: 10°C (hold 1 min.) to 235°C @ 8°C/min.  
 Det: Agilent 6890/5973 GC/MS  
 5 min. solvent delay  
 Transfer line temp.: 260°C  
 Scan range: 35 to 350amu  
 Ionization: EI  
 Mode: scan  
 Other: Nutech 8900DS Preconcentrator  
 Conditions:  
 Sample = 200mL from canister  
 Cryotrap1 = -160°C  
 Desorb = 20°C  
 Cryotrap2 = 20°C  
 Desorb = 200°C  
 Cryofocuser = 200°C  
 Desorb = 200°C

## Cannabinoids

Rxi®-5ms



Restek Corporation 110 Benner Circle Bellefonte, PA 16823  
814-353-1300 • 800-356-1688 • Fax: 814-353-1309 • [www.restek.com](http://www.restek.com)



# Fast Screening and Confirmation of Gamma-Hydroxybutyrate (GHB) in Urine

*Maximize your analytical options with this versatile GHB extraction method. No derivatization means faster sample preparation. Extracts are amenable to both liquid injection GC/FID and headspace GC/MS methods.*

By Amanda Rigdon, Pharmaceutical Innovations Chemist and Kristi Sellers, Clinical/Forensic Innovations Chemist

Gamma-hydroxybutyrate (GHB) and its precursor, gamma-butyrolactone (GBL), are controlled substances associated with drug-facilitated sexual assault. Criminal cases often hinge on lab results, which can include screening urine samples and then quantifying GHB using GC/MS. In its native state, GHB is extremely difficult to chromatograph and must be analyzed as a trimethylsilyl derivative or converted to GBL. The headspace (HS) procedure described here (adapted from an FBI Chemistry Unit method) eliminates time-consuming derivatization.<sup>1</sup> This procedure reduces sample preparation time and minimizes both column contamination from derivatization reagents and contamination from sample matrix caused by liquid injections.

## Eliminate Derivatization and Reduce System Contamination

Samples were spiked in urine and extracted according the procedure in Table I, using alpha-methylene-gamma-butyrolactone (AMGB) as an internal standard. GHB is converted to GBL with sulfuric acid, eliminating the need for derivatization (Figure 1). Note the unconverted sample shows comparable levels of GBL and AMGB, whereas GBL levels in the converted sample are significantly higher, due to the conversion of GHB to GBL.

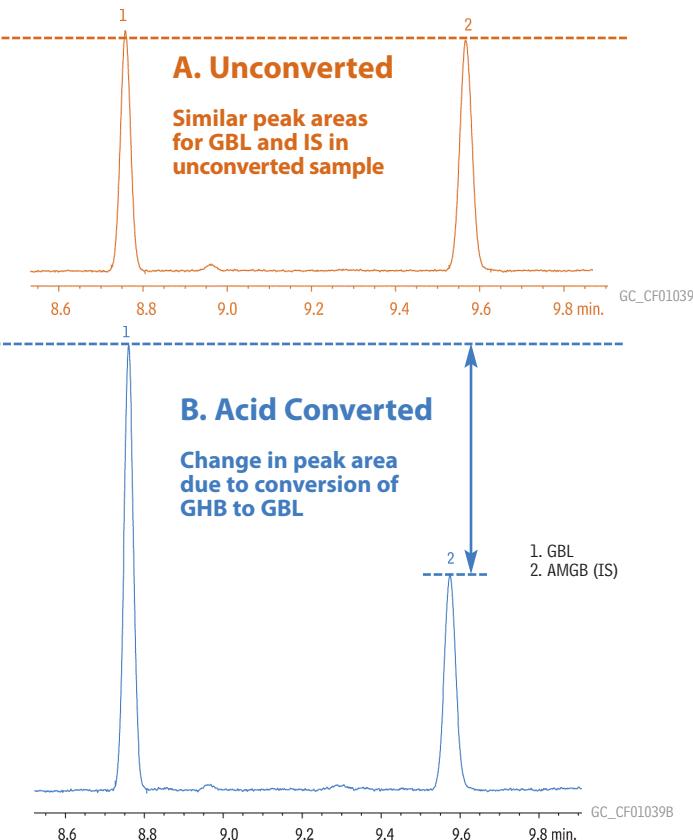
## Reliably Screen Samples Using Existing Blood Alcohol Testing Set-Up

Headspace injections (using the total vaporization technique) of the final urine extracts were screened by GC/FID using an Rtx®-BAC1 column in a blood alcohol headspace GC system. This system is com-

**Table I** Extraction procedure for GHB and GBL.

1. Label two screw top test tubes per specimen. One for total GHB, the other for GBL only.
2. Add 1mL of sample (urine) to each tube.
3. Add 50 $\mu$ L of AMGB to each tube.
4. Add 150 $\mu$ L concentrated sulfuric acid only to tubes used for analysis of total GHB.
5. Vortex all tubes and allow them to sit 5 minutes.
6. Add 5mL methylene chloride to each tube. Shake 10 minutes to extract.
7. Centrifuge samples at 3,000 rpm for 5 minutes.
8. Transfer bottom (methylene chloride) layer to a clean test tube for drying.
9. Concentrate samples to ~100 $\mu$ L at 30°C under nitrogen.
10. For headspace analysis, inject 15 $\mu$ L of sample into a capped headspace vial. Or, for liquid injection, transfer extract to a limited volume insert.

**Figure 1** GHB can be converted to GBL for analysis, saving time by eliminating derivatization.

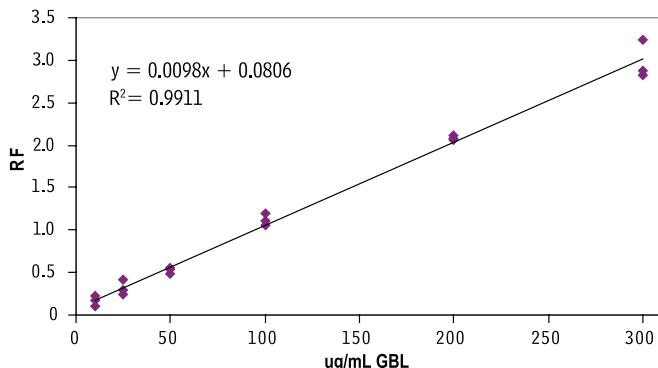


Column:	Rtx®-BAC1, 30m, 0.32mm ID, 1.8 $\mu$ m (cat.# 18003)	Headspace conditions: Equilibration temp.: 100°C Equilibration time: 10 min. Injection volume: 1mL
Sample:	50 $\mu$ g/mL GHB, GBL, and AMGB (IS) in urine	Oven temp.: 50°C (hold 3 min.) to 150°C @ 20°C/min. (hold 7 min.)
Inj.:	A: unconverted B: converted with sulfuric acid 1mL headspace injection, split (10:1), 1mm split inlet liner (cat.# 20972)	Det.: FID @ 240°C Hydrogen: 40mL/min. Air: 400mL/min. Makeup: 40mL/min.
Inj. temp.:	200°C	
Carrier gas:	helium, constant flow	
Flow rate:	1.0mL/min.	

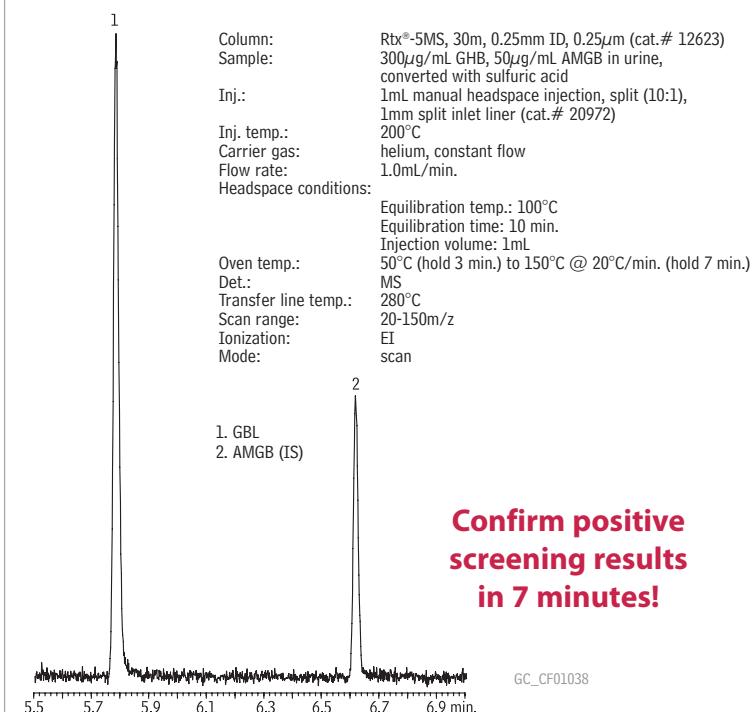
Sample: urine spiked with 50 $\mu$ g/mL each GHB, GBL, and AMGB (IS), extracted according to procedure in Table I, and analyzed using headspace (total vaporization technique).

## This versatile extraction and headspace method improves lab efficiency and reduces both contamination and matrix effects by eliminating the need for derivatization and liquid injections.

**Figure 2** GHB (analyzed as GBL) confirmation method calibration curve for headspace GC/MS analysis (10-300 $\mu$ g/mL in urine).



**Figure 3** Confirmation headspace GC/MS analysis of 300 $\mu$ g/mL converted GHB (analyzed as GBL) standard in urine.



monly used in clinical/forensic labs, eliminating the need for additional equipment. Excellent linear response was obtained from both unconverted ( $r^2 = 0.9992$ , 10-100 $\mu$ g/mL 4-point curve) and converted GHB in matrix ( $r^2 = 0.9910$ , 20-200 $\mu$ g/mL 4-point curve) with AMBG at 50 $\mu$ g/mL.

### Fast, Definitive Confirmation Analysis by Headspace GC/MS

Positive screening results were quickly confirmed on an Rtx®-5MS column by headspace GC/MS; several quantification and qualifier ions were identified for each compound (GBL: 42, 56, 86; AMBG: 40, 68, 98). Again, excellent linearity was achieved (Figure 2) and analysis time was less than 7 minutes (Figure 3).

In summary, the versatile extraction and headspace method shown here saves lab time and minimizes contamination by eliminating the need for derivatization and by reducing matrix effects. Rapid screening is accomplished on commonly used blood alcohol GC columns, allowing labs to reduce costs by using existing equipment. Confirmation testing using the Rtx®-5MS column, provides the definitive results needed in court with a fast analysis time of less than 7 minutes.

#### References

- M.A. LeBeau, M.A. Montgomery, M.L. Miller, S.G. Burmeister, J. Anal. Toxicol. 24 (2000) 421.

## Product Listing

### Rtx®-BAC1 Columns (fused silica)

ID	df (μm)	temp. limits	length	cat. #	price
0.32mm	1.80	-20 to 240/260°C	30-Meter	18003	

### Rtx®-5MS—Low-bleed GC/MS Columns (fused silica)

(Crossbond® 5% diphenyl/95% dimethyl polysiloxane)

ID	df (μm)	temp. limits	length	cat. #	price
0.25mm	0.25	-60 to 330/350°C	30-Meter	12623	

### Exempted Drug of Abuse Reference Materials

Concentration is  $\mu$ g/mL. Volume is 1mL/ampul.

Compound	CAS#	Solvent				
			Code	Conc.	cat.#	price
GHB						
$\gamma$ -butyrolactone (GBL)	96-48-0	ACN	1,000		34077	
$\alpha$ -methylene- $\gamma$ -butyrolactone (AMGBL)	547-65-9	ACN	1,000		34079	
ACN=acetonitrile						

### 1mm Split Liners for Agilent GCs

ID* x OD & Length	qty.	cat.#	price
1mm Split			
1.0mm x 6.3mm x 78.5mm	ea.	20972	

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*Versatile GHB Method for Headspace or Liquid Injection*



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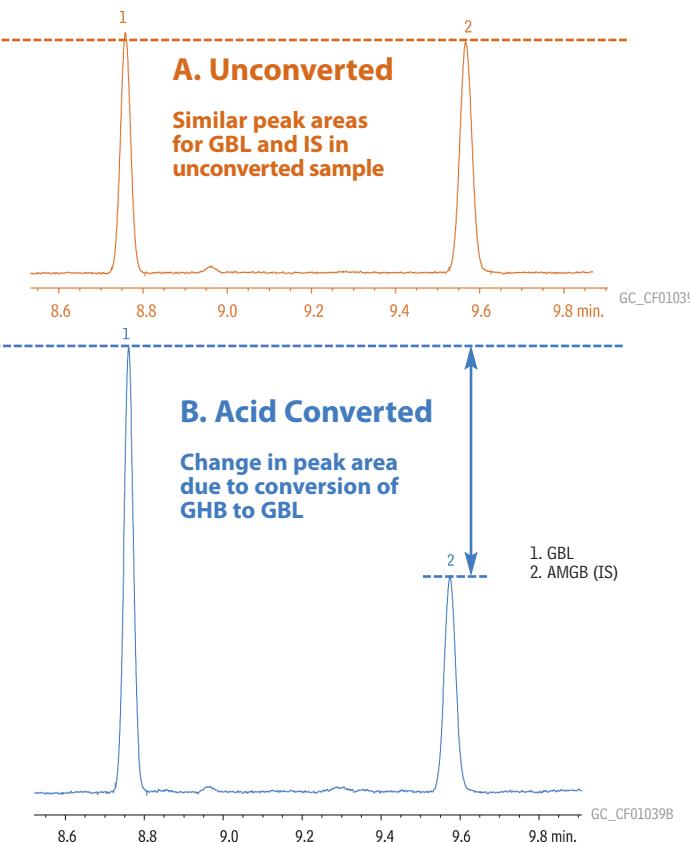
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7. Centrifuge samples at 3,000 rpm for 5 minutes.
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9. Concentrate samples to ~100 $\mu$ L at 30°C under nitrogen.
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**Figure 1** GHB can be converted to GBL for analysis, saving time by eliminating derivatization.

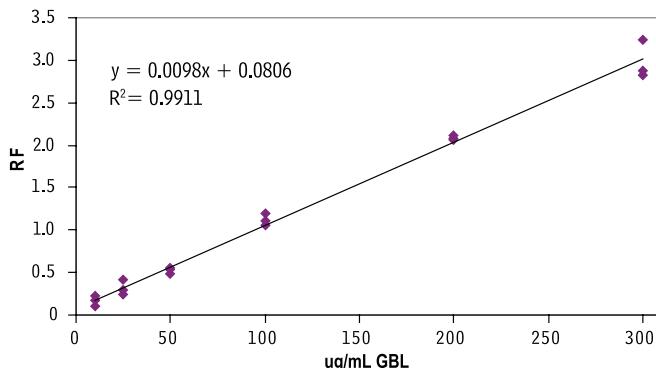


Column:	Rtx®-BAC1, 30m, 0.32mm ID, 1.8 $\mu$ m (cat.# 18003)	Headspace conditions: Equilibration temp.: 100°C Equilibration time: 10 min. Injection volume: 1mL
Sample:	50 $\mu$ g/mL GHB, GBL, and AMGB (IS) in urine	Oven temp.: 50°C (hold 3 min.) to 150°C @ 20°C/min. (hold 7 min.)
Inj.:	A: unconverted B: converted with sulfuric acid 1mL headspace injection, split (10:1), 1mm split inlet liner (cat.# 20972)	Det.: FID @ 240°C Hydrogen: 40mL/min. Air: 400mL/min. Makeup: 40mL/min.
Inj. temp.:	200°C	
Carrier gas:	helium, constant flow	
Flow rate:	1.0mL/min.	

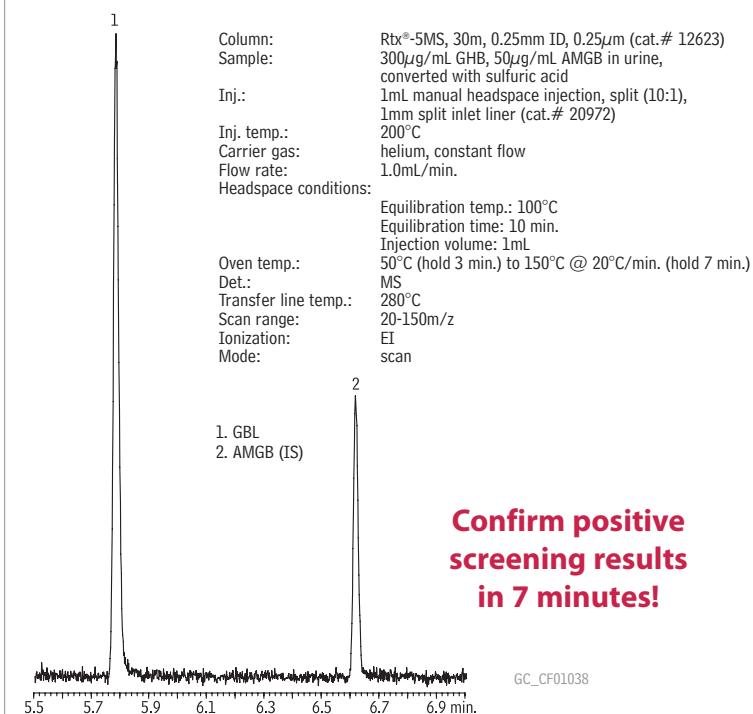
Sample: urine spiked with 50 $\mu$ g/mL each GHB, GBL, and AMGB (IS), extracted according to procedure in Table I, and analyzed using headspace (total vaporization technique).

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(Crossbond® 5% diphenyl/95% dimethyl polysiloxane)

ID	df (μm)	temp. limits	length	cat. #	price
0.25mm	0.25	-60 to 330/350°C	30-Meter	12623	

### Exempted Drug of Abuse Reference Materials

Concentration is  $\mu$ g/mL. Volume is 1mL/ampul.

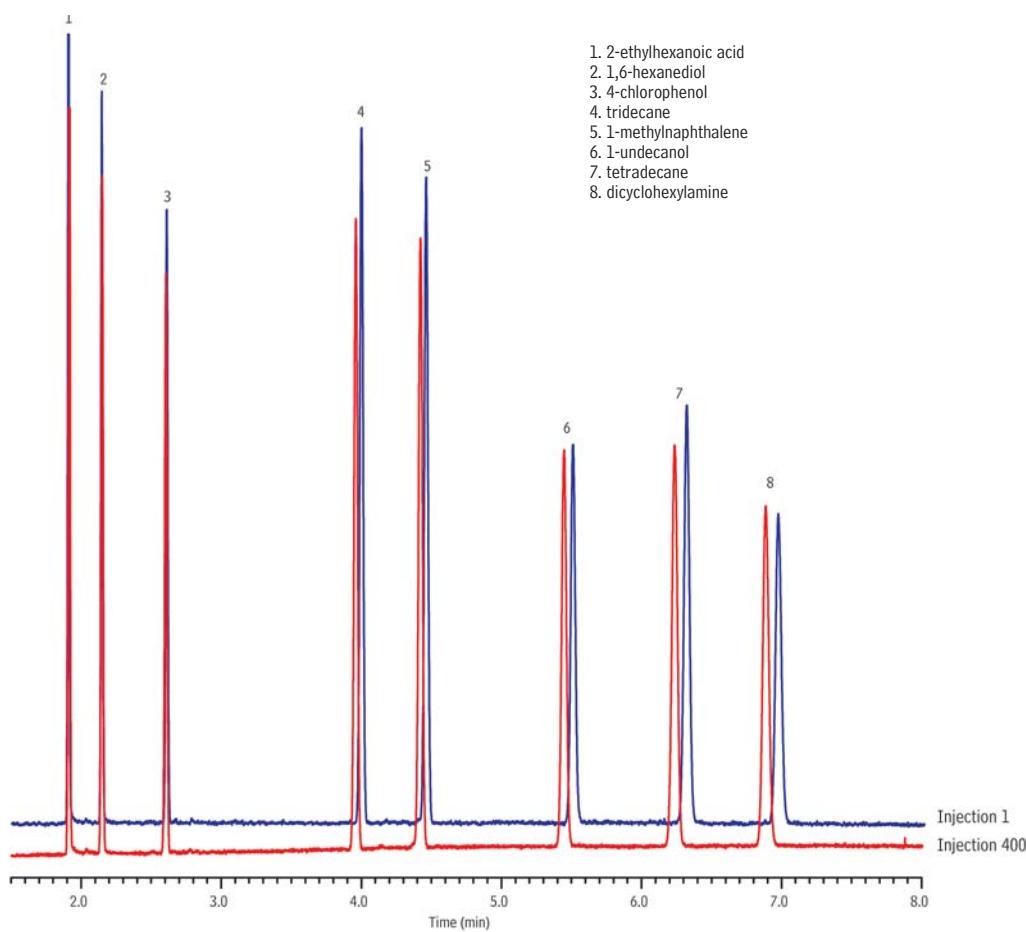
Compound	CAS#	Solvent				
			Code	Conc.	cat.#	price
GHB						
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$\alpha$ -methylene- $\gamma$ -butyrolactone (AMGBL)	547-65-9	ACN	1,000		34079	
ACN=acetonitrile						

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ID* x OD & Length	qty.	cat.#	price
1mm Split			
1.0mm x 6.3mm x 78.5mm	ea.	20972	

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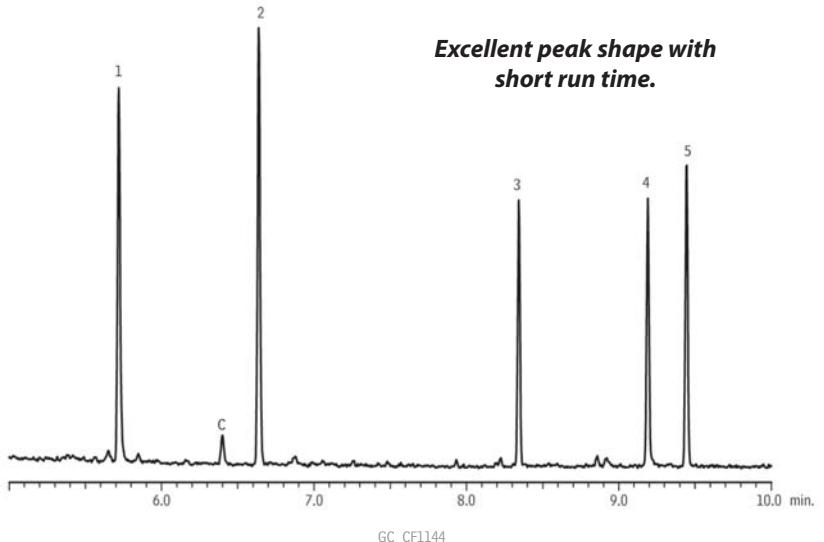
**Column Test Mix**  
**Rxi®-5Sil MS**



GC\_CF01131

Column: Rxi®-5Sil MS, 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13623)  
Sample: Column Test Mix (cat.# 35226)  
Inj.: 1.0 $\mu$ L split (split ratio 1:60), 4mm recessed gooseneck liner (cat.# 20983)  
Inj. temp.: 250°C  
Carrier gas: helium, constant pressure  
Linear velocity: 36cm/sec @ 125°C  
Oven temp.: 125°C  
Det: FID @ 320°C  
Instrument: Agilent 6890

## Derivatized Amphetamines (500 ng/mL) on Rx<sup>i</sup>-5Sil MS

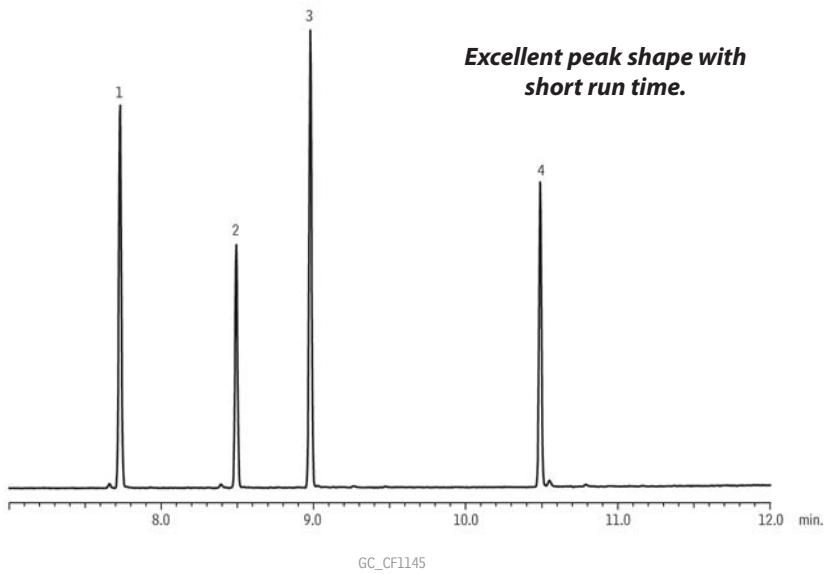


### Peaks

1. Amphetamine
  2. Methamphetamine
  3. MDA
  4. MDMA
  5. MDEA
- C-contaminant

**Column** Rx<sup>i</sup>-5Sil MS, 30 m, 0.25 mm ID, 0.25  $\mu$ m (cat.# 13623)  
**Sample** Diluent: Butyl chloride  
Conc.: 500 ng/mL HFAA derivatives  
**Injection** Inj. Vol.: 1  $\mu$ L splitless (hold 1 min.)  
Liner: 3.5mm Gooseneck Splitless w/Wool (cat.# 22286-200.1)  
Inj. Temp.: 250 °C  
Purge Flow: 28 mL/min.  
**Oven** Oven Temp: 75 °C to 300 °C at 15 °C/min.  
Carrier Gas He, constant linear velocity  
Linear Velocity: 45 cm/sec., 13.5 psi, 93.1kPa @ 75 °C  
**Detector** MS  
Mode: Scan  
Transfer Line Temp.: 250 °C  
Analyzer Type: Quadrupole  
Source Temp.: 200 °C  
Electron Energy: 70 eV  
Solvent Delay Time: 4 min.  
Tune Type: PFTBA  
Ionization Mode: EI  
Scan Range: 40-300 amu  
Scan Rate: 5 scans/sec.  
**Instrument** Shimadzu 2010 GC & QP2010+ MS

## Derivatized Cannabinoids (5 $\mu$ g/mL) on Rx<sup>i</sup>-5Sil MS

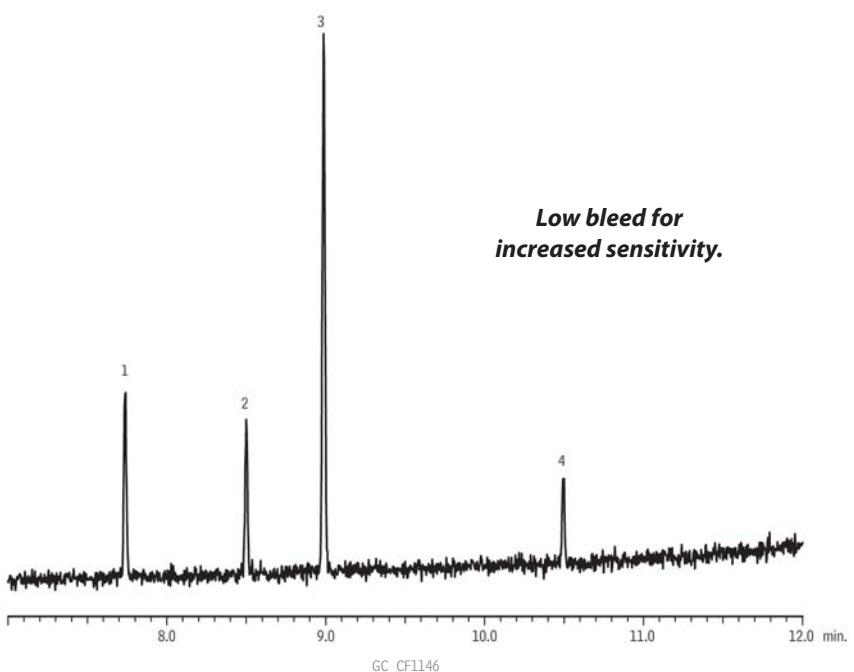


### Peaks

1. Cannabidiol
2. delta 9 THC
3. Cannabinol
4. THC-COOH; THCA

**Column** Rx<sup>i</sup>-5Sil MS, 30 m, 0.25 mm ID, 0.25  $\mu$ m (cat.# 13623)  
**Sample**  
**Diluent** Ethyl acetate  
**Conc.** 5  $\mu$ g/mL TMS derivatives  
**Injection**  
**Inj. Vol.** 1  $\mu$ L splitless (hold 1 min.)  
**Liner** 3.5mm Gooseneck Splitless w/Wool (cat.# 22286-200.1)  
**Inj. Temp.**: 250 °C  
**Purge Flow**: 21.4 mL/min.  
**Oven**  
**Oven Temp**: 150 °C to 330 °C at 15 °C/min. (hold 3 min.)  
**Carrier Gas** He, constant linear velocity  
**Linear Velocity**: 40 cm/sec., 13.8 psi, 95.1kPa @ 150 °C  
**Detector** MS  
**Mode**: Scan  
**Transfer Line**  
**Temp.**: 280 °C  
**Analyzer Type**: Quadrupole  
**Source Temp.**: 200 °C  
**Electron Energy**: 70 eV  
**Solvent Delay**  
**Time**: 4 min.  
**Tune Type**: PFTBA  
**Ionization Mode**: EI  
**Scan Range**: 200-500 amu  
**Scan Rate**: 5 scans/sec.  
**Instrument**: Shimadzu 2010 GC & QP2010+ MS

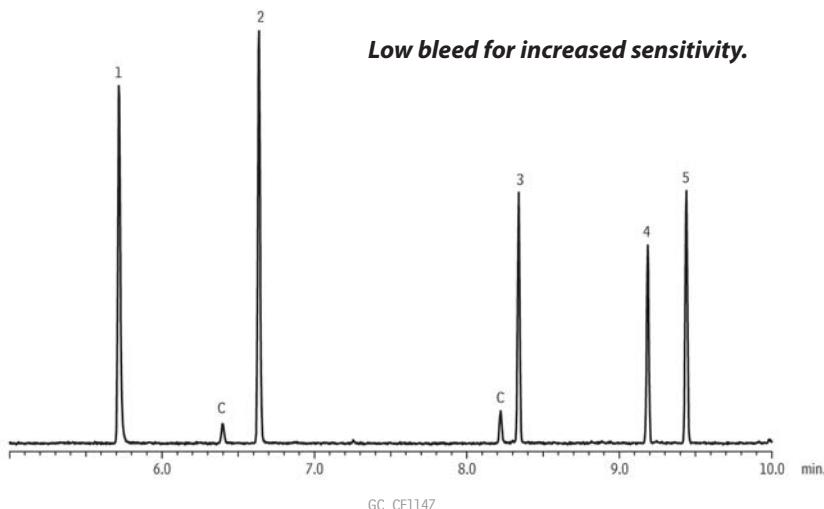
## Derivatized Cannabinoids (50 ng/mL) on Rx<sup>i</sup>-5Sil MS



Peaks	m/z 1	m/z 2	m/z 3
1. Cannabidiol	390	337	458
2. delta-9-THC	371	386	343
3. Cannabinol	367	382	310
4. THC-COOH; THCA	371	473	398

**Column Sample** Rx<sup>i</sup>-5Sil MS, 30 m, 0.25 mm ID, 0.25  $\mu$ m (cat.# 13623)  
**Diluent:** Ethyl acetate  
**Conc.:** 50 ng/mL TMS derivatives  
**Injection**  
**Inj. Vol.:** 1  $\mu$ L splitless (hold 1 min.)  
**Liner:** 3.5mm Gooseneck Splitless w/Wool (cat.# 22286-200.1)  
**Inj. Temp.:** 250 °C  
**Purge Flow:** 21.4 mL/min.  
**Oven**  
**Oven Temp:** 150 °C to 330 °C at 15 °C/min. (hold 3 min.)  
**Carrier Gas** He, constant linear velocity  
**Linear Velocity:** 40 cm/sec., 13.8 psi, 95.1kPa @ 150 °C  
**Detector**  
**Mode:** MS  
**SIM Program:** 390, 337, 458, 367, 382, 310, 371, 386, 343, 473, 398 m/z  
**Transfer Line**  
**Temp.:** 280 °C  
**Analyzer Type:** Quadrupole  
**Source Temp.:** 200 °C  
**Solvent Delay**  
**Time:** 4 min.  
**Tune Type:** PFTBA  
**Ionization Mode:** EI  
**Instrument** Shimadzu 2010 GC & QP2010+ MS

## Derivatized Amphetamines (50 ng/mL) on Rx<sup>i</sup><sup>®</sup>-5Sil MS



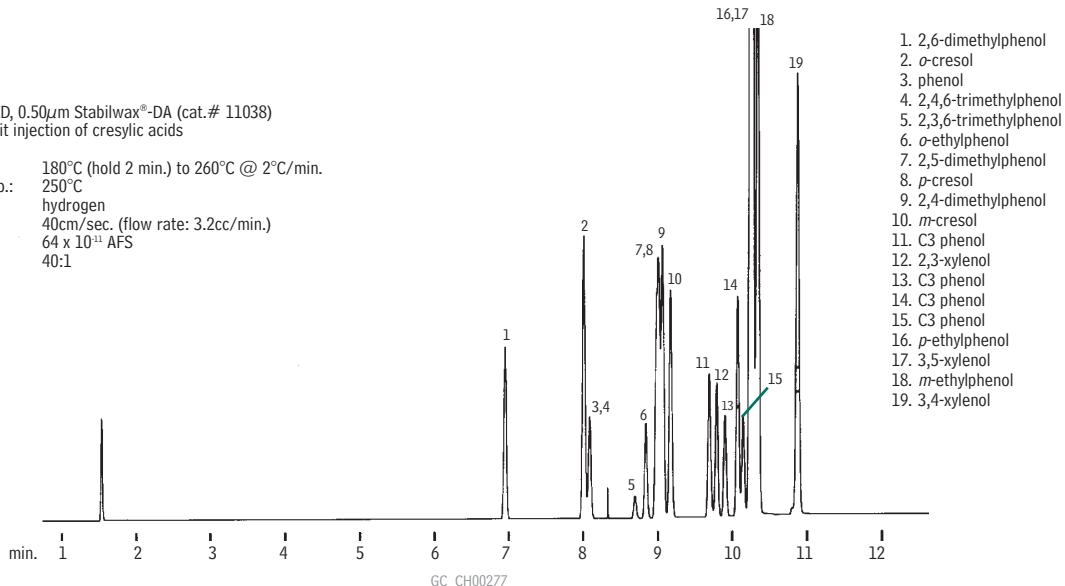
Peaks	m/z 1	m/z 2	m/z 3
1. Amphetamine	118	240	91
2. Methamphetamine	254	118	91
3. MDA	135	162	240
4. MDMA	254	162	135
5. MDEA	268	240	162
C-contaminant			

**Column** Rx<sup>i</sup><sup>®</sup>-5Sil MS, 30 m, 0.25 mm ID, 0.25  $\mu$ m (cat.# 13623)  
**Sample**  
**Diluent** Butyl chloride  
**Conc.** 50 ng/mL HFAA derivatives  
**Injection**  
**Inj. Vol.** 1  $\mu$ L splitless (hold 1 min.)  
**Liner** 3.5mm Gooseneck Splitless w/Wool (cat.# 22286-200.1)  
**Inj. Temp.**: 250 °C  
**Purge Flow**: 28.8 mL/min.  
**Oven**  
**Oven Temp.**: 75 °C to 300 °C at 15 °C/min.  
**Carrier Gas** He, constant linear velocity  
**Linear Velocity**: 45 cm/sec., 13.5 psi, 93.1kPa @ 75 °C  
**Detector** MS  
**Mode**: SIM  
**SIM Program**: 91, 118, 240, 254, 135, 162, 268 m/z  
**Transfer Line Temp.**: 280 °C  
**Analyzer Type**: Quadrupole  
**Source Temp.**: 200 °C  
**Solvent Delay Time**: 4 min.  
**Tune Type**: PFTBA  
**Ionization Mode**: EI  
**Instrument** Shimadzu 2010 GC & QP2010+ MS

## Cresylic Acids Stabilwax®-DA

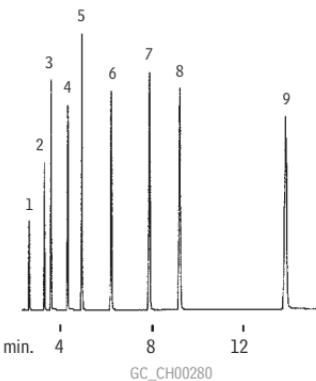
30m, 0.25mm ID, 0.50 $\mu$ m Stabilwax®-DA (cat.# 11038)  
Wet needle split injection of cresylic acids

Oven temp.: 180°C (hold 2 min.) to 260°C @ 2°C/min.  
Inj. & det. temp.: 250°C  
Carrier gas: hydrogen  
Linear velocity: 40cm/sec. (flow rate: 3.2cc/min.)  
FID sensitivity: 64 x 10<sup>-11</sup> AFS  
Split ratio: 40:1



## Fatty Acids (Free) Stabilwax®-DA

1. acetic acid
2. propionic acid
3. isobutyric acid
4. *n*-butyric acid
5. isovaleric acid
6. *n*-valeric acid
7. isocaproic acid
8. caproic acid
9. heptanoic acid



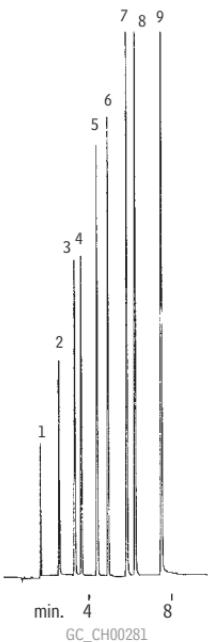
30m, 0.25mm ID, 0.25 $\mu$ m Stabilwax®-DA (cat.# 11023)  
1.0 $\mu$ L split injection of a free acid standard.  
Concentration approximately 10 to 20ng/ $\mu$ L.

Oven temp.: 145°C  
Inj. & det. temp.: 250°C  
Carrier gas: hydrogen  
Linear velocity: 40cm/sec.  
FID sensitivity:  $2 \times 10^{11}$  AFS  
Split ratio: 50:1

## Fatty Acids (Free)

### Rtx®-1

1. acetic acid
2. propionic acid
3. isobutyric acid
4. *n*-butyric acid
5. isovaleric acid
6. *n*-valeric acid
7. isocaprylic acid
8. caproic acid
9. heptanoic acid

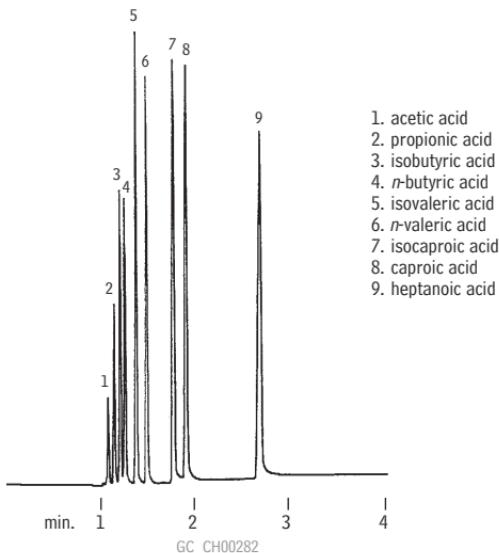


30m, 0.53mm ID, 5.0 $\mu$ m Rtx®-1 (cat.# 10179)  
0.2 $\mu$ L injection of a 10–20ng/ $\mu$ L free fatty acid standard in water.  
Direct injection using a Uniliner® inlet liner.

Oven temp.: 60°C to 180°C @ 15°C/min.  
Inj. & det. temp.: 250°C  
Carrier gas: hydrogen  
Linear velocity: 50cm/sec. (flow rate: 6cc/min.)  
FID sensitivity: 4 x 10<sup>-11</sup> AFS

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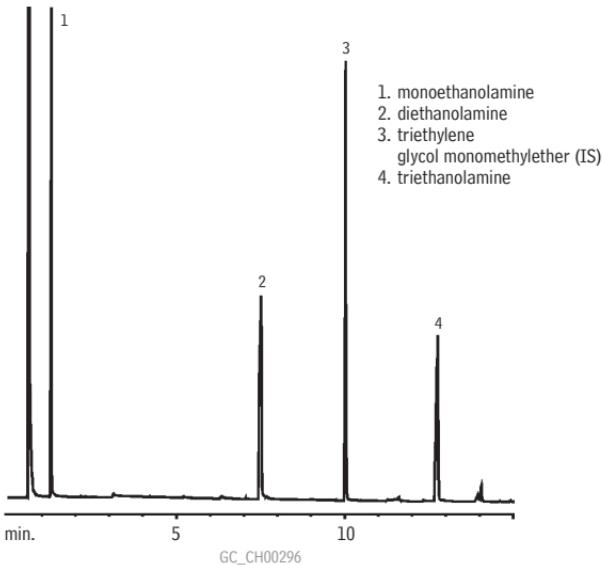
## Fatty Acids (Free) Rtx®-200



30m, 0.25mm ID, 0.25 $\mu$ m Rtx®-200 (cat.# 15023)  
Sample: 0.8 $\mu$ L split injection of a free fatty acid standard.  
Conc.: approximately 10 to 20ng/ $\mu$ L.  
Oven temp.: 90°C  
Inj. & det. temp.: 250°C  
Carrier gas: hydrogen  
Linear velocity: 40cm/sec. (flow rate: 1.4cc/min.)  
FID sensitivity: 4 x 10<sup>11</sup> AFS  
Split vent: 40cc/min.

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## Ethanolamines Rtx®-5 Amine

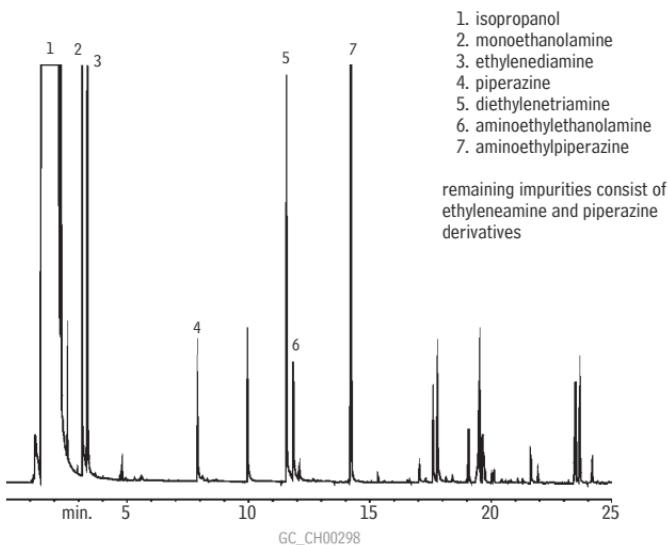


15m, 0.25mm ID, 0.50 $\mu$ m Rtx®-5 Amine (cat.# 12335)  
1.0 $\mu$ L split injection of ethanolamine mix in methanol  
On-column conc.: 34ng

Oven temp.: 50°C (hold 2 min.) to 180°C @  
10°C/min. (hold 2 min.)  
Inj. & det. temp.: 280°C / 300°C  
Carrier gas: hydrogen  
Linear velocity: 43cm/sec. set @ 50°C  
FID sensitivity: 6.4 x 10<sup>-11</sup> AFS  
Split ratio: 58:1

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## Ethyleneamines Rtx®-5 Amine

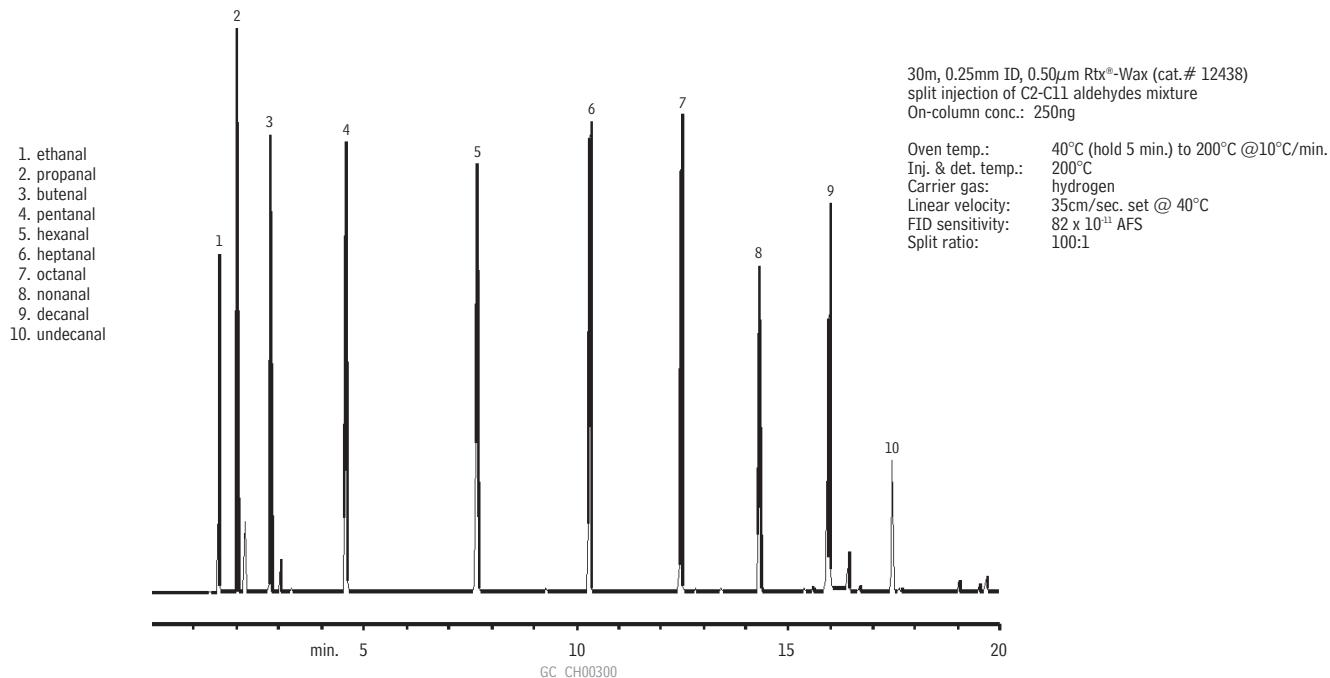


30m, 0.25mm ID, 0.50 $\mu$ m Rtx®-5 Amine (cat.# 12338)  
3.0 $\mu$ L split injection of ethyleneamine industrial sample  
On-column conc.: ~5-80ng

Oven temp.: 40°C (hold 4 min.) to 315°C  
@ 10°C/min. (hold 5 min.)  
Inj. & det. temp.: 315°C  
Carrier gas: hydrogen  
Linear velocity: 43cm/sec. set @ 40°C  
FID sensitivity: 6.4 x 10<sup>11</sup> AFS  
Split ratio: 20:1

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## Aldehydes Rtx®-Wax



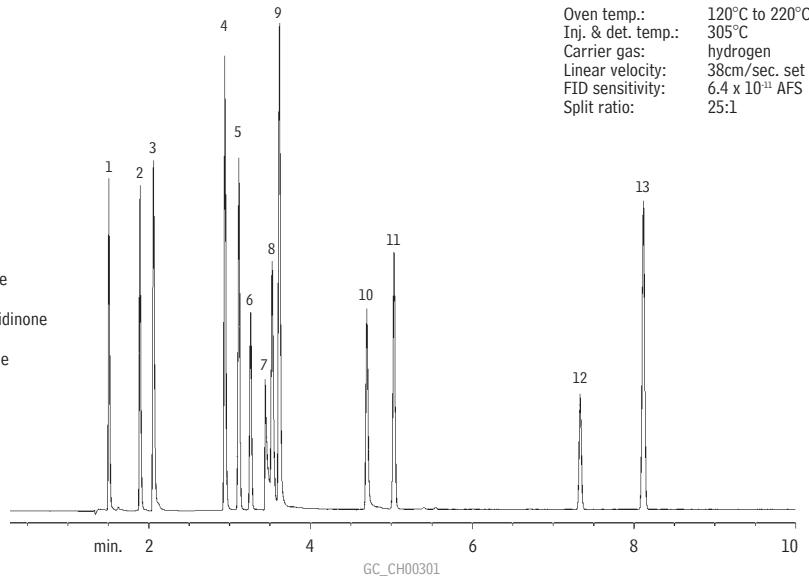
## Amines & Phenols

### Rtx<sup>®</sup>-5 Amine

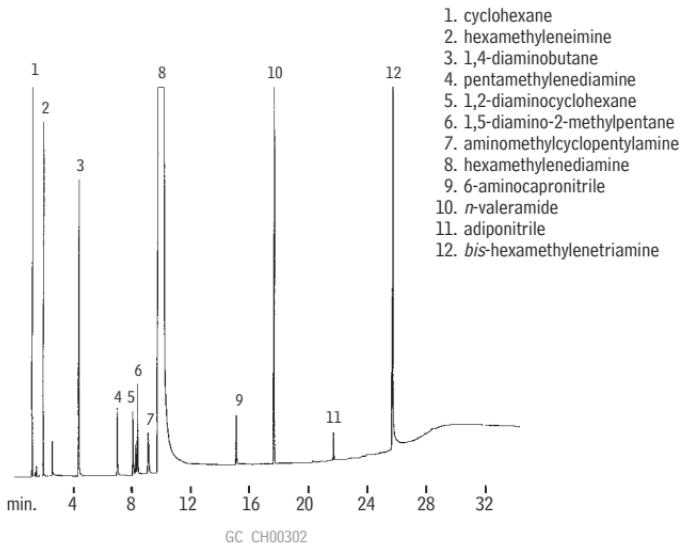
30m, 0.32mm ID, 1.0 $\mu$ m Rtx<sup>®</sup>-5 Amine (cat.# 12354)  
1.0 $\mu$ L split injection of miscellaneous amines and phenols in water  
On-column conc.: 22ng

Oven temp.: 120°C to 220°C @ 10°C/min.  
Inj. & det. temp.: 305°C  
Carrier gas: hydrogen  
Linear velocity: 38cm/sec. set @ 120°C  
FID sensitivity: 6.4 x 10<sup>-11</sup> AFS  
Split ratio: 25:1

1. diethylamine
2. pyridine
3. morpholine
4. phenol
5. aniline
6. 2-chlorophenol
7. diethylenetriamine
8. octylamine
9. 1-methyl-2-pyrrolidinone
10. 2-nitrophenol
11. 2,6-dimethylaniline
12. nicotine
13. 2-nitroaniline



## Hexamethylenediamine Stabilwax<sup>®</sup>-DB

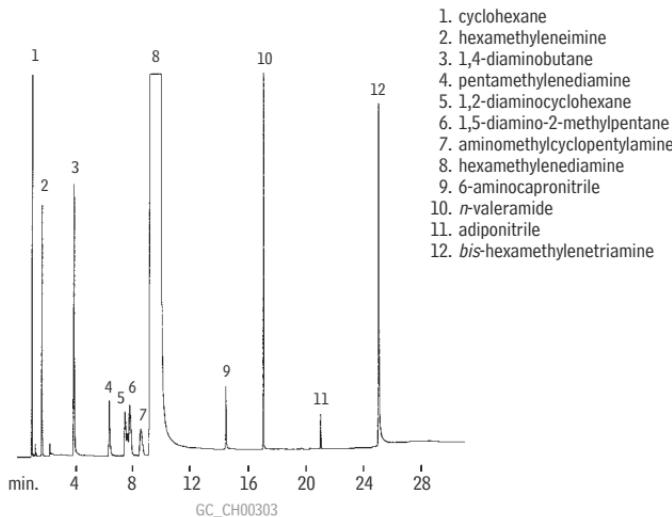


30m, 0.32mm ID, 0.25 $\mu$ m Stabilwax-DB (cat.# 10824)  
0.4 $\mu$ L direct injection of a neat hexamethylenediamine sample  
On-column conc.: 10 to 1000ng/component

Oven temp.: 95°C (hold 6 min.) to 235°C @  
7°C/min. (hold 4 min.)  
Inj. & det. temp.: 250°C  
Carrier gas: hydrogen  
Linear velocity: 40cm/sec.  
FID sensitivity: 2 x 10<sup>-11</sup> AFS

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## Hexamethylenediamine Stabilwax®-DB

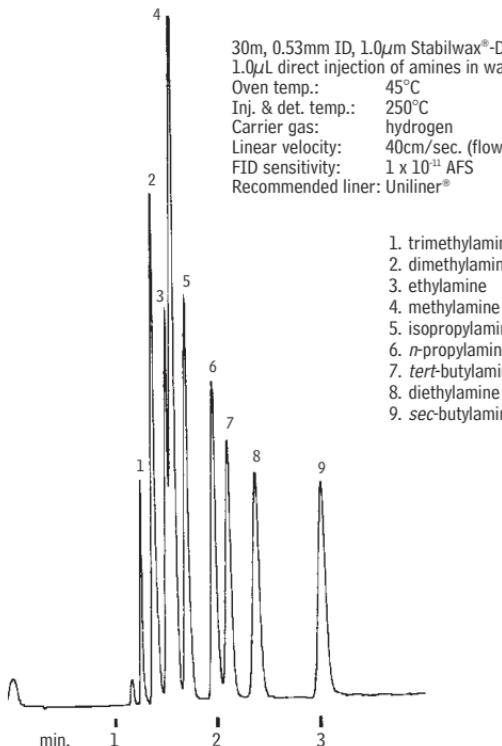


30m, 0.53mm ID, 0.5 $\mu$ m Stabilwax®-DB (cat.# 10840)  
0.2 $\mu$ L direct injection of a neat hexamethylenediamine sample onto  
a Uniliner® liner

Oven temp.: 95°C (hold 6 min.) to 235°C @  
7°C/min. (hold 2 min.)  
Inj. & det. temp.: 255°C  
Carrier gas: hydrogen  
Linear velocity: 40cm/sec. (flow rate: 5cc/min.)  
FID sensitivity: 64 x 10<sup>-11</sup> AFS

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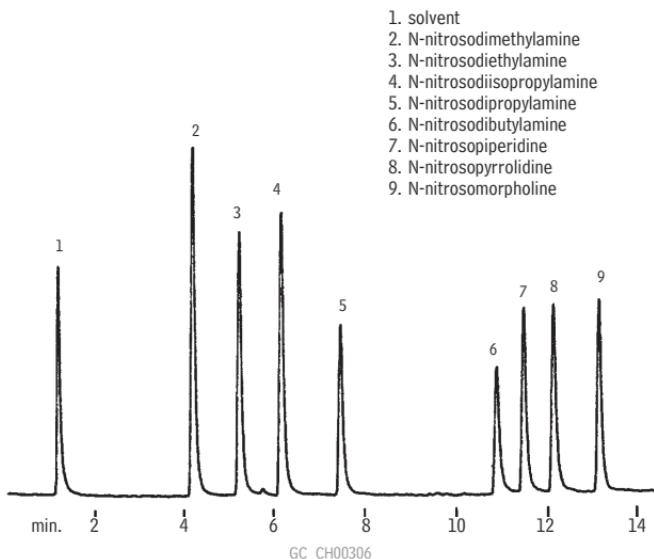
## Amines (low MW) Stabilwax®-DB



GC\_CH00304

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## Nitrosamines Stabilwax®-DB



60m, 0.53mm ID, 1.0 $\mu$ m Stabilwax®-DB (cat.# 10858)

Direct injection of nitrosamines

Conc.: 1.0 $\mu$ g/mL

Oven temp.: 100°C (hold 1 min.) to 170°C @ 5°C/min.

Inj. & det. temp.: 200°C

Carrier gas: helium

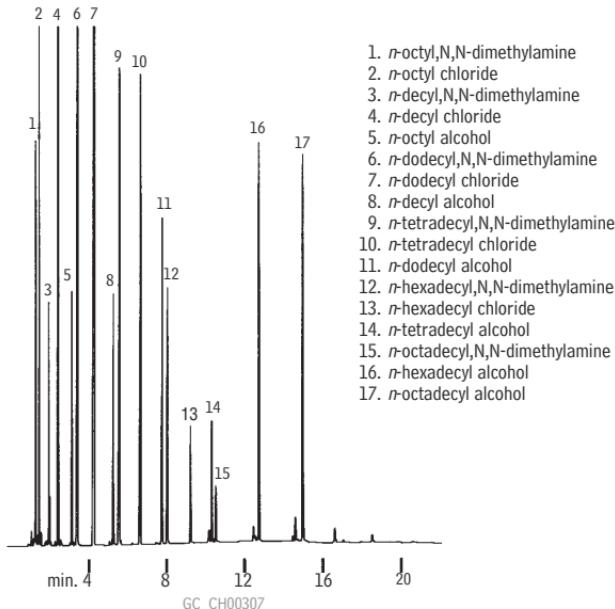
Linear velocity: 100cm/sec. (flow rate: 15cc/min.)

Detector: TSD

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# Amines/Alcohols/Chlorides

## Stabilwax®



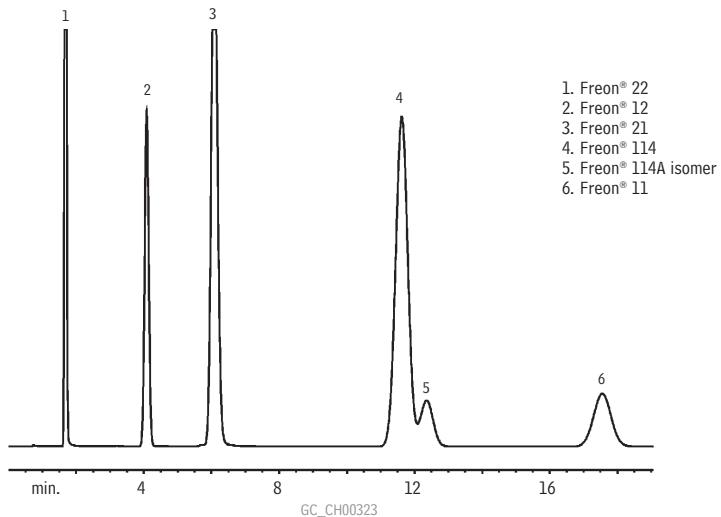
1. *n*-octyl,N,N-dimethylamine
2. *n*-octyl chloride
3. *n*-decyl,N,N-dimethylamine
4. *n*-decyl chloride
5. *n*-octyl alcohol
6. *n*-dodecyl,N,N-dimethylamine
7. *n*-dodecyl chloride
8. *n*-decyl alcohol
9. *n*-tetradecyl,N,N-dimethylamine
10. *n*-tetradecyl chloride
11. *n*-dodecyl alcohol
12. *n*-hexadecyl,N,N-dimethylamine
13. *n*-hexadecyl chloride
14. *n*-tetradecyl alcohol
15. *n*-octadecyl,N,N-dimethylamine
16. *n*-hexadecyl alcohol
17. *n*-octadecyl alcohol

30m, 0.53mm ID, .25 $\mu$ m Stabilwax® (cat.# 10625)  
0.5 $\mu$ L split injection

Oven temp.: 100°C to 250°C @  
8°C/min. (hold 5 min.)  
Inj. & det. temp.: 250°C  
Carrier gas: hydrogen  
Linear velocity: 40cm/sec. (flow rate: 5.2cc/min.)  
FID sensitivity: 128 x 10<sup>-11</sup> AFS  
Split ratio: 40:1

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**Chlorofluorocarbons**  
**5% Krytox on 60/80 CarboBlack™ B**

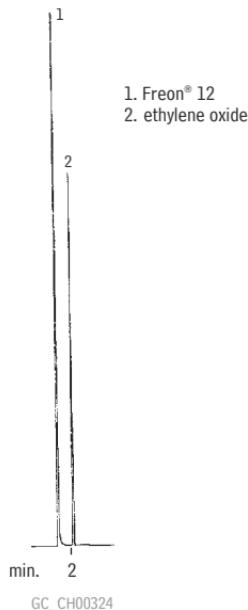


5% Krytox on 60/80 CarboBlack™ B (cat.# 80127)  
3.05m,  $\frac{1}{8}$ " OD x 2.1mm ID SilcoSmooth™ stainless steel tubing  
1 $\mu$ L injected, concentration 20% each component

Oven temp.: 50°C  
Inj./det. temp.: 200°C/250°C  
Carrier gas: nitrogen @ 30mL/min.  
Detector: FID

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## Freon® & Ethylene Oxide Rtx®-1

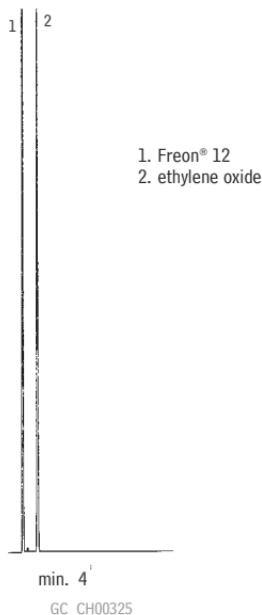


30m, 0.53mm ID, 5.0 $\mu$ m Rtx®-1 (cat.# 10179)  
50 $\mu$ L split injection of Freon® 12 and ETO

Oven temp.:	25°C
Inj. & det. temp.:	290°C
Carrier gas:	hydrogen
Linear velocity:	40cm/sec.
FID sensitivity:	4 x 10 <sup>11</sup> AFS
Split vent:	40:1

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## Freon® & Ethylene Oxide Rtx®-200



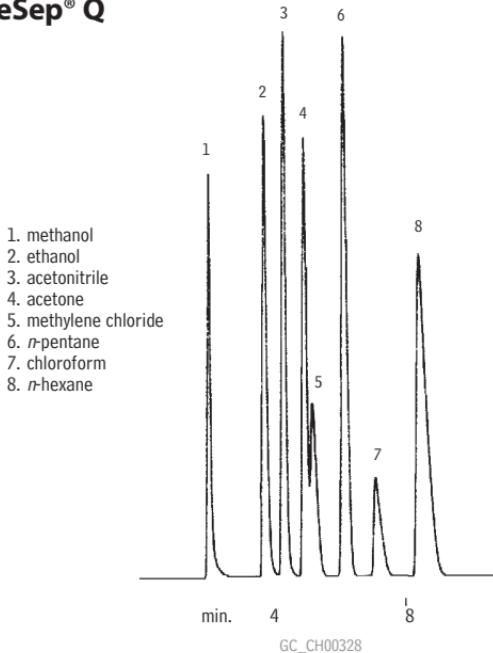
30m, 0.53mm ID, 3.0 $\mu$ m Rtx®-200 (cat.# 15085)  
50 $\mu$ L direct injection of Freon® 12 and ETO

Oven temp.: 25°C  
Inj. & det. temp.: 290°C  
Carrier gas: hydrogen  
Linear velocity: 40cm/sec. (flow rate: 5.2cc/min.)

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## Solvents

### HayeSep® Q



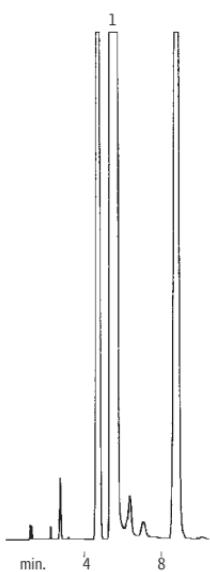
2m, 1mm ID HayeSep® Q (cat.# 19017)  
1 $\mu$ L direct injection of a neat solvent mixture

Oven temp.: 80°C to 180°C @  
16°C/min. (hold 5 min.)  
Inj. & det. temp.: 200°C  
Carrier gas: helium  
Flow: 20mL/min. set @ 40°C  
FID sensitivity: 512 x 10<sup>11</sup> AFS

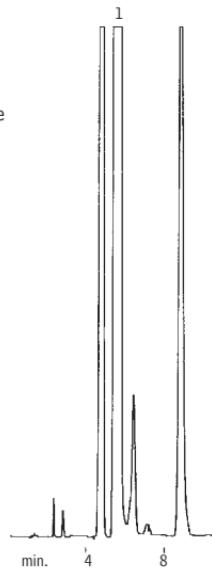
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## Pentane (lot purity analysis) MXT®-1

LOT A



LOT B



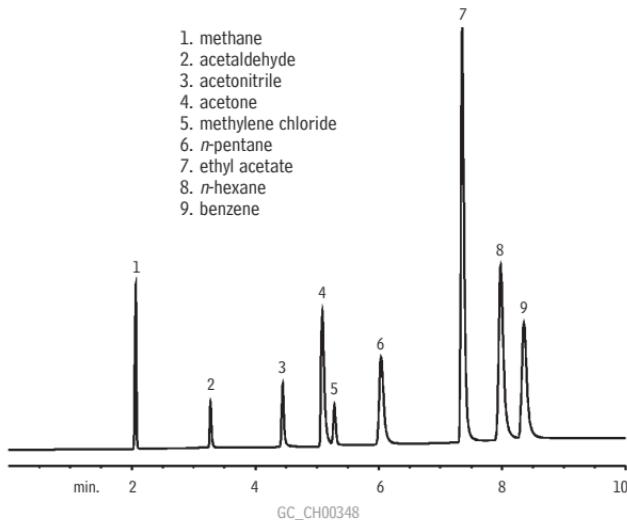
GC\_CH00332

60m, 0.53mm ID, 5.0 $\mu$ m MXT®-1 (cat.# 70183)  
1.0 $\mu$ L direct injection of high purity pentane

Oven temp.: 40°C  
Inj. & det. temp.: 200°C  
Carrier gas: helium  
Linear velocity: 40cm/sec. (flow rate: 10cc/min.)  
FID sensitivity: 4 x 10<sup>-11</sup> AFS

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## Solvents Rt-Q PLOT™



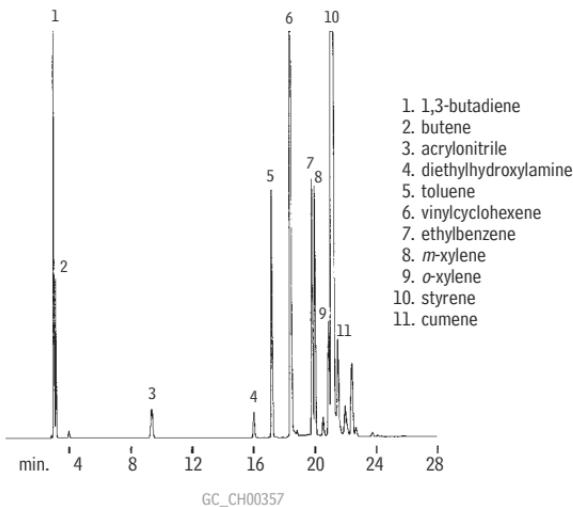
30m, 0.53mm ID Rt-Q PLOT™ (cat.# 19716)  
70 $\mu$ L split injection of solvent mixture

Oven temp.: 100°C to 220°C @ 15°C/min. (hold 2 min.)  
Inj. & det. temp.: 220°C  
Carrier gas: helium  
Linear velocity: 23.6cm/sec. set @ 100°C  
FID sensitivity: 1.28 x 10<sup>10</sup> AFS  
Split ratio: 7.7:1  
Split: 44.5cc/min.  
Column flow: 6.6cc/min.

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# Styrene Impurities

## Rtx®-1701



30m, 0.53mm ID, 3.0 $\mu$ m Rtx®-1701 (cat.# 12085)  
0.5mL split injection of a 95% pure styrene

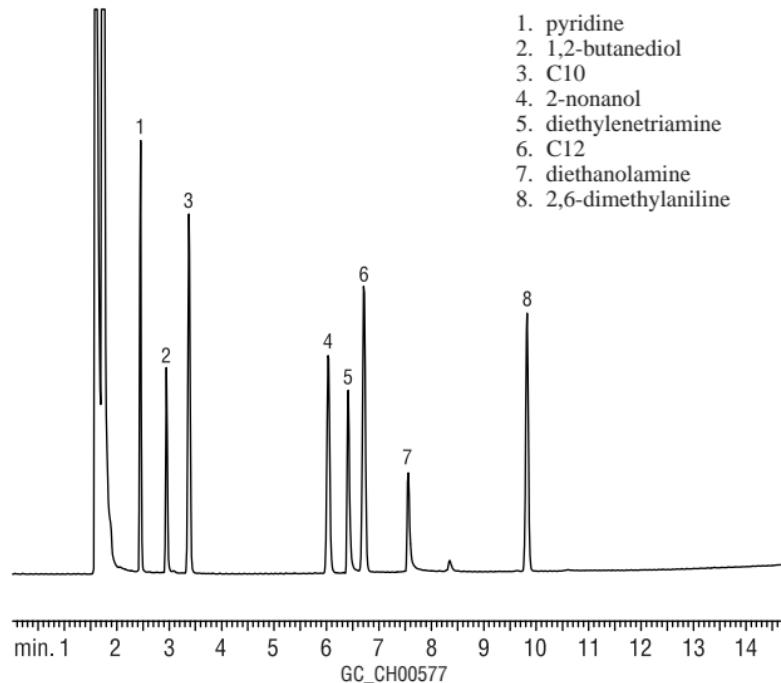
Oven temp.: 40°C (hold 10 min.) to 150°C  
@ 12°C/min. (hold 15 min.)  
Inj. & det. temp.: 150°C  
Carrier gas: helium  
Linear velocity: 20cm/sec. set @ 40°C  
FID sensitivity: 16 x 10<sup>11</sup> AFS  
Split vent: 40cc/min.

Permission to publish this chromatogram granted  
by Copolymer Rubber and Chemical Corp.

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# Amine Test Mix

## Rtx®-35 Amine



Rtx®-35Amine 30m, 0.53mm ID, 1.0 $\mu$ m (cat.# 11355)

Sample: amine test mix (cat.# 35002), 450–900ppm in

methanol/methylene chloride

Inj.: 1.0 $\mu$ L, split (10:1), 4mm base-deactivated  
single gooseneck (cat.# 20798-210.1)

Inj. temp.: 250°C

Carrier gas: helium, constant pressure

Linear velocity: 30cm/sec

Oven temp.: 110°C (hold 4 min.) to 200°C @  
8°C/min. (hold 5 min.)

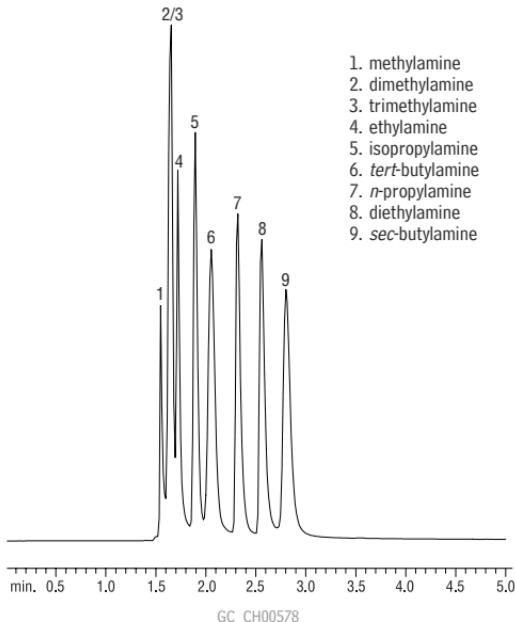
Det. FID @ 300°C

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## Primary Amines

### Rtx®-35 Amine



Rtx®-35 Amine 30m, 0.53mm ID, 1.0 $\mu$ m (cat.# 11355)

Sample: primary amines, 50ppm on-column conc. in water

Inj.: 1.0 $\mu$ L, split (10:1), 4mm base-deactivated single gooseneck (cat.# 20798-210.1)

Injector: 250°C

Carrier gas: helium, constant pressure

Linear velocity: 35.7cm/sec

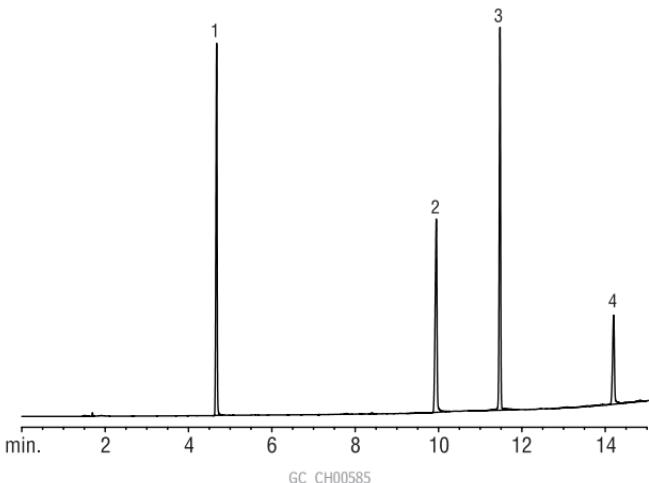
Oven temp.: 35°C (hold 5.0 min.)

Det.: FID @ 300°C

Restek Corporation 110 Benner Circle Bellefonte, PA 16823  
814-353-1300 • 800-356-1688 • Fax: 814-353-1309 • [www.restek.com](http://www.restek.com)

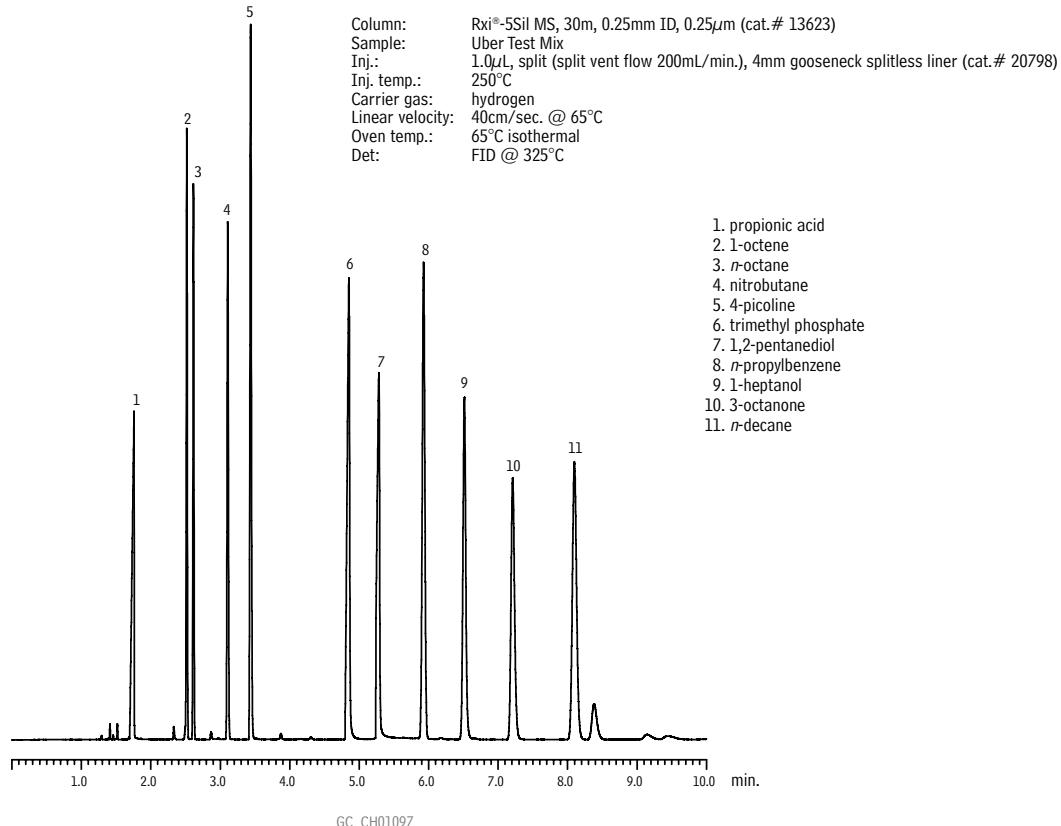
## Ethanolamines Rtx®-35 Amine

1. monoethanolamine
2. diethanolamine
3. triethyleneglycol monomethylether
4. triethanolamine



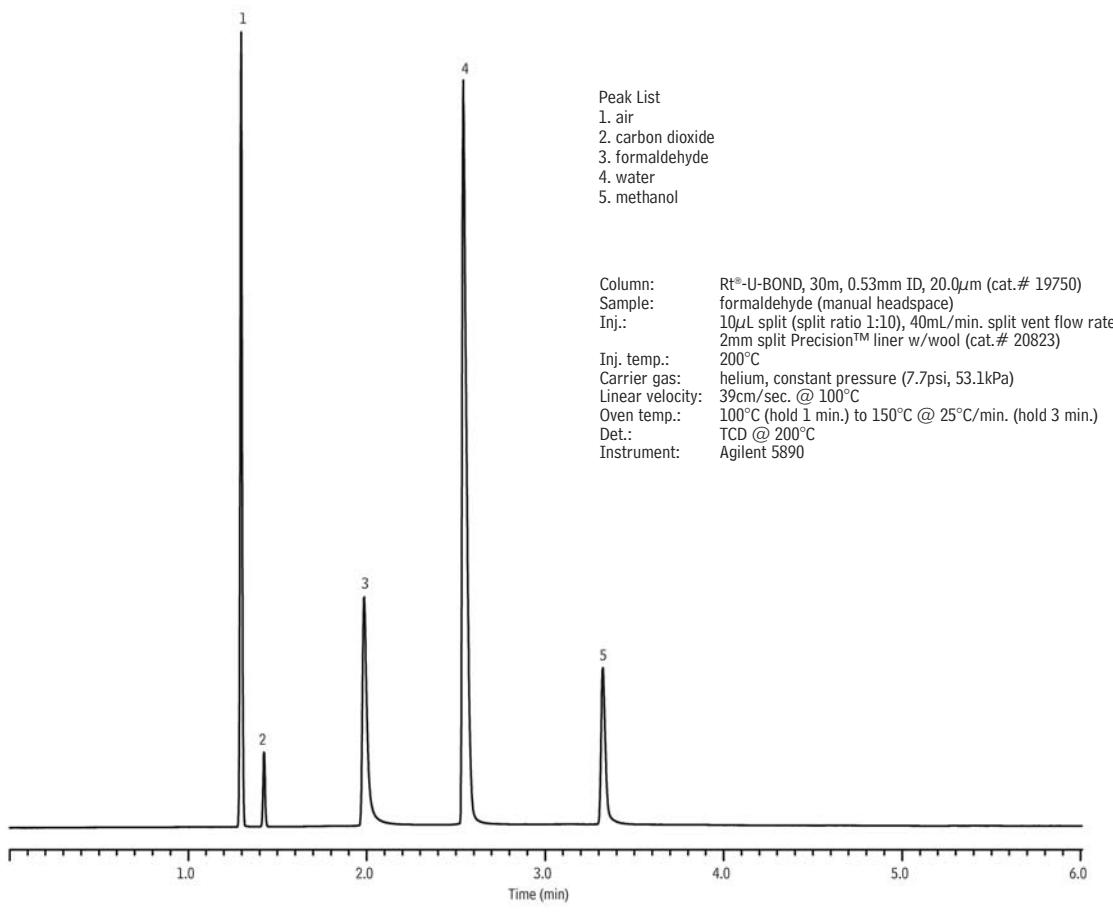
Rtx®-35 Amine 30m, 0.32mm ID, 1.0 $\mu$ m (cat.# 11354)  
Sample: 500 $\mu$ g/mL ethanolamine standard in water  
Inj.: 1.0 $\mu$ L split (split ratio 10:1),  
cup splitter inlet liner (cat.# 20709)  
Inj. temp.: 30°C  
Carrier gas: helium, constant pressure  
Linear velocity: 40cm/sec. @ 50°C  
Oven temp.: 50°C (hold 0.50min.) to 280°C @15°C/min.  
Det.: FID @300°C

**Uber Test Mix**  
**Rxi®-5Sil MS**



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**Formaldehyde**  
**Rt®-U-BOND**

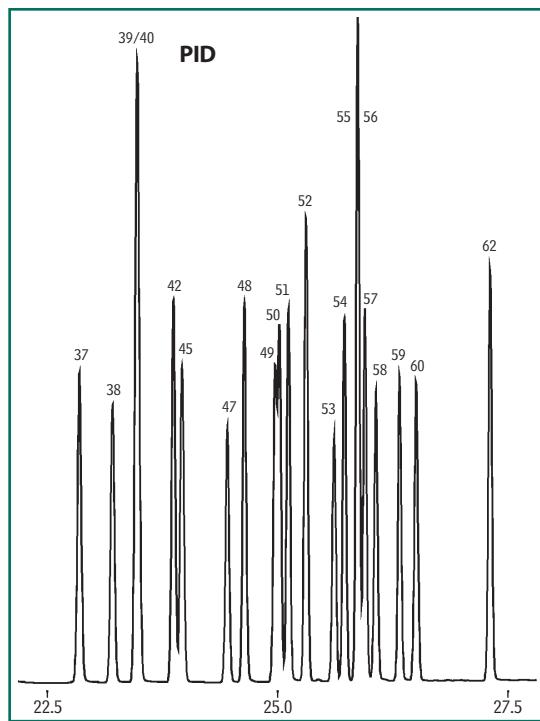
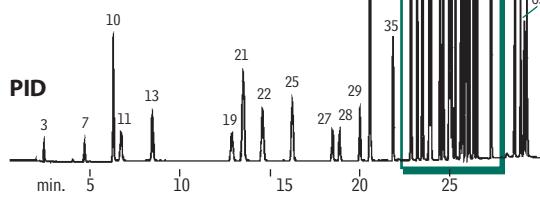


GC\_CH01137

**Volatile Organics**  
**US EPA Method 8021**  
**Rtx®-VRX**

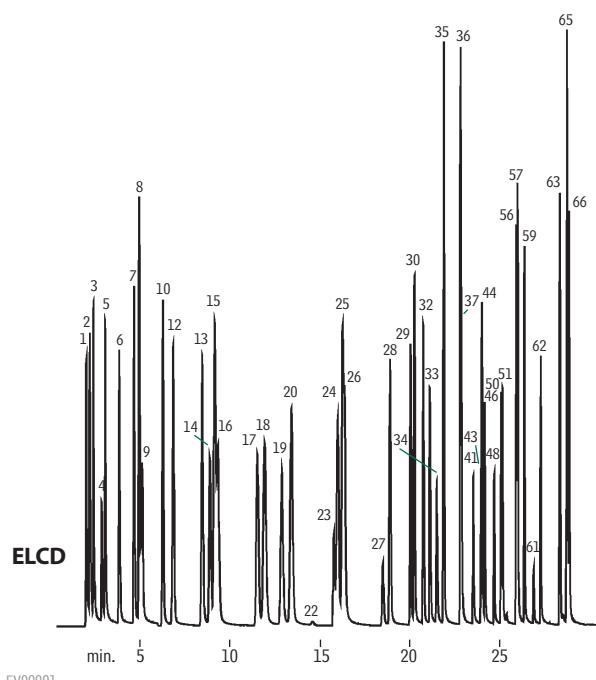
- Good choice for waste water analysis.

1. dichlorodifluoromethane  
 2. chloromethane  
 3. vinyl chloride  
 4. bromomethane  
 5. chloroethane  
 6. trichlorofluoromethane  
 7. 1,1-dichloroethene  
 8. methylene chloride  
 9. Freon® 113  
 10. *trans*-1,2-dichloroethene  
 11. methyl *tert*-butyl ether  
 12. 1,1-dichloroethane  
 13. *cis*-1,2-dichloroethene  
 14. bromochloromethane  
 15. chloroform  
 16. 2,2-dichloropropane  
 17. 1,2-dichloroethane  
 18. 1,1,1-trichloroethane  
 19. 1,1-dichloropropene  
 20. carbon tetrachloride  
 21. benzene  
 22. fluorobenzene (SS)  
 23. dibromomethane  
 24. 1,2-dichloropropane  
 25. trichloroethene  
 26. bromodichloromethane  
 27. 2-chloroethyl vinyl ether  
 28. *cis*-1,3-dichloropropene  
 29. *trans*-1,3-dichloropropene  
 30. 1,1,2-trichloroethane  
 31. toluene  
 32. 1,3-dichloropropane  
 33. dibromochloromethane  
 34. 1,2-dibromoethane  
 35. tetrachloroethene  
 36. 1,1,1,2-tetrachloroethane  
 37. chlorobenzene  
 38. ethyl benzene  
 39. *m*-xylene  
 40. *p*-xylene  
 41. bromoform  
 42. styrene  
 43. 1,4-dichlorobutane (SS)  
 44. 1,1,2,2-tetrachloroethane  
 45. *o*-xylene  
 46. 1,2,3-trichloropropane  
 47. isopropyl benzene  
 48. bromobenzene  
 49. *n*-propylbenzene  
 50. 2-chlorotoluene  
 51. 4-chlorotoluene  
 52. 1,3,5-trimethylbenzene  
 53. *tert*-butylbenzene  
 54. 1,2,4-trimethylbenzene  
 55. *sec*-butylbenzene  
 56. 1,3-dichlorobenzene  
 57. 1,4-dichlorobenzene  
 58. *p*-isopropyltoluene  
 59. 1,2-dichlorobenzene  
 60. *n*-butylbenzene  
 61. 1,2-bromo-3-chloropropane  
 62. 4-bromo-1-chlorobenzene (SS)  
 63. 1,2,4-trichlorobenzene  
 64. naphthalene  
 65. hexachlorobutadiene  
 66. 1,2,3-trichlorobenzene



75m, 0.45mm ID, 2.55 $\mu$ m Rtx®-VRX (cat.# 19309)  
 Conc.: 20ppb in 5mL of RO water (see below)  
 Concentrator: Tekmar LSC-3000 Purge and Trap  
 Trap: Vocarb 3000  
 Purge: 11 min. @ 40mL/min.  
 Dry purge: 1 min. @ 40mL/min. (MCS bypassed with SilcoSteel® tubing)  
 Desorb preheat: 245°C  
 Desorb: 250°C for 2 min.  
 Bake: 260°C for 8 min.  
 Interface: direct  
 Transfer line: 0.32mm ID Siltek® tubing  
 GC: Finnigan 9001  
 GC program: 35°C (hold 12 min.) to 60°C  
 (@ 5°C/min. (hold 1 min.) to 220°C @ 17°C/min. (hold 3 min.)  
 helium 9mL/min.  
 $\mu$ Gold Tandem PID/HALL 2000  
 PID: makeup 7mL/min., purge 7mL/min, set @ 0.35mV base temp. 200°C.  
 ELCD Hall 2000: RxnGas 25mL/min., RxnTemp.: 940°C,  
 propanol flow 470 $\mu$ L/min.

Reference Standard	cat.#
502.2 Cal2000 MegaMix™	30431
502.2 Calibration Mix#1A	30439
4-bromoanisole	30230
2-chloroethyl vinyl ether	30265
1,4-dichlorobutane	30227
fluorobenzene	30030
methyl- <i>tert</i> -butyl-ether	30402
Freon® 113	custom



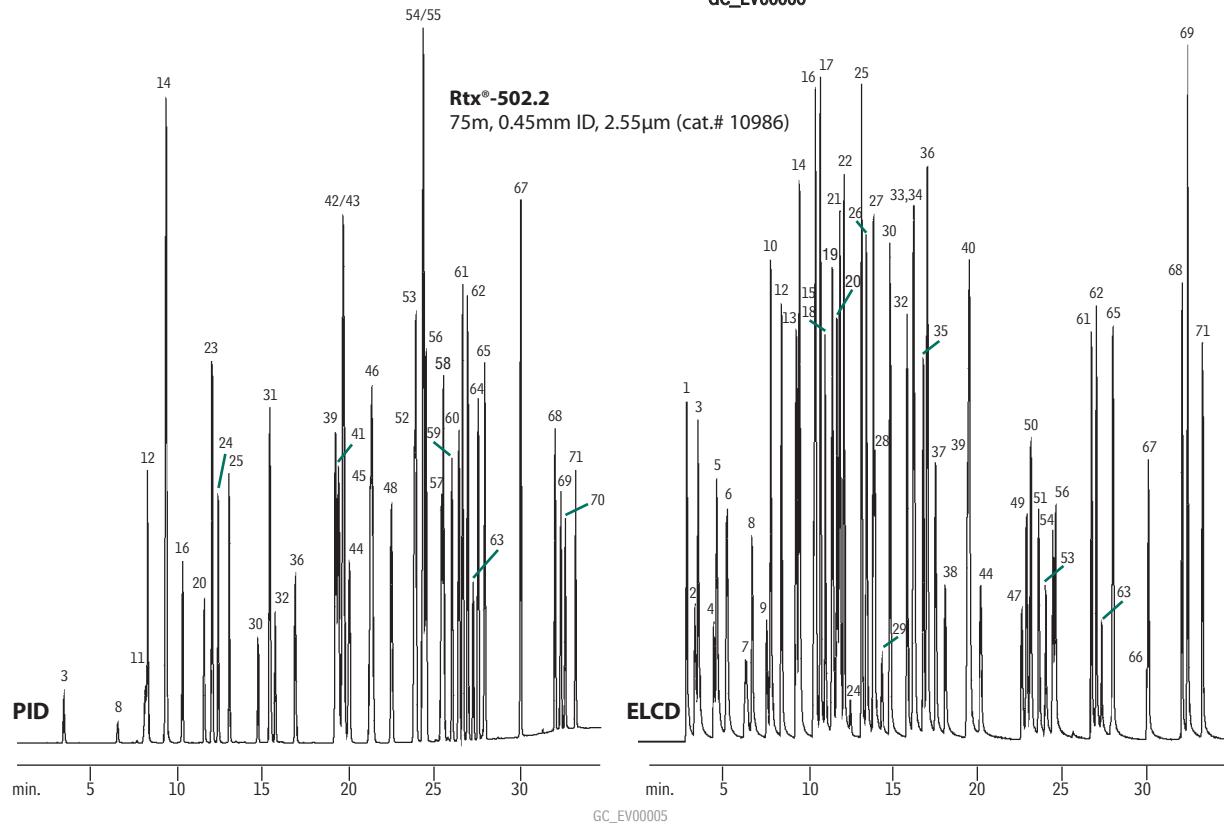
Acknowledgement: Finnigan 9001 GC,  $\mu$ Gold Tandem Photoionization/HALL® 2000 Electrolytic Conductivity Detector provided courtesy of Thermo Finnigan GC & GC/MS Division, 2215 Grand Avenue Pkwy, Austin, Texas 78728

**Volatile Organics**  
**US EPA Method 502.2**  
**Rtx®-502.2**

for more info

A confirmational analysis can be found on  
[www.restek.com/chromatograms](http://www.restek.com/chromatograms)

Search for chromatogram number  
**GC\_EV00006**



**PID**

GC\_EV00005

min. 5 10 15 20 25 30

1. dichlorodifluoromethane
2. chloromethane
3. vinyl chloride
4. bromomethane
5. chloroethane
6. trichlorofluoromethane
7. Freon® 113
8. 1,1-dichloroethene
9. allyl chloride
10. methylene chloride
11. methyl *tert*-butyl ether
12. *trans*-1,2-dichloroethene
13. 1,1-dichloroethane
14. chloropropene (40ppb)
15. 2,2-dichloropropane
16. *cis*-1,2-dichloroethene
17. chloroform
18. bromochloromethane
19. 1,1,1-trichloroethane
20. 1,1-dichloropropene
21. carbon tetrachloride
22. 1,2-dichloroethane
23. benzene
24. fluorobenzene (SS)
25. trichloroethene
26. 1,2-dichloropropane
27. bromodichloromethane
28. dibromomethane
29. 2-chloroethyl vinyl ether
30. *cis*-1,3-dichloropropene
31. toluene
32. *trans*-1,3-dichloropropene
33. 1,1,2-trichloroethane
34. 2-bromo-1-chloropropane (IS)
35. 1,3-dichloropropane
36. tetrachloroethene

37. dibromochloromethane
38. 1,2-dibromoethane
39. chlorobenzene
40. 1,1,1,2-tetrachloroethane
41. ethyl benzene
42. *m*-xylene
43. *p*-xylene
44. 1-chloro-2-fluorobenzene (IS)
45. *o*-xylene
46. styrene
47. bromoform
48. isopropyl benzene
49. 1,4-dichlorobutane (SS)
50. 1,1,2,2-tetrachloroethane
51. 1,2,3-trichloropropane
52. *n*-propylbenzene
53. bromobenzene
54. 2-chlorotoluene
55. 1,3,5-trimethylbenzene
56. 4-chlorotoluene
57. *tert*-butylbenzene
58. 1,2,4-trimethylbenzene
59. sec-butylbenzene
60. *p*-isopropyltoluene
61. 1,3-dichlorobenzene
62. 1,4-dichlorobenzene
63. benzyl chloride
64. *n*-butylbenzene
65. 1,2-dichlorobenzene
66. 1,2-bromo-3-chloropropane
67. 4-bromo-1-chlorobenzene (SS)
68. 1,2,4-trichlorobenzene
69. hexachlorobutadiene
70. naphthalene
71. 1,2,3-trichlorobenzene

Column:  
Conc.:  
Inj.:

75m, 0.45mm ID, 2.55 $\mu$ m Rtx®-502.2 (cat.# 10986).  
20ppb in 5mL of RO water (unless otherwise noted, peak 14).  
a combination of the following reference materials was used:  
502.2 Cal2000 MegaMix™ (cat.# 30431)  
502.2 Calibration Mix #1A (cat.# 30439)  
502.2 Internal Standard Mix #2 (cat.# 30041)  
1-chloro-2-fluorobenzene (cat.# 30040)  
4-bromochlorobenzene (cat.# 30230)  
2-chloroethyl vinyl ether (cat.# 30265)  
1,4-dichlorobutane (cat.# 30227)  
MTBE (cat.# 30402)  
and custom mixtures of Freon® 113, allyl chloride,  
chloroprene, and benzyl chloride.

Concentrator:  
Trap:  
Purge:  
Dry purge:  
Desorb preheat:  
Desorb:  
Bake:

Tekmar LSC-3000 Purge and Trap  
Vocabar 3000  
11 min. @ 40mL/min.  
1 min. @ 40mL/min. (MCS off)  
245°C  
250°C for 2 min.  
260°C for 8 min.

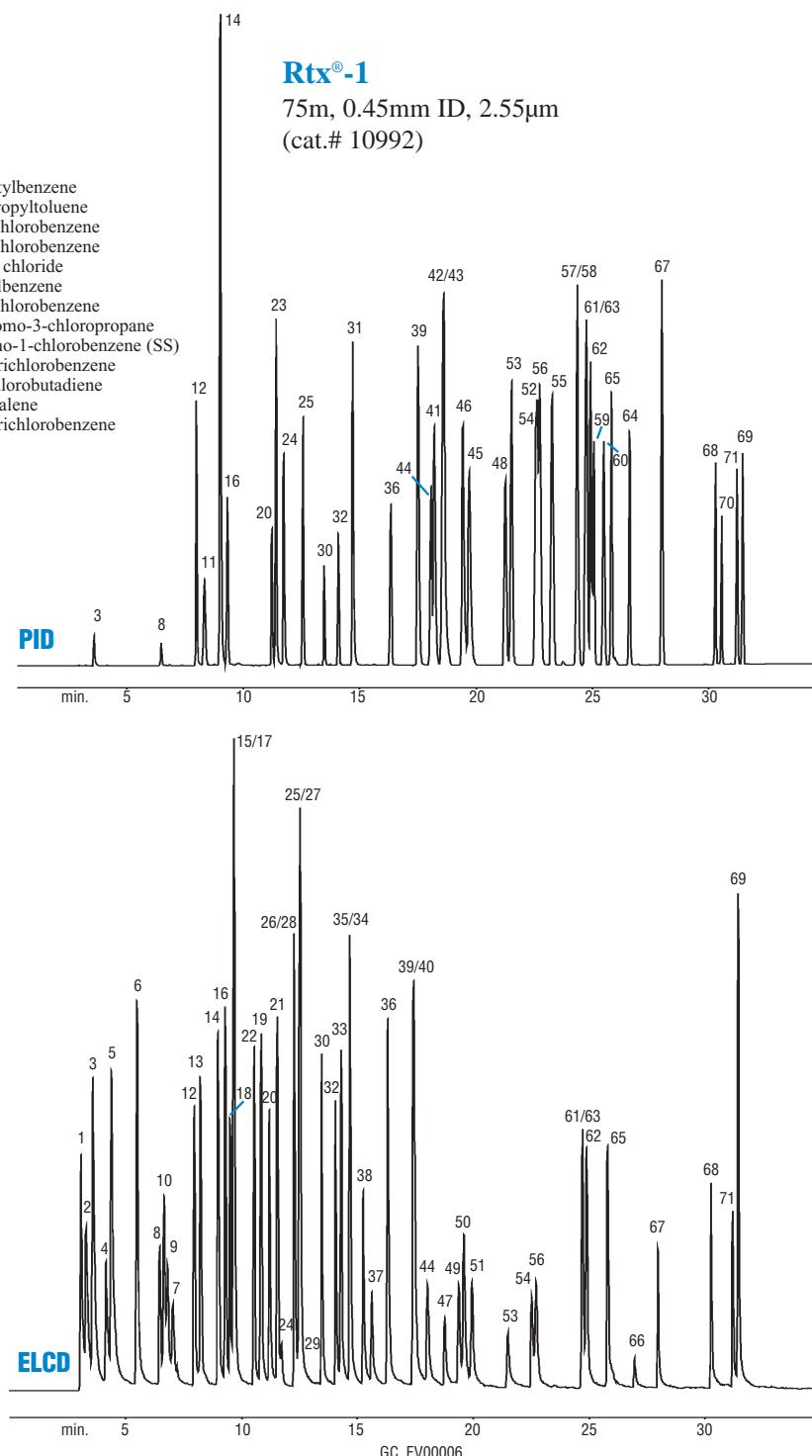
GC:  
Carrier gas:  
Oven temp.:

Finnigan 9001  
helium, 9mL/min. constant pressure  
35°C (hold 6 min.) to 115°C @ 11°C/min. (hold 7 min.) to 130°C @ 7°C/min. (no hold), to 220°C @ 9.2°C/min. (hold 4 min.)  
μGold Tandem PID/HALL 2000  
PID: makeup 7mL/min., purge 7mL/min. set @ 0.35mV, base temp. 200°C  
Hall 2000: Rxn gas 25mL/min., Rxn temp. 940°C  
propanol flow 470 $\mu$ L/min.

Acknowledgement: Finnigan 9001 GC, μGold Tandem Photoionization/HALL® 2000 Electrolytic Conductivity Detector provided courtesy of Thermo Finnigan GC & GC/MS Division, 2215 Grand Avenue Pkwy, Austin, Texas 78728

**Volatile Organics**  
**Confirmational Analysis**  
**EPA Method 502.2**  
**Rtx®-1**

1. dichlorodifluoromethane
2. chloromethane
3. vinyl chloride
4. bromomethane
5. chloroethane
6. trichlorofluoromethane
7. Freon® 113
8. 1,1-dichloroethene
9. allyl chloride
10. methylene chloride
11. methyl *tert*-butyl ether
12. *trans*-1,2-dichloroethene
13. 1,1-dichloroethane
14. chloropropene (40ppb)
15. 2,2-dichloropropane
16. *cis*-1,2-dichloroethene
17. chloroform
18. bromochloromethane
19. 1,1,1-trichloroethane
20. 1,1-dichloropropene
21. carbon tetrachloride
22. 1,2-dichloroethane
23. benzene
24. fluorobenzene (SS)
25. trichloroethene
26. 1,2-dichloropropane
27. bromodichloromethane
28. dibromomethane
29. 2-chloroethyl vinyl ether
30. *cis*-1,3-dichloropropene
31. toluene
32. *trans*-1,3-dichloropropene
33. 1,1,2-trichloroethane
34. 2-bromo-1-chloropropane (SS)
35. 1,3-dichloropropane
36. tetrachloroethene
37. dibromochloromethane
38. 1,2-dibromoethane
39. chlorobenzene
40. 1,1,1,2-tetrachloroethane
41. ethyl benzene
42. *m*-xylene
43. *p*-xylene
44. 1-chloro-2-fluorobenzene (SS)
45. *o*-xylene
46. styrene
47. bromoform
48. isopropyl benzene
49. 1,4-dichlorobutane (SS)
50. 1,1,2,2-tetrachloroethane
51. 1,2,3-trichloropropane
52. *n*-propylbenzene
53. bromobenzene
54. 2-chlorotoluene
55. 1,3,5-trimethylbenzene
56. 4-chlorotoluene
57. *tert*-butylbenzene
58. 1,2,4-trimethylbenzene

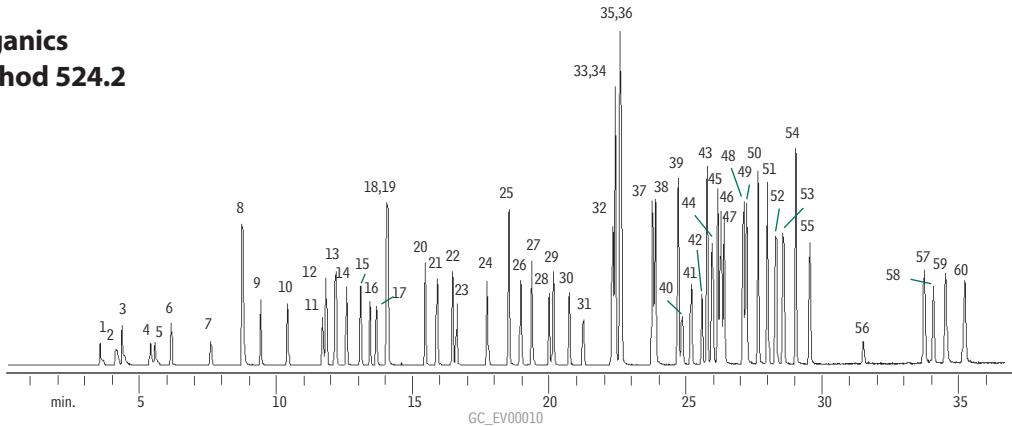


Acknowledgement: Finnigan 9001 GC, µGold Tandem Photoionization/HALL® 2000  
 Electrolytic Conductivity Detector provided courtesy of Thermo Finnigan GC & GC/MS Division, 2215 Grand Avenue Pkwy, Austin, Texas 78728

Column: 75m, 0.45mm ID, 2.55µm Rtx®-1 (cat.# 10992).  
 Conc.: 20ppb in 5mL of RO water (unless otherwise noted, peak 14).  
 Inj.: a combination of the following reference materials was used:  
 502.2 Cal2000 MegaMix™ (cat.# 30431)  
 502.2 Calibration Mix #1A (cat.# 30439)  
 502.2 Internal Standard Mix #2 (cat.# 30041)  
 1-chloro-2-fluorobenzene (cat.# 30040)  
 4-bromochlorobenzene (cat.# 30230)  
 2-chloroethyl vinyl ether (cat.# 30265)  
 1,4-dichlorobutane (cat.# 30227)  
 MTBE (cat.# 30402)  
 and custom mixtures of Freon® 113, allyl chloride, chloroprene, and benzyl chloride.

Concentrator: Tekmar LSC-3000 purge and trap  
 Trap: Vocarb™ 3000  
 Purge: 11 min. @ 40mL/min.  
 Dry purge: 1 min. @ 40mL/min. (MCS off)  
 Desorb preheat: 245°C  
 Desorb: 250°C for 2 min.  
 Bake: 260°C for 8 min.  
 GC: Finnigan 9001  
 Carrier gas: helium, 9mL/min. constant pressure  
 Oven temp.: 35°C (hold 6 min.) to 115°C @ 11°C/min. (hold 7 min.) to 130°C @ 7°C/min. (no hold), to 220°C @ 9.2°C/min. (hold 4 min.)  
 Detectors: µGold Tandem PID/HALL 2000  
 PID: makeup 7mL/min., purge 7mL/min. set @ 0.35mV, base temp. 200°C  
 Hall 2000: Rxn gas 25mL/min., Rxn temp. 940°C  
 Propanol Flow 470µL/min.

**Volatile Organics**  
**US EPA Method 524.2**  
**Rtx®-502.2**



40m, 0.18mm ID, 1.0 $\mu$ m Rtx®-502.2 (cat.# 40915)  
 Conc.: Reference Standard 524 Volatiles Kit (cat. # 30052)  
 200ppb VOA standards in 5mL RO water.  
 Purge & trap: Tekmar LCS 2000  
 Trap: Vocarb 4000  
 Purge: 11 min.  
 Desorb preheat: 250°C  
 Desorb time: 2 min.

Desorb flow rate: 30mL/min.  
 Oven temp.: 35°C (hold 4 min.) to 150°C @ 6°C/min. to  
 220°C @ 8°C/min. (hold 8 min.).  
 Inj. / det. temp.: 200°C / 250°C  
 Detector: MS  
 Linear velocity: 21cm/sec. set @ 35°C  
 Split ratio: 30:1

1. dichlorodifluoromethane	14. chloroform	27. 1,1,2-trichloroethane	40. bromoform	53. 1,4-dichlorobenzene
2. chloromethane	15. 1,1,1-trichloroethane	28. 1,3-dichloropropane	41. 1,1,2,2-tetrachloroethane	54. <i>n</i> -butylbenzene
3. vinyl chloride	16. 1,1-dichloropropene	29. tetrachloroethene	42. 1,2,3-trichloropropane	55. 1,2-dichlorobenzene
4. bromomethane	17. carbon tetrachloride	30. dibromochloromethane	43. propylbenzene	56. 1,2-dibromo-3-chloro-
5. chloroethane	18. benzene	31. ethylene dibromide	44. bromobenzene	propane
6. trichlorofluoromethane	19. 1,2-dichloroethane	32. chlorobenzene	45. 1,3,5-trimethylbenzene	57. 1,2,4-trichlorobenzene
7. 1,1-dichloroethene	20. trichloroethene	33. ethylbenzene	46. 2-chlorotoluene	58. hexachlorobutadiene
8. methylene chloride	21. 1,2-dichloropropane	34. 1,1,2-tetrachloroethane	47. 4-chlorotoluene	59. naphthalene
9. <i>trans</i> -1,2-dichloroethene	22. bromodichloromethane	35. <i>m</i> -xylene	48. <i>tert</i> -butylbenzene	60. 1,2,3-trichlorobenzene
10. 1,1-dichloroethane	23. dibromomethane	36. <i>p</i> -xylene	49. 1,2,4-trimethylbenzene	
11. 2,2-dichloropropane	24. <i>cis</i> -1,3-dichloropropene	37. <i>o</i> -xylene	50. <i>sec</i> -butylbenzene	
12. <i>cis</i> -1,2-dichloroethene	25. toluene	38. styrene	51. <i>p</i> -isopropyltoluene	
13. bromochloromethane	26. <i>trans</i> -1,3-dichloropropene	39. isopropylbenzene	52. 1,3-dichlorobenzene	

## US EPA TO-14 Compounds

### Rtx®-1

60m, 0.32mm ID, 3.0 $\mu$ m Rtx®-1 (cat.# 10187)  
5mL of 2ppmv TO-14 standard.

Oven temp.: 30°C (hold 4 min.) to 250°C @ 7°C/min. (hold 15 min.).

Detector: MS

Det. temp.: 250°C

Carrier gas: helium

Linear velocity: 21cm/sec. set @ 30°C

Ionization: EI

Scan range: 34-280 AMU

Preconcentrator conditions:

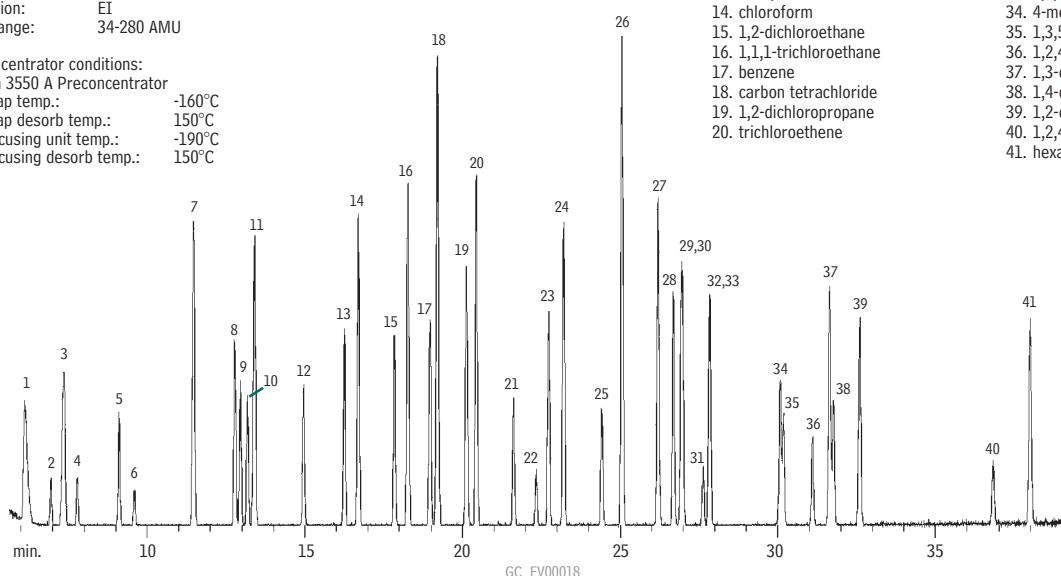
Nutech 3550 A Preconcentrator

Cryotrap temp.: -160°C

Cryotrap desorb temp.: 150°C

Cryofocusing unit temp.: -190°C

Cryofocusing desorb temp.: 150°C



1. dichlorodifluoromethane
2. chloromethane
3. 1,2-dichlortetrafluoroethane
4. vinyl chloride
5. bromomethane
6. chloroethane
7. trichlorofluoromethane
8. 1,1-dichloroethene
9. methylene chloride
10. 3-chloropropene
11. 1,1,2-trichloro-1,2,2-trifluoroethane
12. 1,1-dichloroethane
13. *cis*-1,2-dichloroethene
14. chloroform
15. 1,2-dichloroethane
16. 1,1,1-trichloroethane
17. benzene
18. carbon tetrachloride
19. 1,2-dichloropropane
20. trichloroethylene
21. *cis*-1,3-dichloropropene
22. *trans*-1,3-dichloropropene
23. 1,1,2-trichloroethane
24. toluene
25. 1,2-dibromoethane
26. tetrachloroethene
27. chlorobenzene
28. ethylbenzene
29. *m*-xylene
30. *p*-xylene
31. styrene
32. *o*-xylene
33. 1,1,2,2-tetrachloroethane
34. 4-methyltoluene
35. 1,3,5-trimethylbenzene
36. 1,2,4-trimethylbenzene
37. 1,3-dichlorobenzene
38. 1,4-dichlorobenzene
39. 1,2-dichlorobenzene
40. 1,2,4-trichlorobenzene
41. hexachlorobutadiene

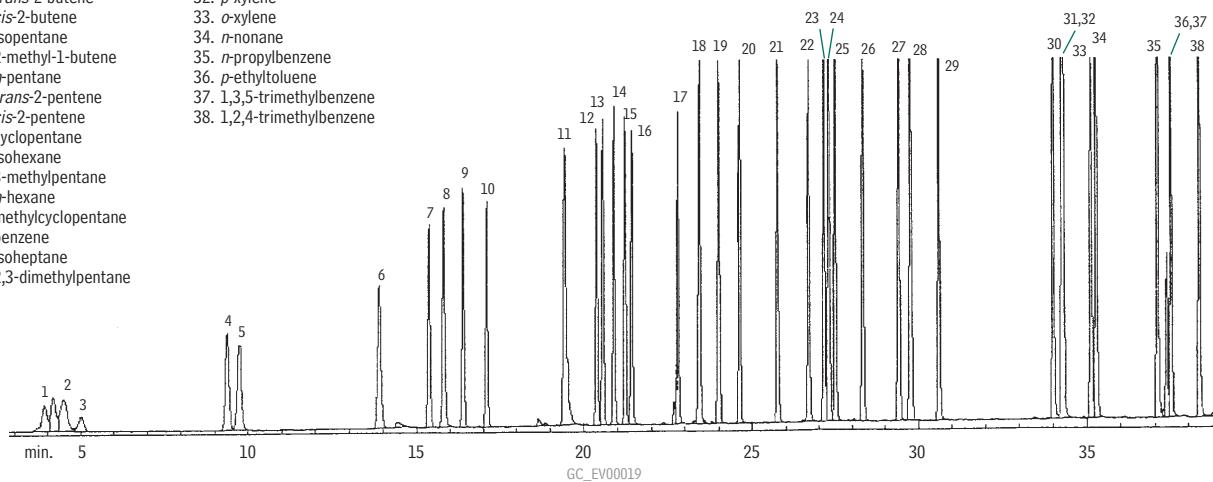
## Ozone Precursors

### Rtx®-1

- |                             |                             |
|-----------------------------|-----------------------------|
| 1. ethylene                 | 24. 3-methylhexane          |
| 2. acetylene                | 25. 2,2,4-trimethylpentane  |
| 3. ethane                   | 26. <i>n</i> -heptane       |
| 4. propylene                | 27. methylcyclohexane       |
| 5. propane                  | 28. 2,2,3-trimethylpentane  |
| 6. isobutane                | 29. toluene                 |
| 7. 1-butene                 | 30. ethylbenzene            |
| 8. <i>n</i> -butane         | 31. <i>m</i> -xylene        |
| 9. <i>trans</i> -2-butene   | 32. <i>p</i> -xylene        |
| 10. <i>cis</i> -2-butene    | 33. <i>o</i> -xylene        |
| 11. isopentane              | 34. <i>n</i> -nonane        |
| 12. 2-methyl-1-butene       | 35. <i>n</i> -propylbenzene |
| 13. <i>n</i> -pentane       | 36. <i>p</i> -ethyltoluene  |
| 14. <i>trans</i> -2-pentene | 37. 1,3,5-trimethylbenzene  |
| 15. <i>cis</i> -2-pentene   | 38. 1,2,4-trimethylbenzene  |
| 16. cyclopentane            |                             |
| 17. isohexane               |                             |
| 18. 3-methylpentane         |                             |
| 19. <i>n</i> -hexane        |                             |
| 20. methylcyclopentane      |                             |
| 21. benzene                 |                             |
| 22. isoheptane              |                             |
| 23. 2,3-dimethylpentane     |                             |

60m, 0.32mm ID, 3.0 $\mu$ m Rtx®-1 (cat.# 10187)  
0.5L of C2-C9 gas standard cryogenically concentrated;  
15nL/component desorbed onto column.

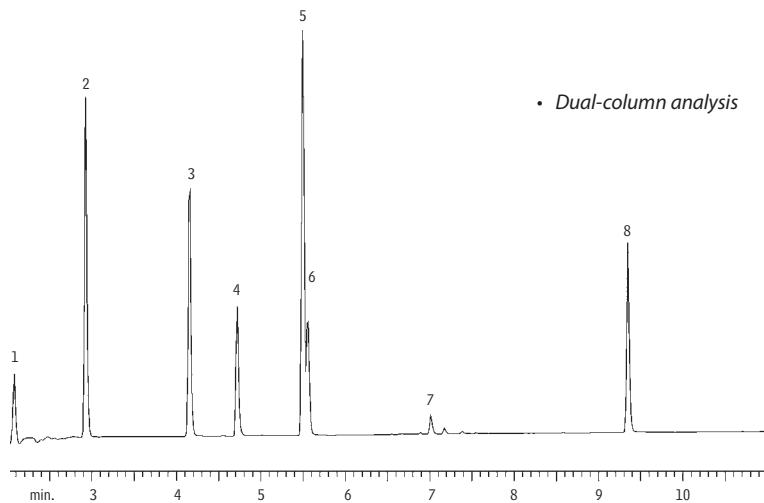
Oven temp.: -60°C (hold 5 min.) to 100°C @ 8°C/min., to  
150°C @ 6°C/min., then to 240°C @ 8°C/min.  
Carrier gas: helium  
Linear velocity: 30cm/sec. (flow rate: 1.8cc/min.)  
FID sensitivity: 64 x 10<sup>-12</sup> AFS



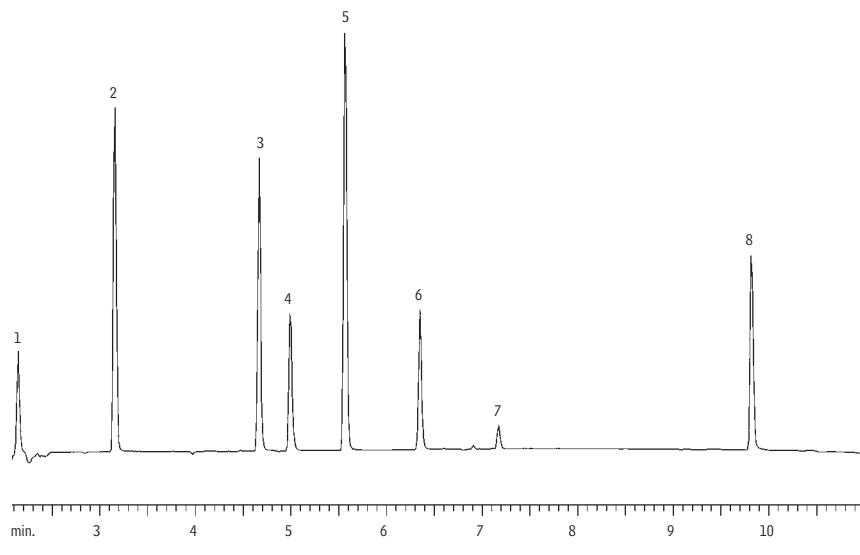
Permission to publish this chromatogram granted by Radian Corporation.

**EDB / DBCP**  
**US EPA Method 504.1**  
**Rtx®-CLPesticides & Rtx®-CLPesticides2**

**Rtx®-CLPesticides**



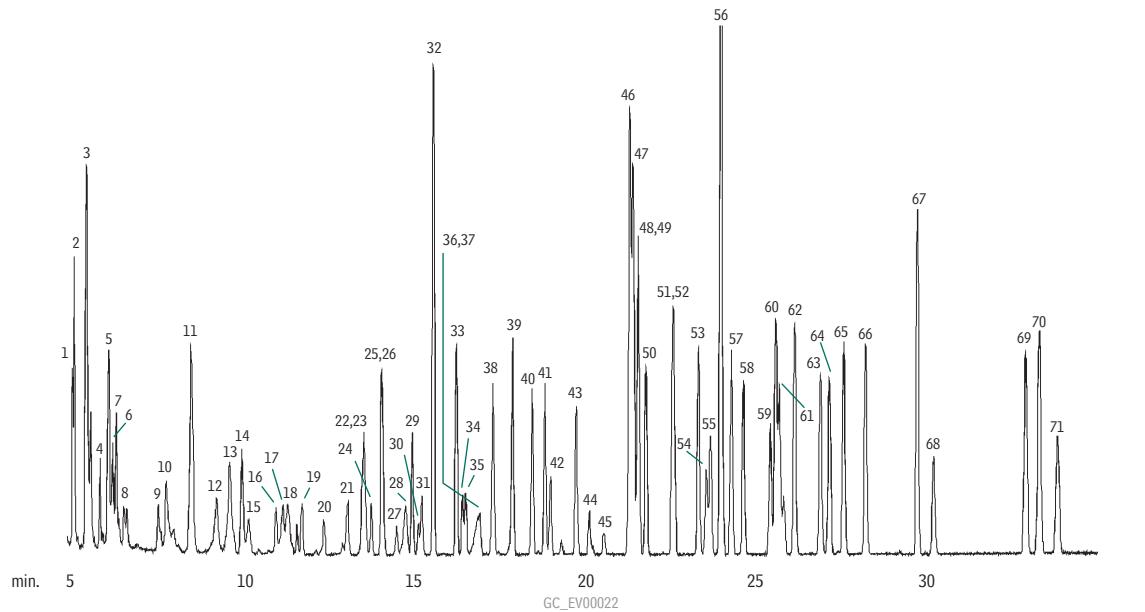
**Rtx®-CLPesticides2**



1. chloroform  
2. bromodichloromethane  
3. chlorodibromomethane  
4. 1,2-dibromoethane (EDB)  
5. 1,1,1,2-tetrachloroethane  
6. bromoform  
7. 1,2,3-trichloropropane  
8. 1,2-dibromo-3-chloropropane (DBCP)

30m, 0.32mm ID, 0.50 $\mu$ m Rtx®-CLPesticides (cat.# 11139) and  
30m, 0.32mm ID, 0.25 $\mu$ m Rtx®-CLPesticides2 (cat.# 11324),  
0.32mm ID guard column (cat.# 10044), universal angled  
"Y" Press-Tight® connector (cat.# 20403).  
Direct injection using a Uniliner® liner (cat.# 20335).  
On-column conc.: 10pg each compound.  
Oven temp.: 35°C (hold 2 min.) to 300°C @ 12°C/min.  
Inj./det. temp.: 200°C/300°C  
Carrier gas: helium, 12psi constant pressure.

**Air Toxins**  
**Rtx®-502.2**



- |                              |                                      |                                  |                               |
|------------------------------|--------------------------------------|----------------------------------|-------------------------------|
| 1. chlorodifluoromethane     | 19. <i>trans</i> -1,2-dichloroethene | 37. bromodichloromethane         | 55. 1,1,1,2-tetrachloroethane |
| 2. dichlorodifluoromethane   | 20. 1,1-dichloroethane               | 38. 4-methyl-2-pentanone         | 56. 4-bromofluoromethane      |
| 3. dichlorotetrafluoroethane | 21. methyl ethyl ketone              | 39. octane                       | 57. <i>n</i> -propylbenzene   |
| 4. chloromethane             | 22. <i>cis</i> -1,2-dichloroethene   | 40. toluene                      | 58. 1,3,5-trimethylbenzene    |
| 5. butane                    | 23. methacrylonitrile                | 41. 2-hexanone                   | 59. $\alpha$ -methylstyrene   |
| 6. vinyl chloride            | 24. chloroform                       | 42. 1,1,2-trichloroethane        | 60. <i>tert</i> -butylbenzene |
| 7. 1,3-butadiene             | 25. bromochloromethane               | 43. tetrahydrofuran              | 61. 1,2,4-trimethylbenzene    |
| 8. acetaldehyde              | 26. tetrahydropuran                  | 44. dibromochloromethane         | 62. <i>sec</i> -butylbenzene  |
| 9. bromomethane              | 27. 1,1,1-trichloroethane            | 45. 1,2-dibromoethane            | 63. 1,3-dichlorobenzene       |
| 10. chloroethane             | 28. <i>n</i> -butanol                | 46. chlorobenzene-d <sub>5</sub> | 64. 1,4-dichlorobenzene       |
| 11. trichlorofluoromethane   | 29. heptane                          | 47. chlorobenzene                | 65. butylbenzene              |
| 12. isopropanol              | 30. 1,2-dichloroethane               | 48. <i>m</i> -xylene             | 66. 1,2-dichlorobenzene       |
| 13. acetone                  | 31. benzene                          | 49. <i>p</i> -xylene             | 67. dodecane                  |
| 14. 1,1-dichloroethene       | 32. 1,4-difluorobenzene              | 50. 2-heptanone                  | 68. dibromochloropropane      |
| 15. acetonitrile             | 33. trichloroethene                  | 51. styrene                      | 69. 1,2,4-trichlorobenzene    |
| 16. dichloromethane          | 34. ethyl methacrylate               | 52. $\alpha$ -xylene             | 70. hexachlorobutadiene       |
| 17. acrylonitrile            | 35. 1,2-dichloropropane              | 53. isopropylbenzene             | 71. naphthalene               |
| 18. 1-propanol               | 36. 1,4-dioxane                      | 54. bromoform                    |                               |

60m, 0.32mm ID, 1.8 $\mu$ m Rtx®-502.2 (cat.# 10920)  
500mL of 10ppbv standard. Concentrated on an AEROCAN® 6000 using a glass bead trap at 165°C  
then desorbed at 200°C for 4 min. @ 1mL/min. Cryofocused @ -175°C then desorbed @ 150°C.

Oven temp.: 35°C (hold 6 min.) to 120°C @ 15°C/min., then to 200°C  
@ 5°C/min., then to 220°C @ 25°C/min. (hold 10 min.).  
Det. & det. temp.: Agilent-5971A GC/MS, 280°C  
Carrier gas: helium @ 1mL/min.  
Linear velocity: 20cm/sec.  
Scan range: 28-260 AMU  
Solvent delay: 4 min.

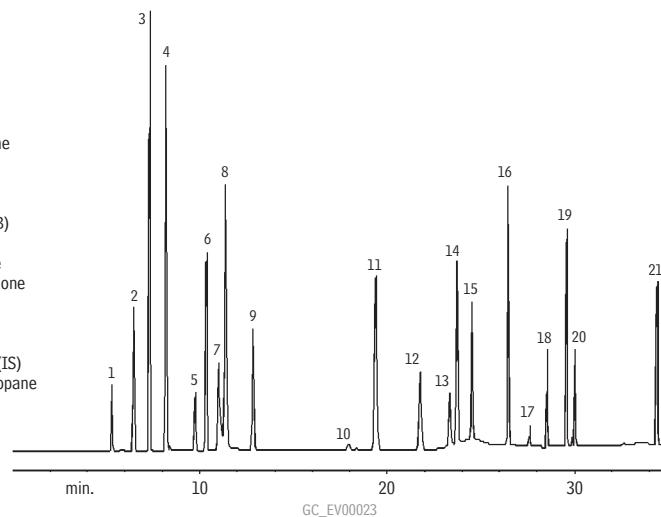
Permission to publish this chromatogram granted by Tekmar Company.

## **Chlorinated Disinfection Byproducts**

### **US EPA Method 551.1**

#### **Rtx®-5**

1. chloroform
2. 1,1,1-trichloroethane
3. carbon tetrachloride
4. trichloroacetonitrile
5. trichloroethylene
6. bromodichloromethane
7. chloral hydrate
8. dichloroacetonitrile
9. 1,1-dichloro-2-propanone
10. 1,1,2-trichloroethane
11. chloropicrin
12. dibromochloromethane
13. 1,2-dibromoethane (EDB)
14. tetrachloroethylene
15. bromochloroacetonitrile
16. 1,1,1-trichloro-2-propanone
17. bromoform
18. dibromoacetonitrile
19. 1,2,3-trichloropropane
20. 4-bromofluorobenzene (IS)
21. 1,2-dibromo-3-chloropropane (DBCP)



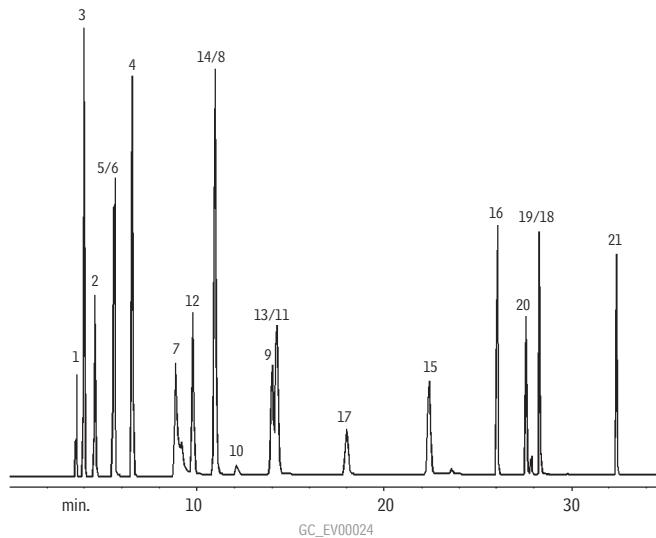
30m, 0.25mm ID, 1.0 $\mu$ m Rtx®-5 (cat.# 10253)  
1.0 $\mu$ L split injection. 1ng on-column concentration.  
Oven temp.: 35°C (hold 22 min.) to 200°C @ 10°C/min.  
Inj./det. temp.: 200°C/290°C  
Carrier gas: helium  
Linear velocity: 30cm/sec. @ 50°C  
ECD sensitivity: 20kHz full scale  
Split ratio: 10:1

## **Chlorinated Disinfection Byproducts**

### **US EPA Method 551.1**

#### **Rtx®-200**

- 1. chloroform
- 2. 1,1,1-trichloroethane
- 3. carbon tetrachloride
- 4. trichloroacetonitrile
- 5. trichloroethylene
- 6. bromodichloromethane
- 7. chloral hydrate
- 8. dichloroacetonitrile
- 9. 1,1-dichloro-2-propanone
- 10. 1,1,2-trichloroethane
- 11. chloropicrin
- 12. dibromochloromethane
- 13. 1,2-dibromoethane (EDB)
- 14. tetrachloroethylene
- 15. bromochloroacetonitrile
- 16. 1,1,1-trichloro-2-propanone
- 17. bromoform
- 18. dibromoacetonitrile
- 19. 1,2,3-trichloropropane
- 20. 4-bromofluorobenzene (IS)
- 21. 1,2-dibromo-3-chloropropane (DBCP)



GC\_EV00024

30m, 0.25mm ID, 1.0 $\mu$ m Rtx®-200 (cat.# 15053)

1.0 $\mu$ L split injection. 1ng on-column concentration.

Oven temp.: 35°C (hold 22 min.) to 200°C @ 10°C/min.

Inj./det. temp.: 200°C/290°C

Carrier gas: helium

Linear velocity: 30cm/sec. @ 50°C

ECD sensitivity: 20kHz full scale

Split ratio: 10:1

# Haloacetic Acids

## US EPA Method 552.2

### Rtx®-5

30m, 0.25mm ID, 1.0 $\mu$ m Rtx®-5 (cat.# 10253)

1.0 $\mu$ L split injection, 1ng on-column concentration.

Oven temp.: 50°C (hold 10 min.) to 225°C @ 8°C/min.

Inj./det. temp.: 200°C/290°C

Carrier gas: helium

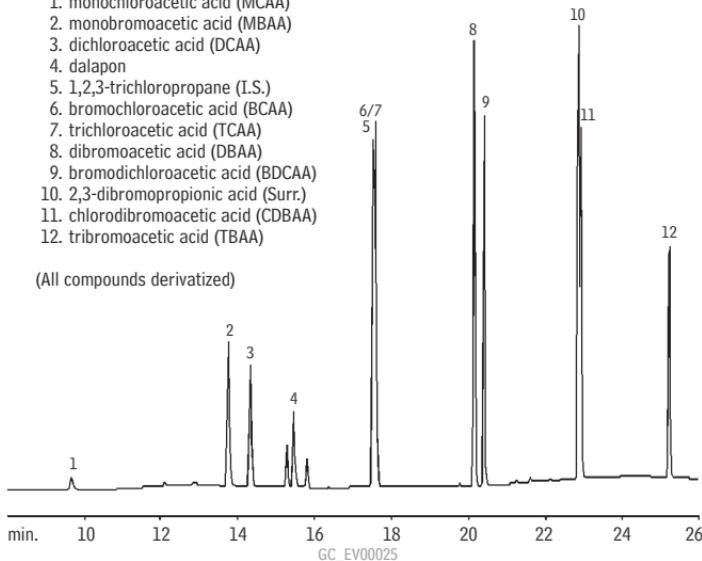
Linear velocity: 30cm/sec. @ 50°C

ECD sensitivity: 20kHz full scale

Split ratio: 10:1

1. monochloroacetic acid (MCAA)
2. monobromoacetic acid (MBAA)
3. dichloroacetic acid (DCAA)
4. dalapon
5. 1,2,3-trichloropropane (I.S.)
6. bromochloroacetic acid (BCAA)
7. trichloroacetic acid (TCAA)
8. dibromoacetic acid (DBAA)
9. bromodichloroacetic acid (BDCAA)
10. 2,3-dibromopropionic acid (Surr.)
11. chlorodibromoacetic acid (CDBAA)
12. tribromoacetic acid (TBAA)

(All compounds derivatized)



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# Haloacetic Acids

## US EPA Method 552.2

### Rtx®-200

30m, 0.25mm ID, 1.0 $\mu$ m Rtx®-200 (cat.# 15053)

1.0 $\mu$ L split injection. 1ng on-column concentration.

Oven temp.: 50°C (hold 10 min.) to 225°C @ 8°C/min.

Inj./det. temp.: 200°C/290°C

Carrier gas: helium

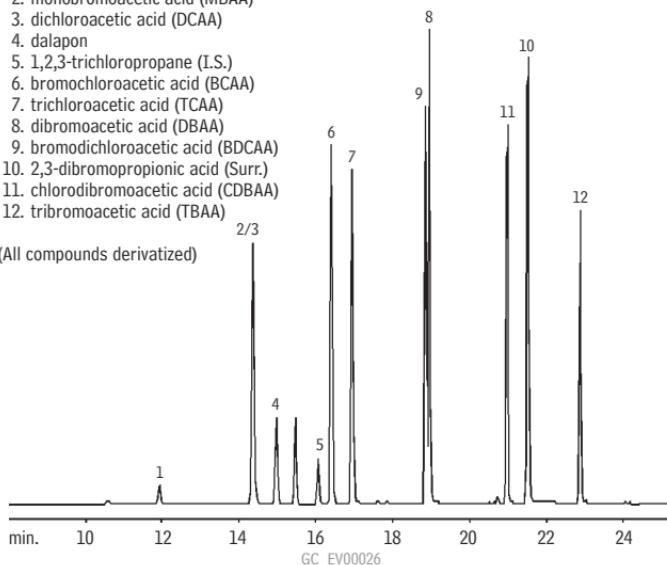
Linear velocity: 30cm/sec. @ 50°C

ECD sensitivity: 20kHz full scale

Split ratio: 10:1

1. monochloroacetic acid (MCAA)
2. monobromoacetic acid (MBAA)
3. dichloroacetic acid (DCAA)
4. dalapon
5. 1,2,3-trichloropropane (I.S.)
6. bromochloroacetic acid (BCAA)
7. trichloroacetic acid (TCAA)
8. dibromoacetic acid (DBAA)
9. bromodichloroacetic acid (BDCAA)
10. 2,3-dibromopropionic acid (Surri)
11. chlorodibromoacetic acid (CDBAA)
12. tribromoacetic acid (TBAA)

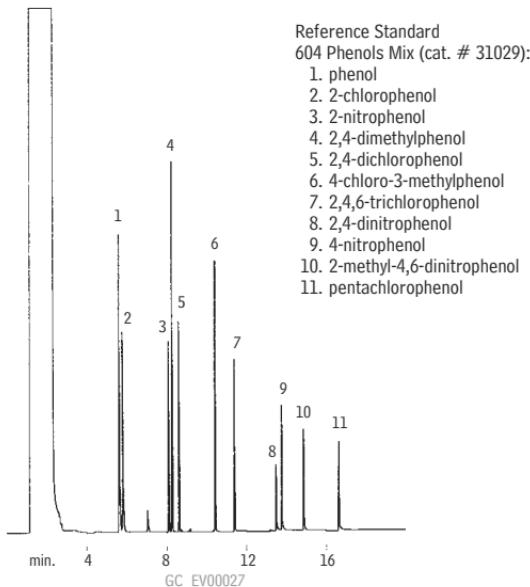
(All compounds derivatized)



# Phenols

## US EPA Method 604

### MXT®-5



30m, 0.28mm ID, 0.25 $\mu$ m MXT®-5 (cat.# 70224)  
1.0 $\mu$ L splitless injection of phenols.  
Concentration 25ng/ $\mu$ L per component.

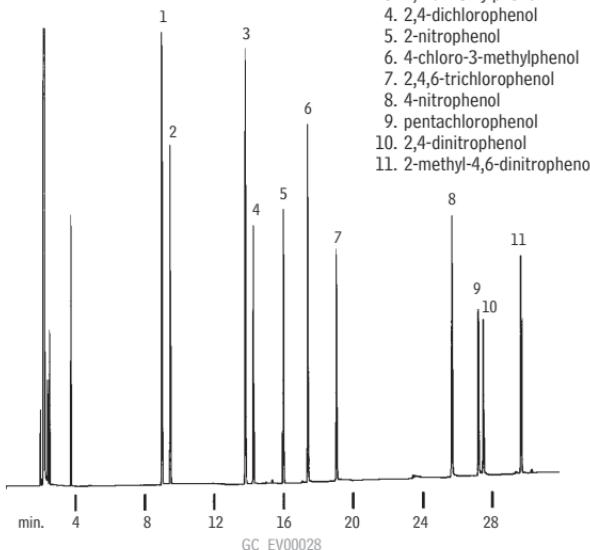
Oven temp.: 40°C to 250°C @ 10°C/min.  
Inj. / det. temp.: 280°C / 300°C  
Carrier gas: hydrogen  
Linear velocity: 50cm/sec. set @ 40°C  
FID sensitivity: 2.56 x 10<sup>-10</sup> AFS

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# Phenols

## US EPA Method 604

### Rtx®-200



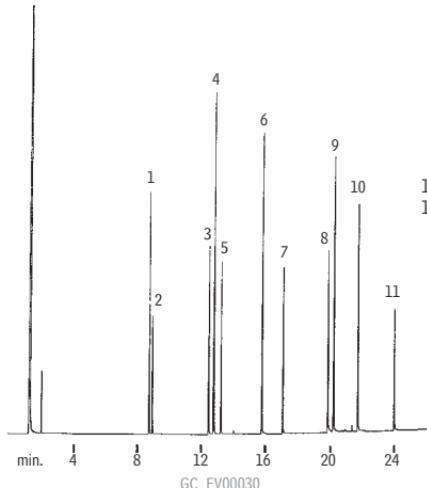
30m, 0.32mm ID, 0.25 $\mu$ m Rtx®-200 (cat.# 15024)  
1.0 $\mu$ L split injection of a 200ng standard.

Oven temp.: 50°C (hold 4 min.) to 250°C @ 6°C/min.  
Inj. & det. temp.: 250°C  
Carrier gas: helium  
Linear velocity: 20cm/sec.  
FID sensitivity: 4 x 10<sup>-11</sup> AFS  
Split ratio: 40:1

# Phenols

## US EPA Method 604

### Rtx®-5



Reference Standard  
604 Phenols Mix (cat. # 31029):

1. phenol
2. 2-chlorophenol
3. 2-nitrophenol
4. 2,4-dimethylphenol
5. 2,4-dichlorophenol
6. 4-chloro-3-methylphenol
7. 2,4,6-trichlorophenol
8. 2,4-dinitrophenol
9. 4-nitrophenol
10. 2-methyl-4,6-dinitrophenol
11. pentachlorophenol

30m, 0.25mm ID, 0.25 $\mu$ m Rtx®-5 (cat.# 10223)

1.0 $\mu$ L split injection of phenols.

Concentration 3-5ng/ $\mu$ L per component.

Oven temp.: 50°C (hold 4 min.) to 250°C  
@ 8°C/min.

Inj. & det. temp.: 250°C

Carrier gas: hydrogen

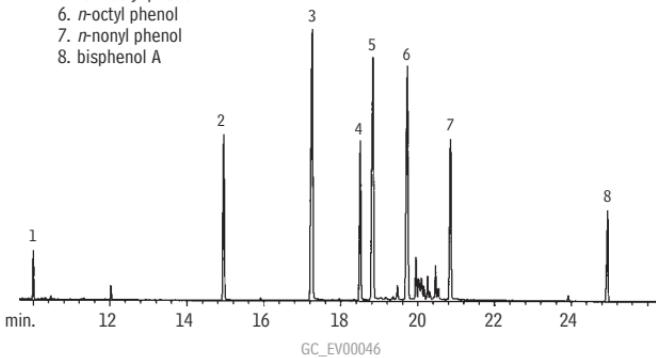
Linear velocity: 40cm/sec. set @ 110°C

FID sensitivity: 8 x 10<sup>-11</sup> AFS

Split ratio: 40:1

## Endocrine Disruptors: Alkyl Phenols Rtx®-5MS

1. *tert*-butyl phenol
2. *n*-pentyl phenol
3. *n*-hexyl phenol
4. *n*-heptyl phenol
5. *tert*-octyl phenol
6. *n*-octyl phenol
7. *n*-nonyl phenol
8. bisphenol A



30m, 0.25mm ID, 0.25 $\mu$ m Rtx®-5MS (cat.# 12623).

Conc.: 5–10ng on-column

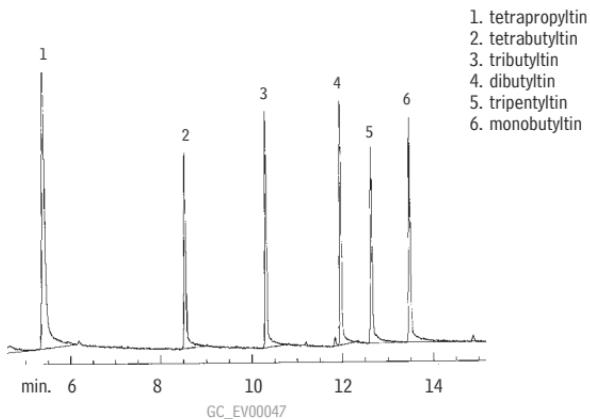
Inj.: splitless, purge on @ 1 min.

Oven temp.: 35°C (hold 1 min.) to 300°C @ 10°C/min. (hold 15 min.)

Inj./det. temp.: 275°C/310°C

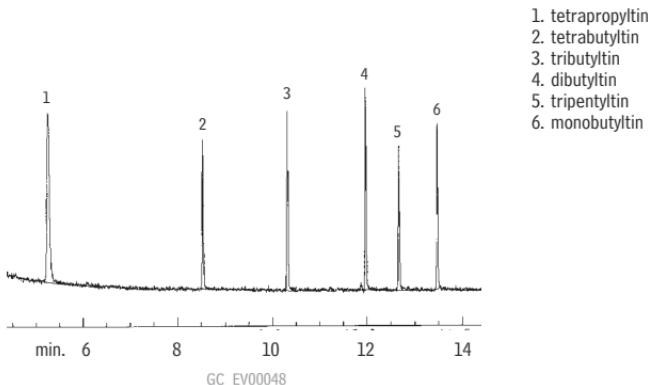
Carrier gas: helium

## **Endocrine Disruptors: Butyl Tins (hexyl derivatives) Rtx®-5**



30m, 0.32mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10239)  
500pg on-column direct injection  
Oven temp.: 100°C (hold 1 min.) to 285°C  
@ 10°C/min.  
Inj./det. temp.: 250°C  
Carrier gas: helium  
Linear velocity: 45cm/sec.  
Detector: FPD with 610nm filter

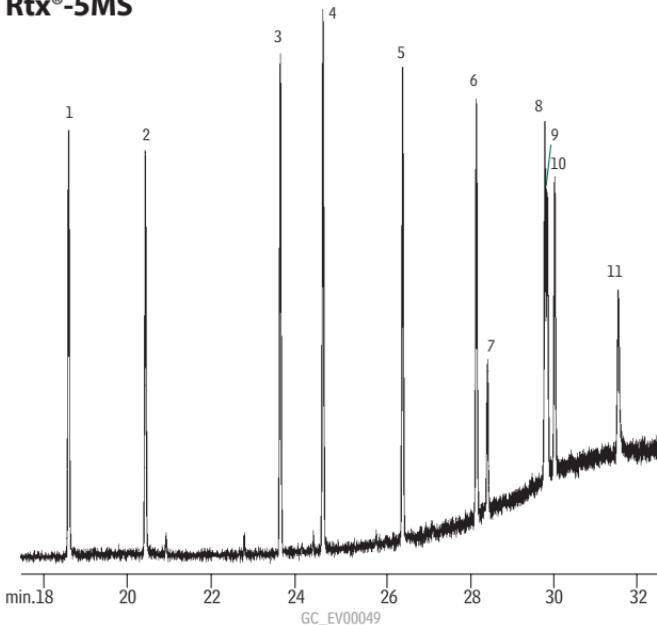
# **Endocrine Disruptors: Butyl Tins (hexyl derivatives) Rtx®-35**



30m, 0.32mm ID, 0.50 $\mu$ m Rtx®-35 (cat.# 10439)  
500pg on-column direct injection  
Oven temp.: 100°C (hold 1 min.) to 285°C  
@ 10°C/min.  
Inj./det. temp.: 250°C  
Carrier gas: helium  
Linear velocity: 45cm/sec.  
Detector: FPD with 610nm filter

## Endocrine Disruptors: Phthalate Esters

### Rtx®-5MS



- |                       |                           |
|-----------------------|---------------------------|
| 1. dimethyl phthalate | 7. benzylethyl phthalate  |
| 2. diethyl phthalate  | 8. diheptyl phthalate     |
| 3. isobutyl phthalate | 9. 2-ethylhexyl phthalate |
| 4. dibutyl phthalate  | 10. cyclohexyl phthalate  |
| 5. dipentyl phthalate | 11. dioctyl phthalate     |
| 6. dihexyl phthalate  |                           |

30m, 0.25mm ID, 0.50 $\mu$ m Rtx®-5MS (cat #12638).

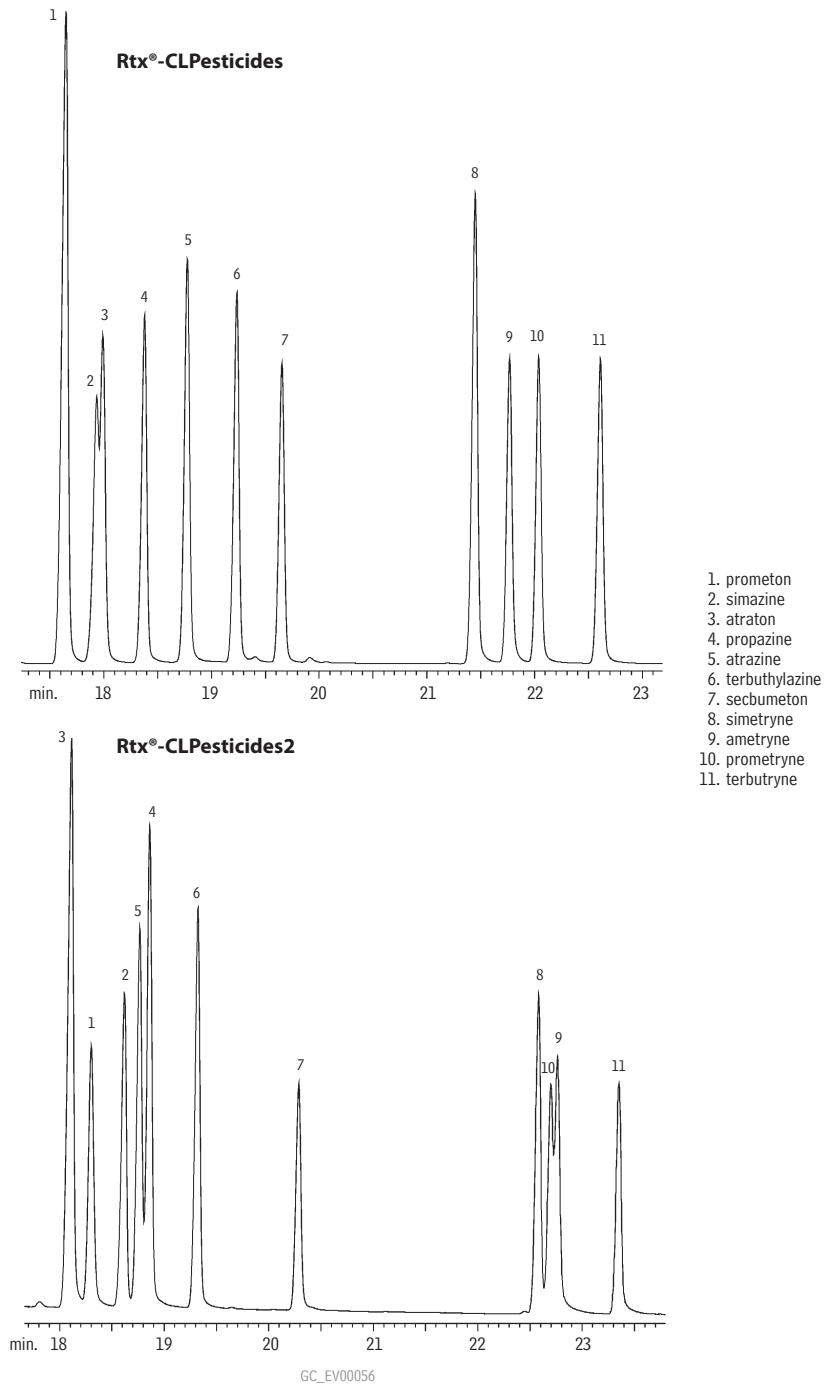
100pg on-column injection MS-SIM.

Oven temp.: 35°C (hold 1 min.) to 285°C @ 10°C/min.

Pressure: 7.5psi constant pressure

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**Nitrogen/Phosphorus Pesticides & Herbicides**  
**US EPA Method 619**  
**Rtx®-CLPesticides & Rtx®-CLPesticides2 (dual column analysis)**



Columns: Rtx®-CLPesticides, 30m, 0.32mm ID, 0.50 $\mu$ m (cat.# 11139) and  
 Rtx®-CLPesticides2, 30m, 0.32mm ID, 0.25 $\mu$ m (cat.# 11324)  
 with a 5m, 0.32mm ID guard column (cat.# 10044) and a "Y" Press-Tight® connector (cat.# 20403)  
 Inj.: Direct injection using a Uniliner® inlet liner (cat.# 20964) and adaptor for an Agilent 5890 (cat.# 21303)  
 Conc.: On-column, 50pg each compound  
 Oven temp.: 100°C (hold 0 min.) to 250°C @ 4°C/min. (hold 5 min.)  
 Inj./det. temp.: 250°C/275°C  
 Carrier gas: hydrogen, 9.65psi constant pressure  
 GC: Agilent 6890 with purged packed injection port  
 Det: NPD

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# Triazine Herbicides

## US EPA Method 619

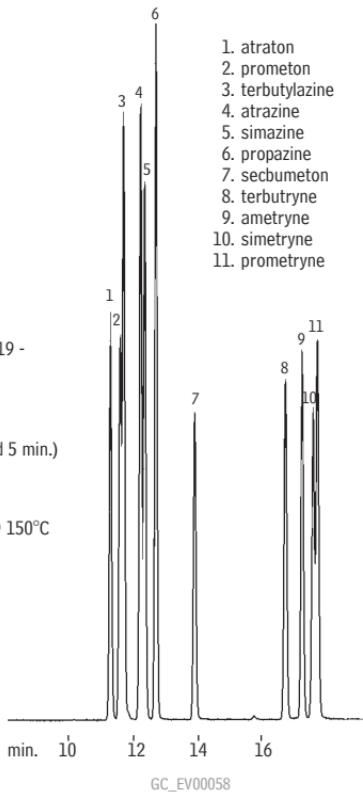
### Rtx®-50

#### Rtx®-50

30m, 0.53mm ID, 0.50µm  
(cat.# 10540)

0.5µL direct injection of EPA Method 619 -  
triazine herbicides.  
On-column concentration: 50ng

Oven temp.: 150°C to 250°C  
(@ 4°C/min. (hold 5 min.)  
Inj. / det. temp.: 250°C /275°C  
Detector: TSD  
Carrier gas: helium  
Linear velocity: 40cm/sec. set @ 150°C



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# Triazine Herbicides

## US EPA Method 619

### Rtx®-200

#### Rtx®-200

30m, 0.53mm ID, 0.50µm  
(cat.# 15040)

0.5µL direct injection of EPA Method 619 - triazine herbicides.

On-column concentration: 50ng

Oven temp.: 150°C to 250°C  
@ 4°C/min. (hold 5 min.)

Inj. / det. temp.: 250°C / 275°C

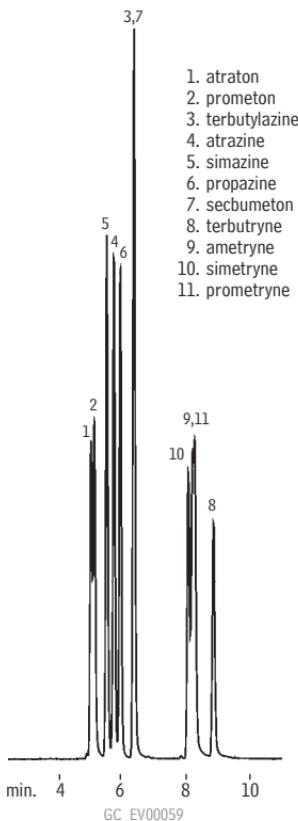
Detector:

TSD

Carrier gas:

helium

Linear velocity: 40cm/sec. set @ 150°C



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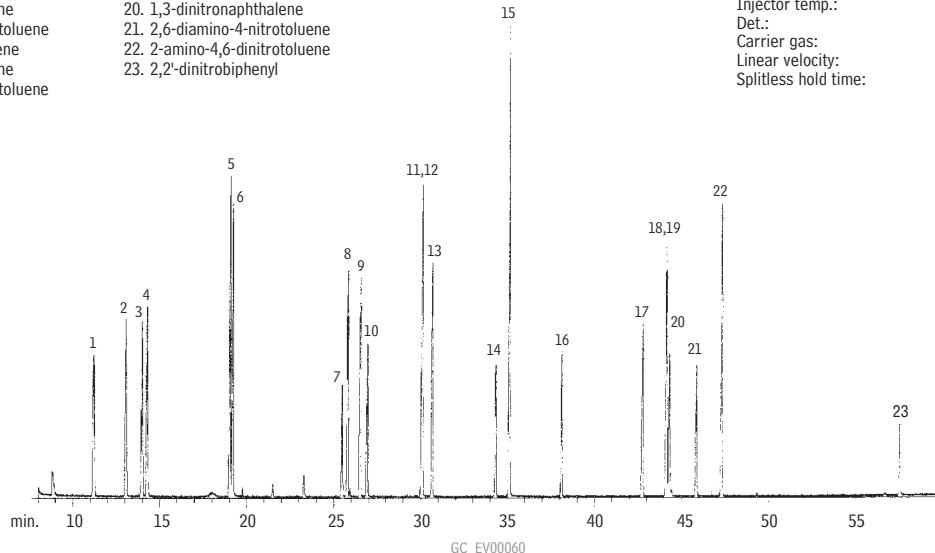
# Explosives

## Rtx®-200

- |                            |                                |
|----------------------------|--------------------------------|
| 1. 2-nitrotoluene          | 13. 2,3-dinitrotoluene         |
| 2. 3-nitrotoluene          | 14. 3,4-dinitrotoluene         |
| 3. 4-nitrotoluene          | 15. 3-nitrobiphenyl            |
| 4. 2,3-diaminotoluene      | 16. 2,4,6-trinitrotoluene      |
| 5. 2,6-diaminotoluene      | 17. 2,4,5-trinitrotoluene      |
| 6. 2,4-diaminotoluene      | 18. 4-amino-2,6-dinitrotoluene |
| 7. 1,4-dinitrobenzene      | 19. 2,3,4-trinitrotoluene      |
| 8. 2,6-dinitrotoluene      | 20. 1,3-dinitronaphthalene     |
| 9. 2-amino-6-nitrotoluene  | 21. 2,6-diamino-4-nitrotoluene |
| 10. 1,3-dinitrobenzene     | 22. 2-amino-4,6-dinitrotoluene |
| 11. 2,4-dinitrotoluene     | 23. 2,2'-dinitrobiphenyl       |
| 12. 2-amino-4-nitrotoluene |                                |

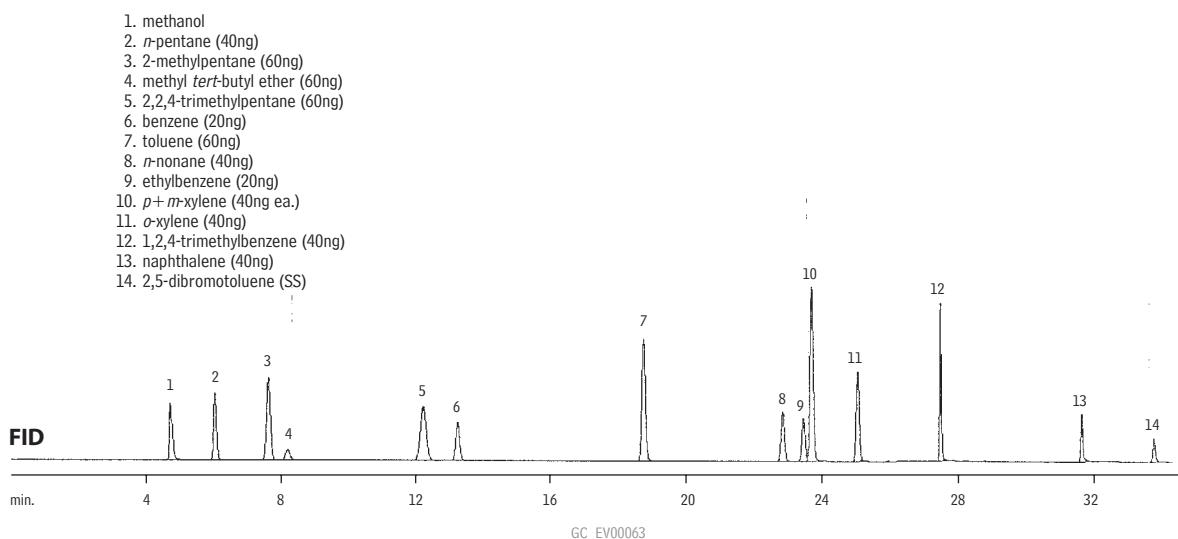
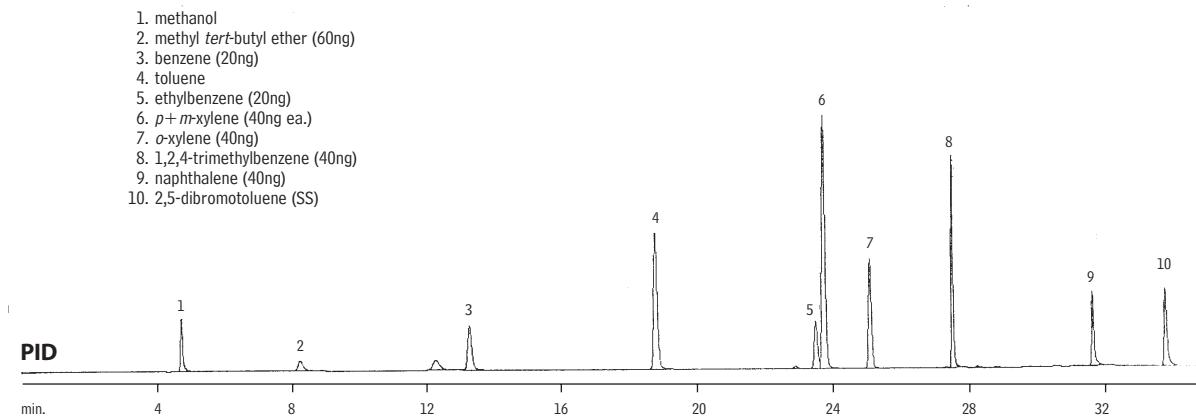
30m, 0.25mm ID, 0.25 $\mu$ m Rtx®-200 (cat.# 15023)  
1.0 $\mu$ L splitless injection of an explosives sample.  
Concentration 20ng/ $\mu$ L.

Oven temp.: 80°C (hold 2 min.) to 260°C @ 3°C/min. (hold 2 min.)  
Injector temp.: 280°C  
Det.: MS, 300°C  
Carrier gas: helium  
Linear velocity: 20cm/sec. set @ 80°C  
Splitless hold time: 0.6 min.



**Volatile Petroleum Hydrocarbons (VPH)**  
**Massachusetts Department of Environmental Protection**  
**Rtx®-502.2**

**For VPH analysis on an Rtx®-502.2 column, use PID for aromatic compounds and FID for aliphatic compounds.**



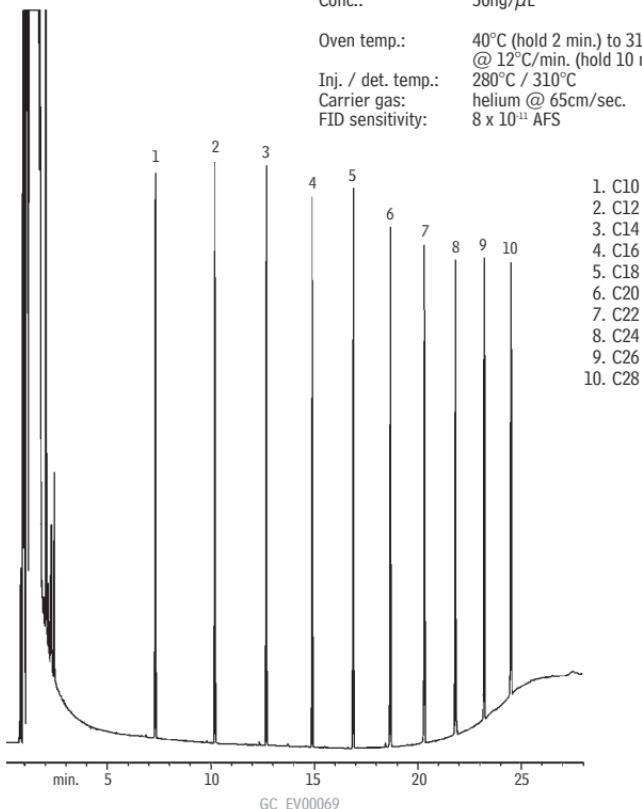
Column: 105m, 0.53mm ID, 3.0 $\mu$ m Rtx®-502.2 (cat.# 10910).  
 Concentration: on-column at levels listed  
 Oven temp: 45°C to 90°C @ 3°C/min., to 140° @ 5°C/min.,  
 to 230°C @ 45°C/min. (hold 8 min.)  
 Carrier gas: helium @ 15mL/min. Tekmar Model LSC 2000  
 Trap: BTEX  
 Purge: helium @ 40mL/min. for 11 min.  
 Dry purge: 2 min.  
 Desorb preheat: 245°C  
 Desorb: 2 min. @ 250°C  
 Bake: 6 min. @ 260°C

Chromatograms courtesy of Severn Trent Laboratories, Burlington, VT.

## DRO Mix Rtx<sup>®</sup>-5

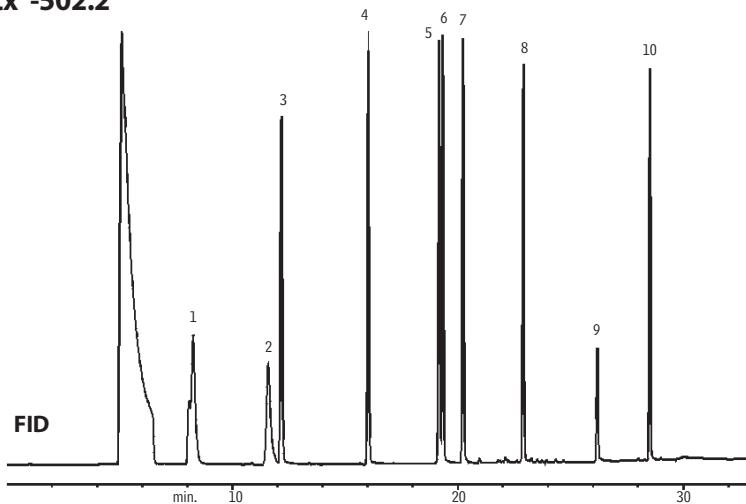
30m, 0.53mm ID, 1.0 $\mu$ m Rtx<sup>®</sup>-5 (cat.# 10255)  
Direct injection of DRO Mix (cat.# 31064)  
Conc.: 50ng/ $\mu$ L

Oven temp.: 40°C (hold 2 min.) to 310°C  
@ 12°C/min. (hold 10 min.)  
Inj. / det. temp.: 280°C / 310°C  
Carrier gas: helium @ 65cm/sec.  
FID sensitivity: 8 x 10<sup>-11</sup> AFS



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## Wisconsin GRO Mix, plus C12 Rtx®-502.2



105m, 0.53mm ID, 3.0 $\mu$ m Rtx®-502.2 (cat.# 10910)  
GRO + C12 standard.

Conc.: 200ppb each in 5mL of H<sub>2</sub>O.

Oven temp.: 40°C (hold 1 min.) to 100°C @ 5°C/min. to  
240°C @ 8°C/min. (hold 8 min.)

Inj. / det. temp.: 200°C / 250°C

Carrier gas: helium

Flow rate: 10mL/min.

Trap: Tenax, silica gel, charcoal

Purge: 12 min. @ 40mL/min.

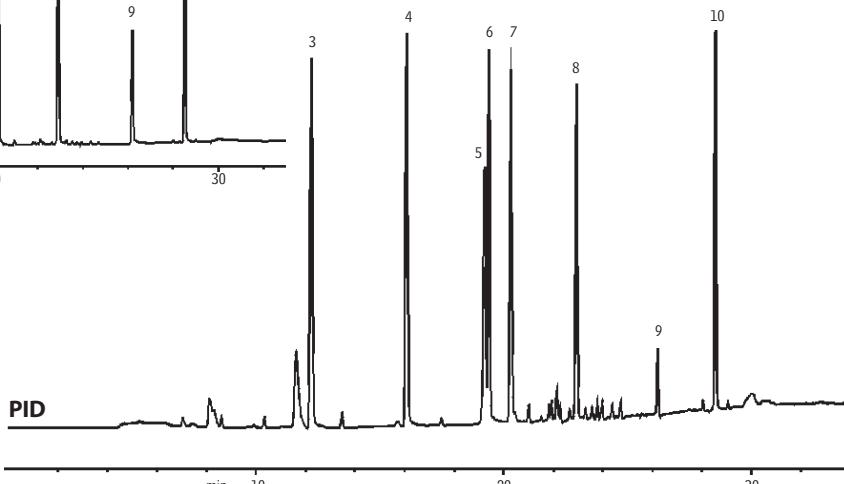
Desorb preheat: 175°C

Desorb temp.: 180°C

Desorb time: 2 min.

Desorb flow: 10mL/min.

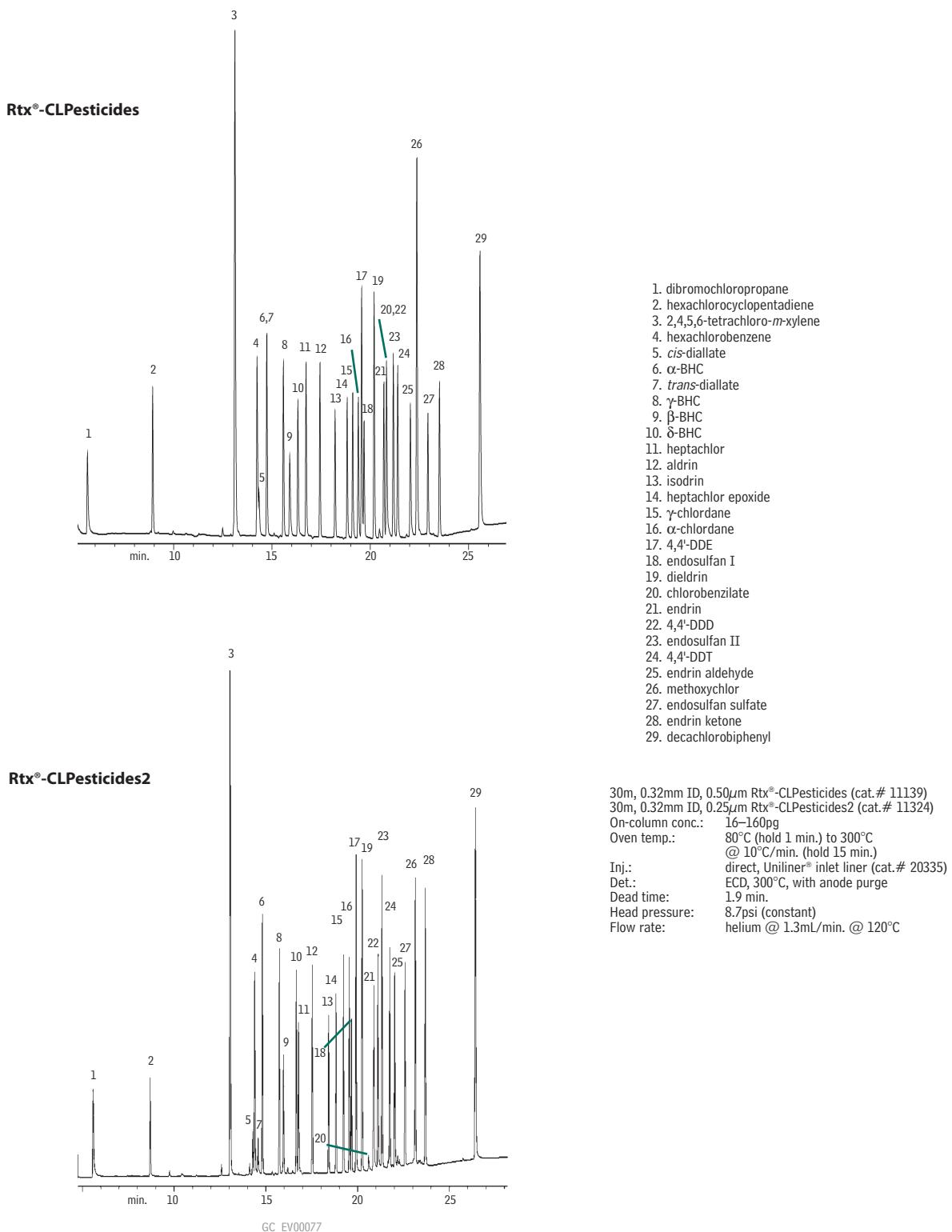
FID sensitivity: 16 x 10<sup>-11</sup> AFS



GC\_EV00071

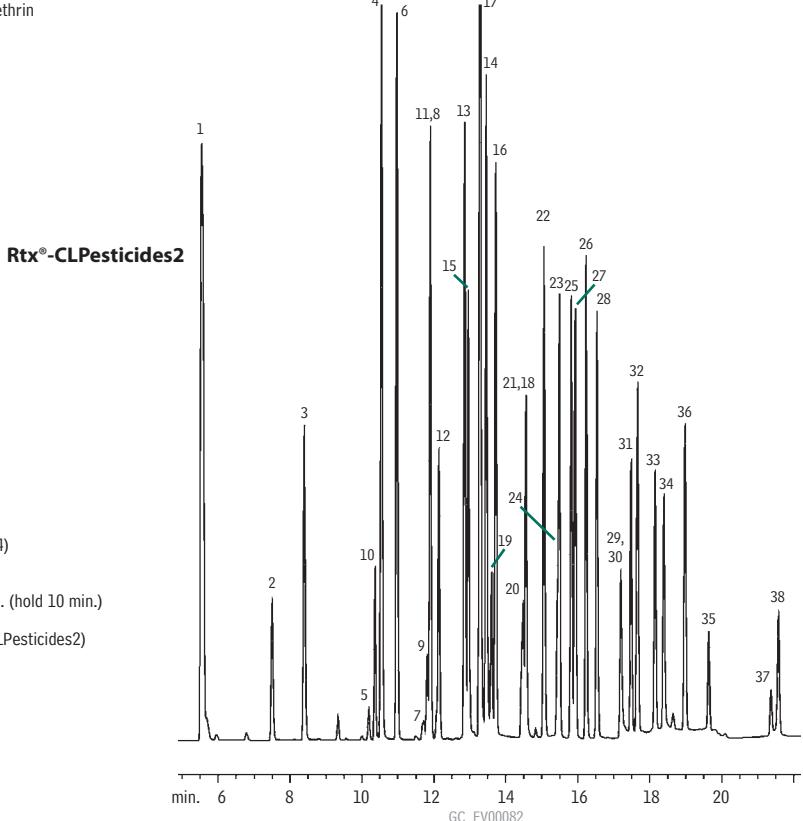
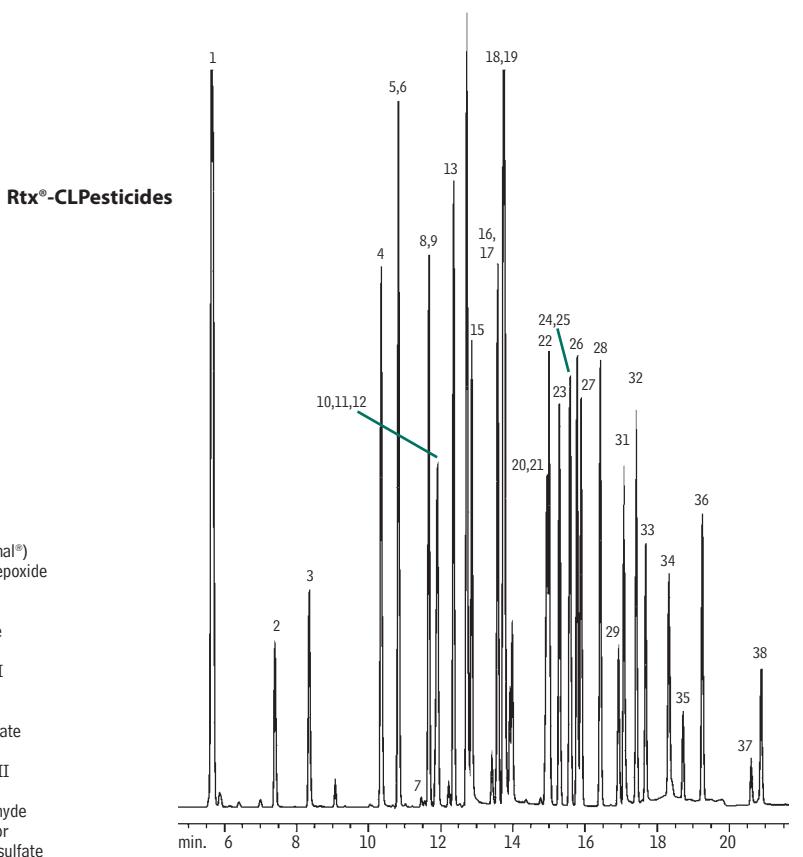
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**Organochlorine Pesticides**  
**US EPA Method 8081A**  
**Rtx®-CLPesticides & Rtx®-CLPesticides2**



**Organochlorine Pesticides**  
**US EPA Method 508**  
**Rtx®-CLPesticides & Rtx®-CLPesticides2**

- |                             |                              |
|-----------------------------|------------------------------|
| 1. hexachloropentadiene     | 21. DCPA (Dacthal®)          |
| 2. etridiazole              | 22. heptachlor epoxide       |
| 3. chlorneb                 | 23. $\gamma$ -chlordane      |
| 4. hexachlorobenzene        | 24. cyanazine                |
| 5. propachlor               | 25. $\alpha$ -chlordane      |
| 6. $\alpha$ -BHC            | 26. 4,4'-DDE                 |
| 7. simazine                 | 27. endosulfan I             |
| 8. $\gamma$ -BHC            | 28. dieldrin                 |
| 9. atrazine                 | 29. endrin                   |
| 10. trifluralin             | 30. chlorobenzilate          |
| 11. pentachloronitrobenzene | 31. 4,4'-DDD                 |
| 12. $\beta$ -BHC            | 32. endosulfan II            |
| 13. $\delta$ -BHC           | 33. 4,4'-DDT                 |
| 14. metribuzin              | 34. endrin aldehyde          |
| 15. heptachlor              | 35. methoxychlor             |
| 16. aldrin                  | 36. endosulfan sulfate       |
| 17. chlorothalonil          | 37. <i>cis</i> -permethrin   |
| 18. 4,4'-dibromobiphenyl    | 38. <i>trans</i> -permethrin |
| 19. alachlor                |                              |
| 20. metalachlor             |                              |

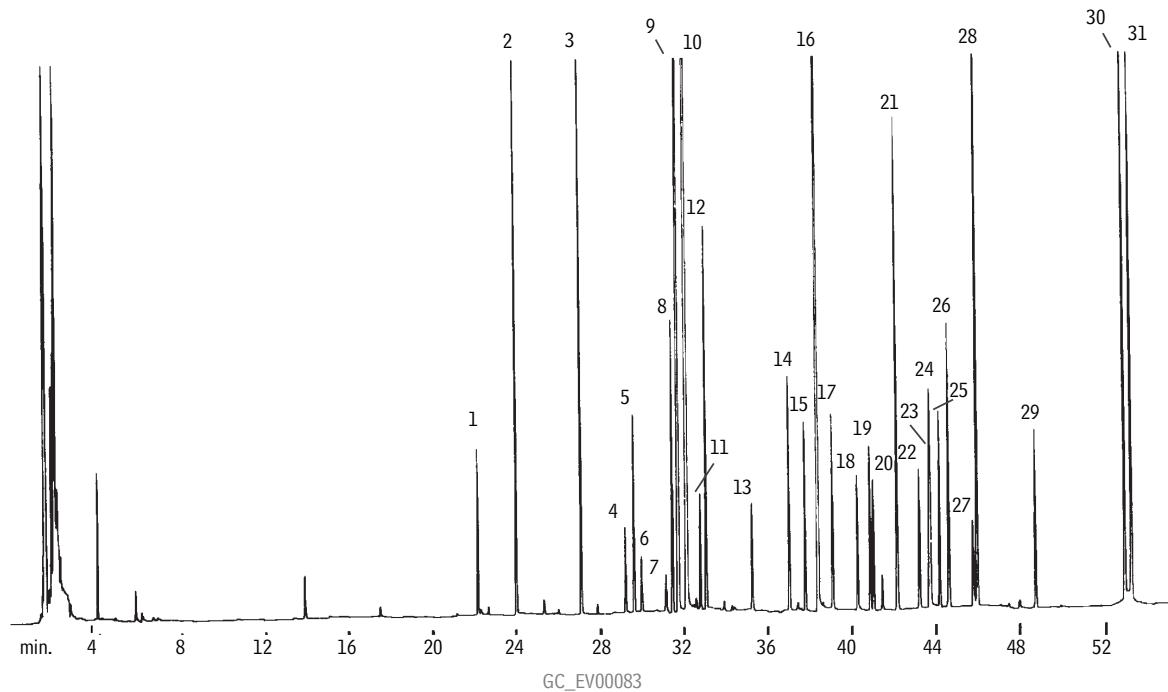


30m, 0.32mm ID, 0.50 $\mu$ m Rtx®-CLPesticides (cat.# 11139)  
 30m, 0.32mm ID, 0.25 $\mu$ m Rtx®-CLPesticides2 (cat.# 11324)  
 EPA 508.1 list w/ added compounds.

Oven temp.: 120°C (hold 1 min.) to 300°C @ 9°C/min. (hold 10 min.)  
 Inj.: direct, Uniliner® inlet liner, 200°C  
 Dead time: 1.797 (Rtx®-CLPesticides), 1.663 (Rtx®-CLPesticides2)  
 Head pressure: 12 psi (constant)  
 Carrier gas: helium  
 Flow: 2.1mL/min. @ 120°C

**Organochlorine Pesticides**  
**US EPA Method 508**  
**Rtx®-5**

Peak	Conc. ( $\mu\text{g}/\mu\text{L}$ )
1. etridiazole	50
2. chlорneb	1000
3. propachlor	1000
4. trifluralin	50
5. $\alpha$ -BHC	20
6. hexachlorobenzene	10
7. $\gamma$ -BHC	30
8. $\beta$ -BHC	20
9. PCNB (impurity)	100
10. PCNB (IS)	100
11. $\delta$ -BHC	20
12. chlorothalonil	50
13. heptachlor	20
14. aldrin	30
15. DCPA	50
16. DCB (SS)	5000
17. heptachlor epoxide	30
18. $\gamma$ -chlordane	30
19. endosulfan I	30
20. $\alpha$ -chlordane	30
21. dieldrin	40
22. endrin	30
23. endosulfan II	30
24. chlorobenzilate	1000
25. 4,4'-DDD	50
26. endrin aldehyde	50
27. endosulfan sulfate	30
28. 4,4'-DDT	120
29. methoxychlor	100
30. <i>cis</i> -permethrin	1000
31. <i>trans</i> -permethrin	1000

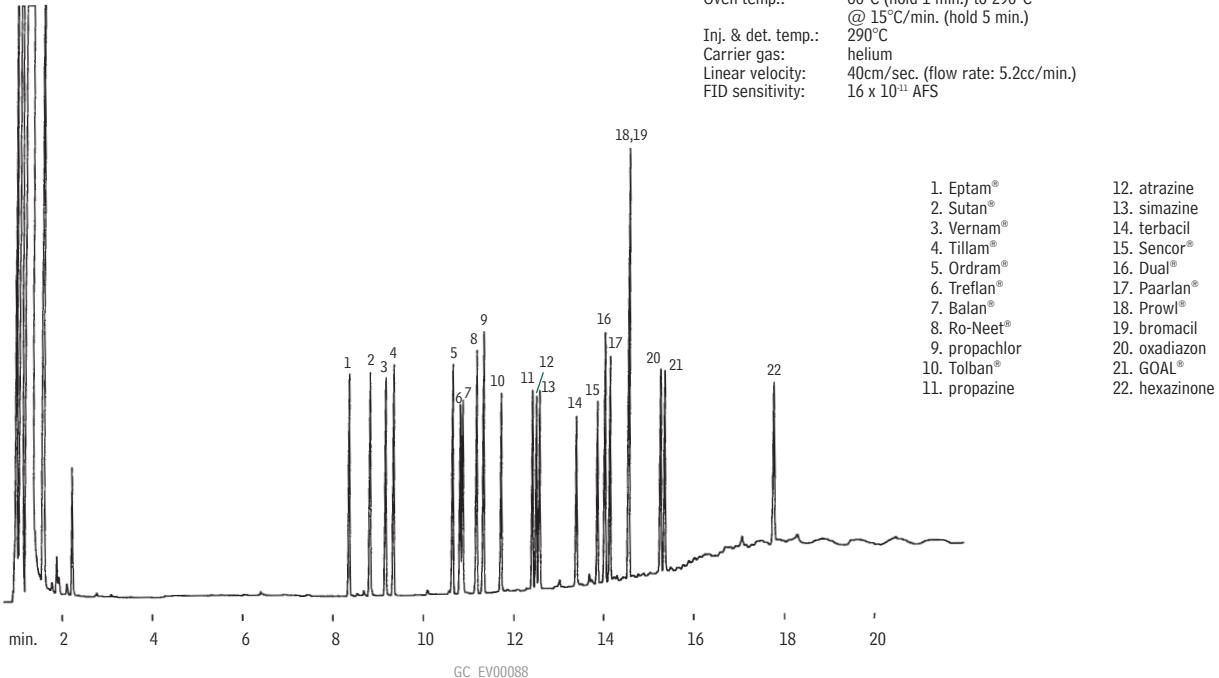


30m, 0.25mm ID, 0.25 $\mu\text{m}$  Rtx®-5 (cat.# 10223)  
 2.0 $\mu\text{L}$  splitless injection  
 Splitless hold: 0.75 min.  
 Oven temp.: 60°C to 300°C @ 4°C/min. (hold 10 min.)  
 Inj. / det. temp.: 250°C / 320°C  
 Carrier gas: helium  
 Linear velocity: 30cm/sec. (flow rate: 1.4cc/min.)

## Nitrogen-Containing Herbicides Rtx<sup>®</sup>-35

30m, 0.53mm ID, 0.50 $\mu$ m Rbx<sup>®</sup>-35 (cat.# 10440)  
0.2 $\mu$ L direct injection, Uniliner<sup>®</sup> liner, concentration approximately 10ng per component.

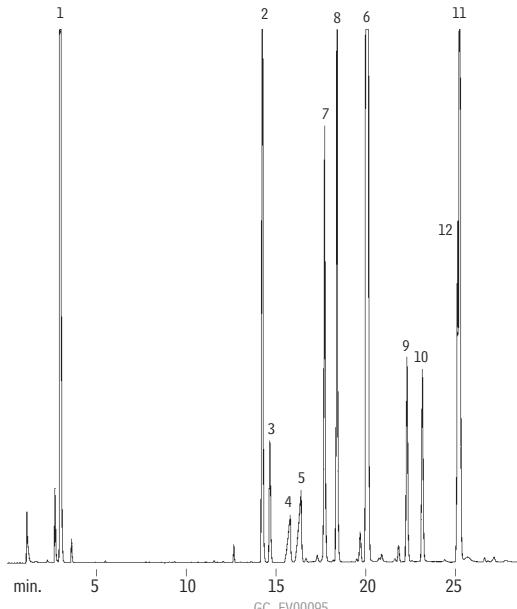
Oven temp.: 60°C (hold 1 min.) to 290°C  
@ 15°C/min. (hold 5 min.)  
Inj. & det. temp.: 290°C  
Carrier gas: helium  
Linear velocity: 40cm/sec. (flow rate: 5.2cc/min.)  
FID sensitivity: 16 x 10<sup>-11</sup> AFS



## Chlorophenoxyacid Herbicides

### US EPA Method 615

Rtx®-5



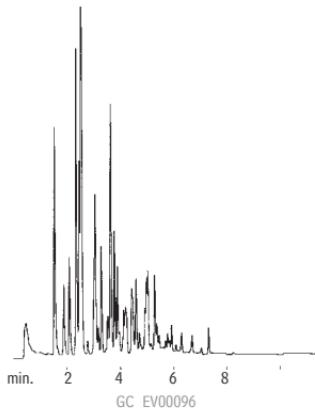
1. dalapon
2. DCAA (S)
3. dicamba
4. MCPP
5. MCPA
6. DBOB (IS)
7. dichlorprop
8. 2,4-D
9. 2,4,5-TP
10. 2,4,5-T
11. dinoseb
12. 2,4-DB

30m, 0.53mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10240)  
0.5 $\mu$ L direct injection of chlorophenoxy herbicides,  
on-column concentration 10–10,000 $\mu$ g/mL

Oven temp.: 60°C to 150°C @ 8°C/min. (hold 5 min.),  
to 210°C @ 4°C/min.  
Inj./det. temp.: 250°C / 275°C  
Carrier gas: helium  
Linear velocity: 35cm/sec. set @ 60°C  
Det.: ECD w/anode purge

## PCBs: Aroclor® Quick Screening Rtx®-5

Aroclor® 1221 Mix (cat.# 32007)



15m, 0.53mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10237)

1.0 $\mu$ L direct injection

Conc.: 50ppm

Oven temp.: 150°C to 300°C @ 12°C/min. (hold 5 min.)

Inj. / det. temp.: 250°C / 310°C

Carrier gas: helium

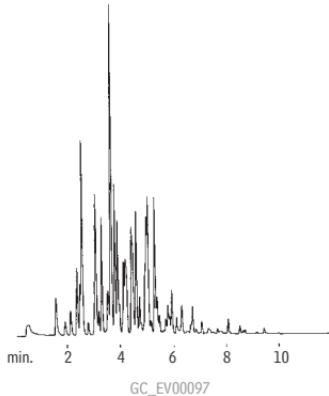
Linear velocity: 30cm/sec. set @ 150°C

ECD sensitivity: 16kHz full scale

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## PCBs: Aroclor® Quick Screening Rtx®-5

Aroclor® 1232 Mix (cat.# 32008)



15m, 0.53mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10237)

1.0 $\mu$ L direct injection

Conc.: 50ppm

Oven temp.: 150°C to 300°C @ 12°C/min. (hold 5 min.)

Inj. / det. temp.: 250°C / 310°C

Carrier gas: helium

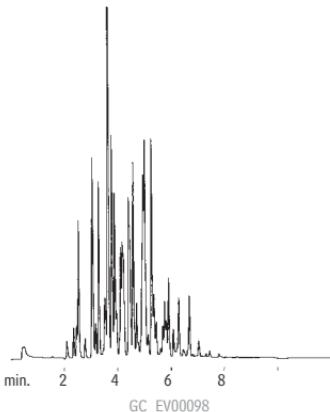
Linear velocity: 30cm/sec. set @ 150°C

ECD sensitivity: 16kHz full scale

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## PCBs: Aroclor® Quick Screening Rtx®-5

Aroclor® 1242 Mix (cat.# 32009)



15m, 0.53mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10237)

1.0 $\mu$ L direct injection

Conc.: 50ppm

Oven temp.: 150°C to 300°C @ 12°C/min. (hold 5 min.)

Inj. / det. temp.: 250°C / 310°C

Carrier gas: helium

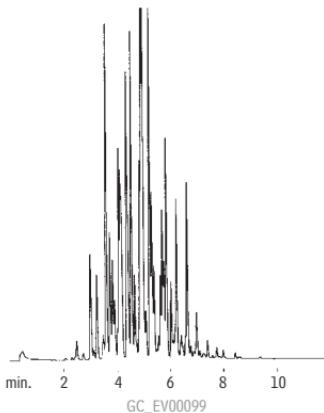
Linear velocity: 30cm/sec. set @ 150°C

ECD sensitivity: 16kHz full scale

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## PCBs: Aroclor® Quick Screening Rtx®-5

Aroclor® 1248 Mix (cat.# 32010)



15m, 0.53mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10237)

1.0 $\mu$ L direct injection

Conc.: 50ppm

Oven temp.: 150°C to 300°C @ 12°C/min. (hold 5 min.)

Inj. / det. temp.: 250°C / 310°C

Carrier gas: helium

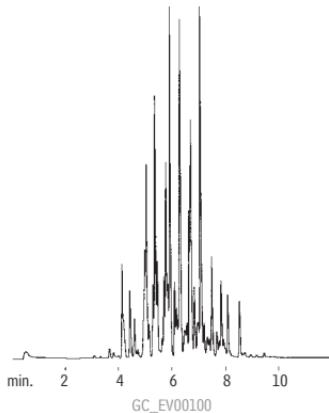
Linear velocity: 30cm/sec. set @ 150°C

ECD sensitivity: 16kHz full scale

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## PCBs: Aroclor® Quick Screening Rtx®-5

Aroclor® 1254 Mix (cat.# 32011)



15m, 0.53mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10237)

1.0 $\mu$ L direct injection

Conc.: 50ppm

Oven temp.: 150°C to 300°C @ 12°C/min. (hold 5 min.)

Inj. / det. temp.: 250°C / 310°C

Carrier gas: helium

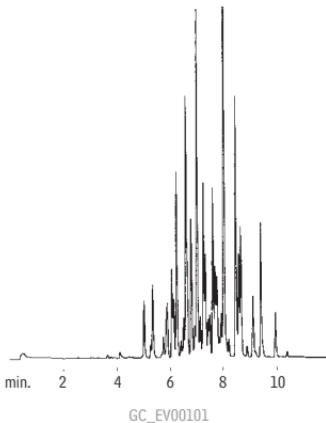
Linear velocity: 30cm/sec. set @ 150°C

ECD sensitivity: 16kHz full scale

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## PCBs: Aroclor® Quick Screening Rtx®-5

Aroclor® 1260 Mix (cat.# 32012)



15m, 0.53mm ID, 0.50 $\mu$ m Rtx®-5 (cat.# 10237)

1.0 $\mu$ L direct injection

Conc.: 50ppm

Oven temp.: 150°C to 300°C @ 12°C/min. (hold 5 min.)

Inj. / det. temp.: 250°C / 310°C

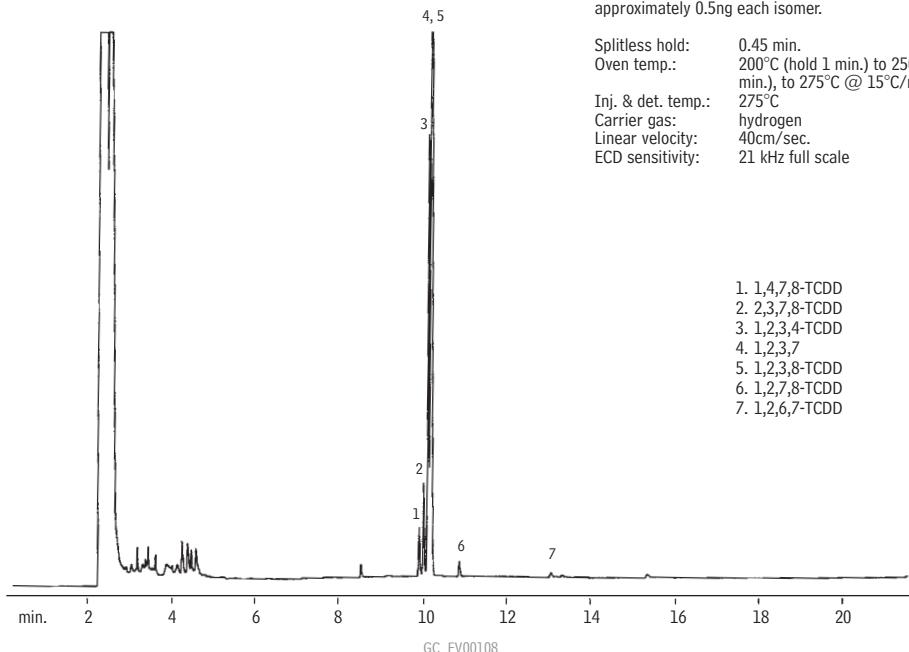
Carrier gas: helium

Linear velocity: 30cm/sec. set @ 150°C

ECD sensitivity: 16kHz full scale

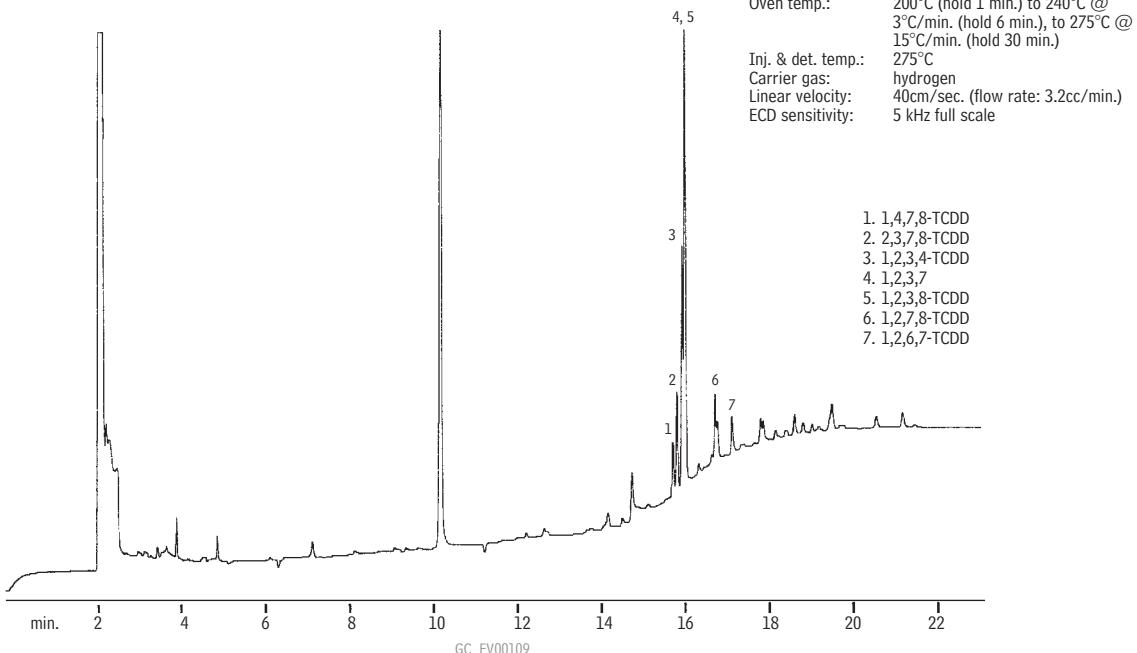
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**TCDD Isomers**  
**Rt<sup>TM</sup>-2330**



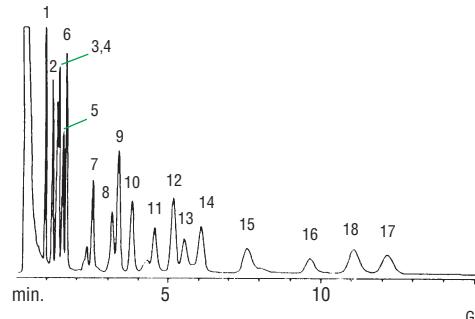
**TCDD Isomers**  
**Rt™-2330**

60m, 0.32mm ID, 0.20 $\mu$ m Rt™-2330 (cat.# 10727)  
1.5 $\mu$ L cold on-column injection of TCDD isomers,  
approximately 0.5ng each isomer.



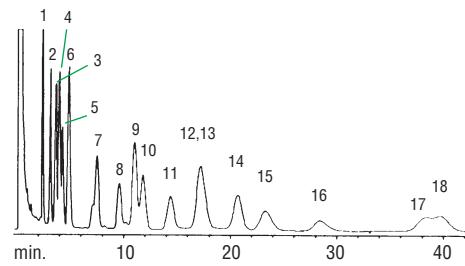
## Rt-608Pkd Silcosteel® packed column exhibits improved inertness and resolution of pesticides with a shorter analysis time.

*Rt-608Pkd Silcosteel® packed column*



2m,  $\frac{1}{8}$ " OD X 2mm ID, Rt-608Pkd (cat.# 80221-810)  
Oven temp.: 200°C isothermal  
Inj. & det. temp.: 250°C  
Det. type: FID  
Column flow: nitrogen, 40cc/min.

*Conventional packed column*

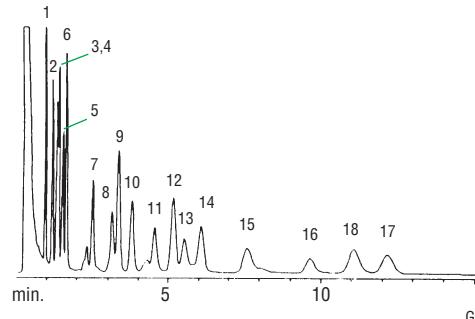


2m X 4mm ID GP 1.5% SP-2250/1.95% SP-2041 on 100/120  
SUPELCOPORT®  
Oven temp.: 200°C isothermal  
Inj. & det. temp.: 250°C  
Det. type: FID  
Column flow: nitrogen, 40cc/min.

1.  $\alpha$ -BHC
2.  $\gamma$ -BHC
3.  $\beta$ -BHC
4. heptachlor
5.  $\delta$ -BHC
6. aldrin
7. heptachlor epoxide
8. endosulfan I
9. 4,4'-DDE
10. dieldrin
11. endrin
12. endosulfan II
13. 4,4'-DDD
14. 4,4'-DDT
15. endrin aldehyde
16. endosulfan sulfate
17. endrin ketone
18. methoxychlor

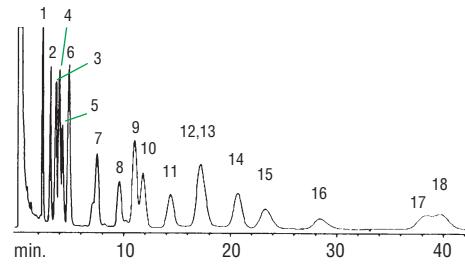
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2m,  $\frac{1}{8}$ " OD X 2mm ID, Rt-608Pkd (cat.# 80221-810)  
Oven temp.: 200°C isothermal  
Inj. & det. temp.: 250°C  
Det. type: FID  
Column flow: nitrogen, 40cc/min.

*Conventional packed column*

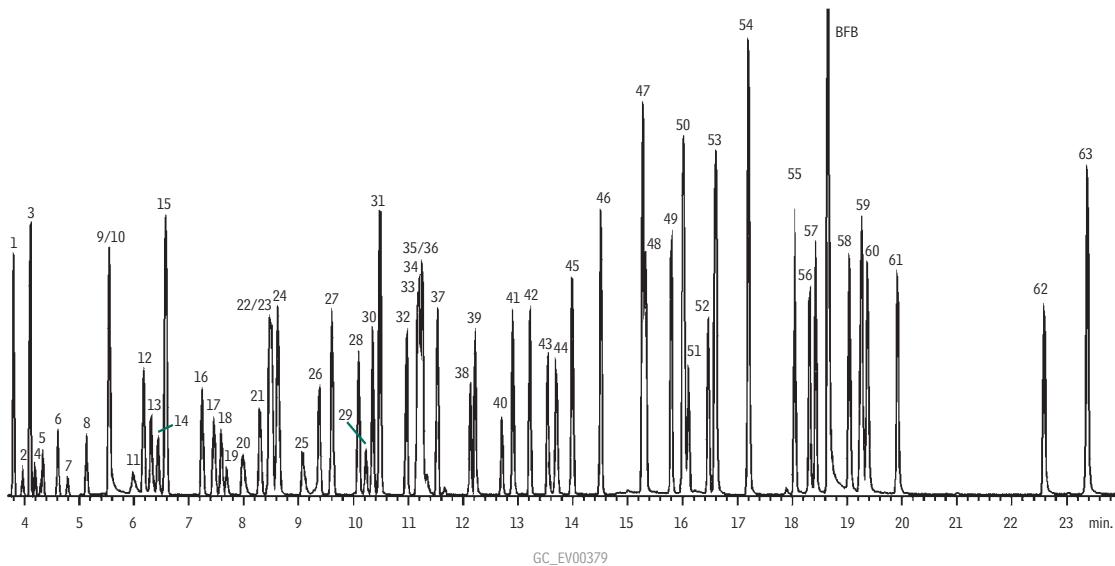


2m X 4mm ID GP 1.5% SP-2250/1.95% SP-2041 on 100/120  
SUPELCOPORT®  
Oven temp.: 200°C isothermal  
Inj. & det. temp.: 250°C  
Det. type: FID  
Column flow: nitrogen, 40cc/min.

1.  $\alpha$ -BHC
2.  $\gamma$ -BHC
3.  $\beta$ -BHC
4. heptachlor
5.  $\delta$ -BHC
6. aldrin
7. heptachlor epoxide
8. endosulfan I
9. 4,4'-DDE
10. dieldrin
11. endrin
12. endosulfan II
13. 4,4'-DDD
14. 4,4'-DDT
15. endrin aldehyde
16. endosulfan sulfate
17. endrin ketone
18. methoxychlor

## US EPA TO-14/TO-15 Compounds

Rtx®-1



Rtx®-1 60m, 0.32mm ID, 1.0 $\mu$ m (cat.# 10157).  
200mL of 10ppbv TO-15 standard (cat.# 34436), injected into TO-Can™ canister and  
humidified to 70% RH.  
Concentrator: Nutech 3550 Preconcentrator  
200mL of sample concentrated at 160°C, thermally desorbed at  
150°C, and cryofocused at 185°C.  
Oven temp.: 30°C (hold 4 min.) to 175°C @ 9°C/min. to 220°C @ 40°C/min.  
Carrier gas: helium @ 1.2mL/min.  
Det.: Agilent 5971 MS  
Scan range: 35-265amu

1. dichlorofluoromethane	23. <i>n</i> -hexane	45. 1,2-dibromoethane
2. chloromethane	24. chloroform	46. tetrachloroethene
3. dichlortetrafluoroethane	25. tetrahydrofuran	47. chlorobenzene-d5 (IS)
4. vinyl chloride	26. 1,2-dichloroethane	48. chlorobenzene
5. 1,3-butadiene	27. 1,1,1-trichloroethane	49. ethylbenzene
6. bromomethane	28. benzene	50a. <i>m</i> -xylene
7. chloroethane	29. carbon tetrachloride	50b. <i>p</i> -xylene
8. bromoethene	30. cyclohexane	51. bromoform
9. acetone	31. 1,4-difluorobenzene (IS)	52. styrene
10. trichlorofluoromethane	32. 1,2-dichloropropane	53. 1,1,2,2-tetrachloroethane
11. isopropyl alcohol	33. bromodichloromethane	54. <i>o</i> -xylene
12. 1,1-dichloroethene	34. trichloroethene	55. 2-chlorotoluene
13. methylene chloride	35. 1,4-dioxane	56. 4-ethyltoluene
14. 3-chloropropene	36. 2,2,4-trimethylpentane	57. 1,3,5-trimethylbenzene
15. carbon disulfide	37. <i>n</i> -heptane	58. 1,2,4-trimethylbenzene
16. Freon® TF	38. <i>cis</i> -1,3-dichloropropene	59. 1,3-dichlorobenzene
17. <i>trans</i> -1,2-dichloroethene	39. methyl isobutyl ketone	60. 1,4-dichlorobenzene
18. 1,1-dichloroethane	40. <i>trans</i> -1,3-dichloropropene	61. 1,2-dichlorobenzene
19. methyl <i>tert</i> -butyl ether	41. 1,1,2-trichloroethane	62. 1,2,4-trichlorobenzene
20. methyl ethyl ketone	42. toluene	63. hexachlorobutadiene
21. <i>cis</i> -1,2-dichloroethene	43. methyl butyl ketone	
22. bromochloromethane (IS)	44. dibromochloromethane	

Chromatogram courtesy of Gina Maio, Severn Trent Laboratories, Inc., Burlington, VT.

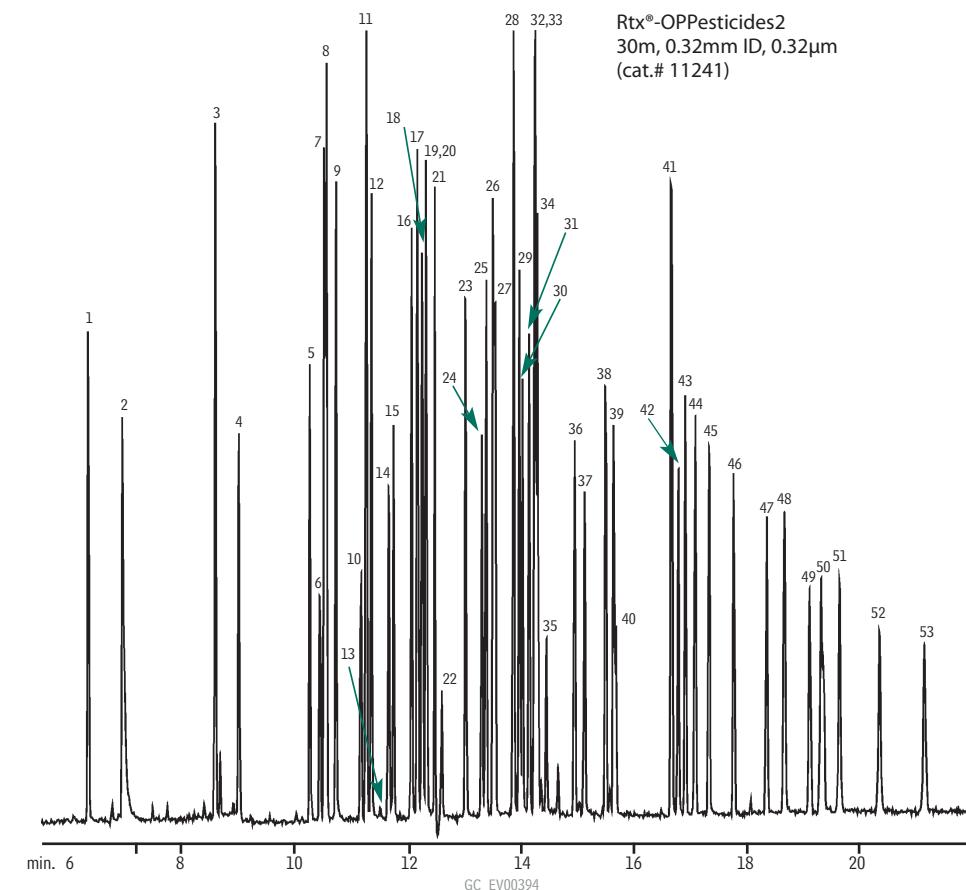
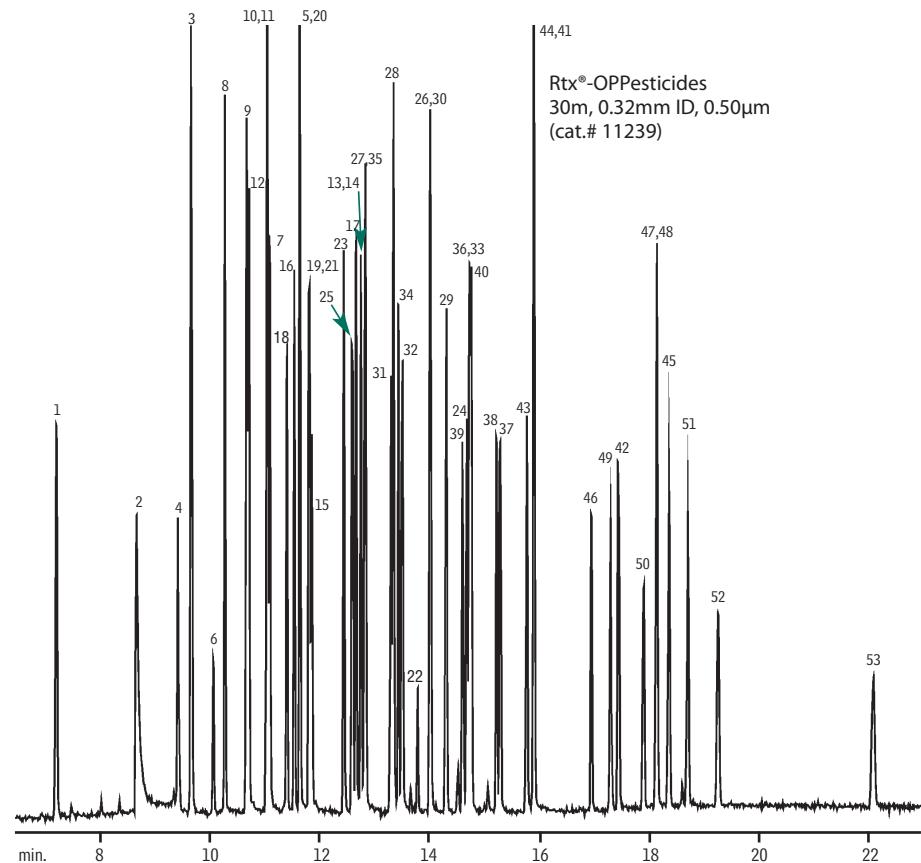
**Organophosphorus Pesticides**  
**US EPA Method 8141A**  
**Rtx®-OPPesticides &**  
**Rtx®-OPPesticides2**

dual-column injector

GC: splitless, purge on 1.0 min. constant pressure  
Oven temp.: 80°C (hold 0.5 min.) to 280°C  
@ 12°C/min. (hold 10 min.)

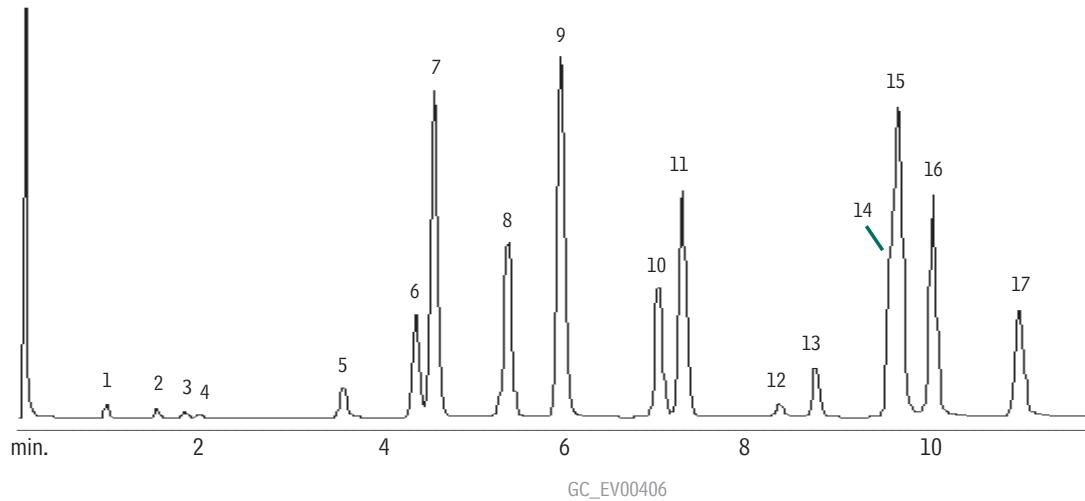
Injector: 200°C  
Inlet liner: 4mm single gooseneck Siltek® inlet liner  
Detector: FPD @ 250°C  
Dead time: 1.03 min. @ 80°C  
Injection: 1μL US EPA Method 8141A Custom Standard Mixes (100ng/mL)  
Triphenylphosphate Standard (cat.# 32281)  
Tributylphosphate Standard (cat.# 32280)  
8140/8141 OP Pesticides Calibration Mix A (cat.# 32277)  
8141 OP Pesticides Calibration Mix B (cat.# 32278)

1. dichlorvos
2. hexamethylphosphoramide
3. mevinphos
4. trichlorfon
5. TEPP
6. demeton-O
7. tributyl phosphate (SS)
8. thionazin
9. ethoprop
10. naled
11. sulfotep
12. phorate
13. dicrotophos
14. monocrotophos
15. demeton-S
16. terbufos
17. dimethoate
18. diazinon
19. dioxathion
20. fonophos
21. disulfoton
22. phosphamidon isomer (breakdown product)
23. dichlorofenthion
24. phosphamidon
25. chlorpyrifos methyl
26. parathion-methyl
27. ronnel
28. aspon
29. fenitrothion
30. malathion
31. chlорpyrifos
32. trichloronate
33. parathion-ethyl
34. fenthion
35. merphos
36. chlorfenvinphos
37. crot oxyphos
38. stirofos
39. tokuthion
40. merphos oxone (breakdown product)
41. ethion
42. fensulfothion
43. bolstar
44. carbophenothion
45. famphur
46. triphenyl phosphate (SS)
47. EPN
48. phosmet
49. leptophos
50. tri-o-cresyl phosphate
51. azinphos-methyl
52. azinphos-ethyl
53. coumaphos



**Explosives**  
**US EPA Method 8095**  
**Rtx®-TNT**

**Rtx®-TNT**



**restek  
innovation!**

Improved resolution of  
nitroaromatic compounds such  
as those listed in US EPA  
Method 8095.

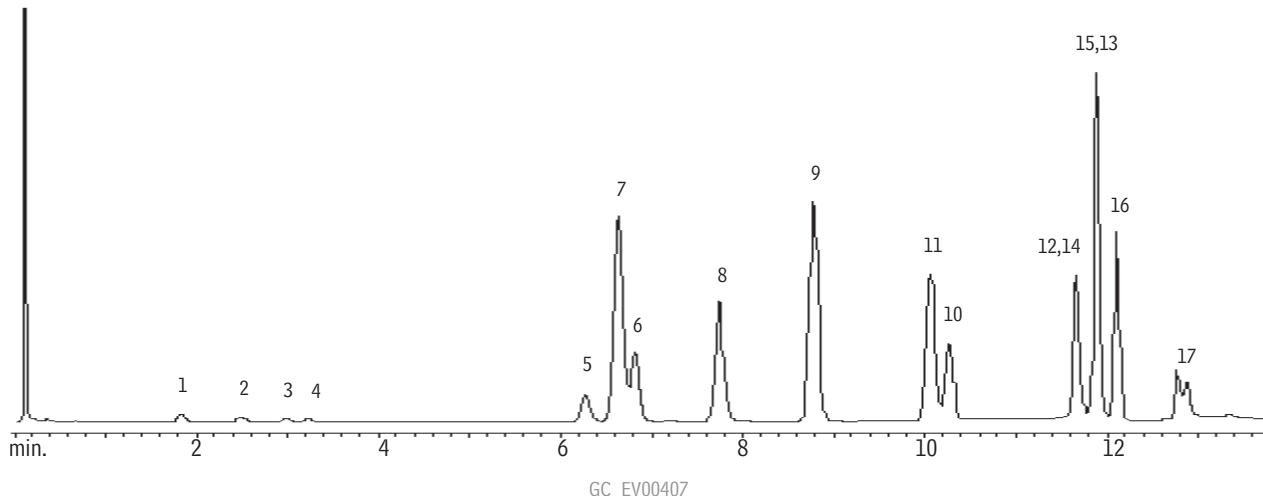
1. nitrobenzene
2. 2-nitrotoluene
3. 3-nitrotoluene
4. 4-nitrotoluene
5. nitroglycerine
6. 1,3-dinitrobenzene
7. 2,6-dinitrotoluene
8. 2,4-dinitrotoluene
9. 3,4-dinitrotoluene (IS)
10. 1,3,5-trinitrobenzene
11. trinitrotoluene
12. PETN
13. RDX
14. 4-amino-2,6-dinitrotoluene
15. 3,5-dinitroaniline
16. 2-amino-4,6-dinitrotoluene
17. tetryl

Column: Rtx®-TNT, 6m, 0.53mm ID, 1.50 $\mu$ m (cat.# 12998)  
Inj.: direct injection using a 1mm Siltek® Uniliner® inlet liner (cat.# 21052-214.1)  
On-column conc.: est. 200-1,000pg/compound. 8095 Calibration Mix A (cat.# 31607),  
8095 Calibration Mix B (cat.# 31608), and 3,4-dinitrotoluene (cat.# 31452)  
Oven temp.: 80°C (hold 1 min.) to 180°C @ 10°C/min. to 300°C @  
30°C/min. (hold 3 min.)  
Inj. temp.: 250°C  
Det.: ECD @ 330°C with anode purge  
Dead time: 4.4 sec.  
Head pressure: helium @ 3psi (20.7 KPa)  
Flow rate: helium @ 17mL/min. @ 80°C

Restek Corporation 110 Benner Circle Bellefonte, PA 16823  
814-353-1300 • 800-356-1688 • Fax: 814-353-1309 • [www.restek.com](http://www.restek.com)

**Explosives**  
**US EPA Method 8095**  
**Rtx®-TNT2**

**Rtx®-TNT2**



**restek  
innovation!**

Improved resolution of  
nitroaromatic compounds such  
as those listed in US EPA  
Method 8095.

1. nitrobenzene
2. 2-nitrotoluene
3. 3-nitrotoluene
4. 4-nitrotoluene
5. nitroglycerine
6. 1,3-dinitrobenzene
7. 2,6-dinitrotoluene
8. 2,4-dinitrotoluene
9. 3,4-dinitrotoluene (IS)
10. 1,3,5-trinitrobenzene
11. trinitrotoluene
12. PETN
13. RDX
14. 4-amino-2,6-dinitrotoluene
15. 3,5-dinitroaniline
16. 2-amino-4,6-dinitrotoluene
17. tetryl

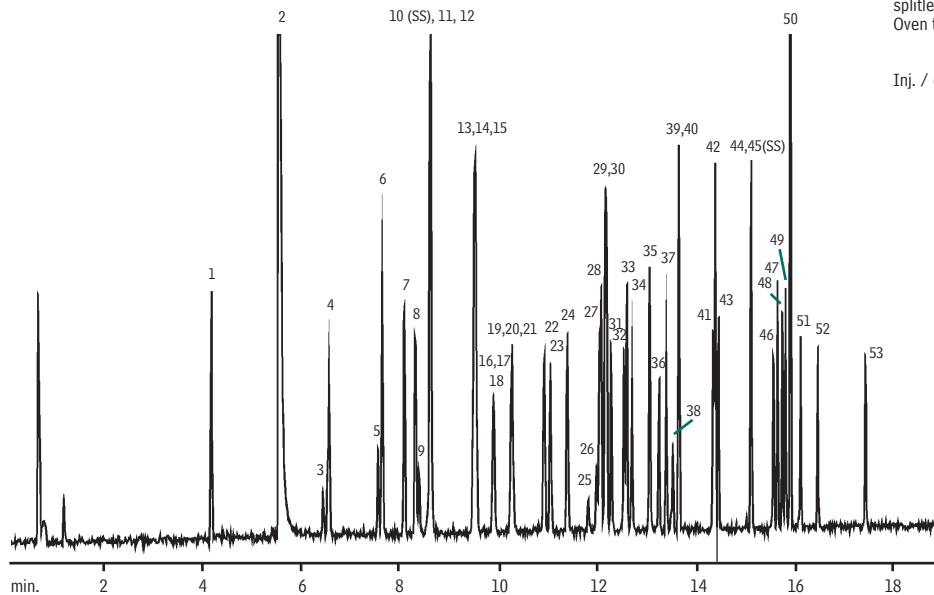
Column: Rtx®-TNT2, 6m, 0.53mm ID, 1.50 $\mu$ m (cat.# 12999)  
Inj.: direct injection using a 1mm Siltek® Uniliner® (cat.# 21052-214.1)  
On-column conc.: est. 200-1,000pg/compound. 8095 Calibration Mix A (cat.# 31607),  
8095 Calibration Mix B (cat.# 31608), and 3,4-dinitrotoluene (cat.# 31452)  
Oven temp.: 80°C (hold 1 min.) to 180°C @ 10°C/min. to 300°C @  
30°C/min. (hold 3 min.)  
Inj. temp.: 250°C  
Det.: ECD @ 330°C with anode purge  
Dead time: 4.4 sec.  
Head pressure: helium @ 3psi (20.7 KPa)  
Flow rate: helium @ 17mL/min. @ 80°C

Restek Corporation 110 Benner Circle Bellefonte, PA 16823  
814-353-1300 • 800-356-1688 • Fax: 814-353-1309 • [www.restek.com](http://www.restek.com)

**Organophosphorus Pesticides**  
**US EPA Method 8140/8141/8141A**  
**Rtx®-CLPesticides**

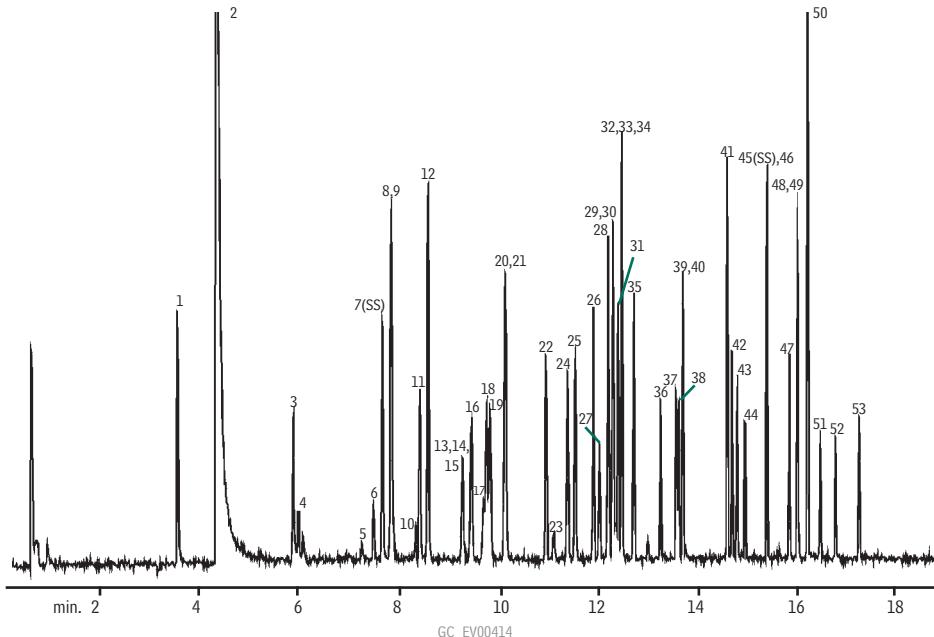
30m, 0.32mm ID, 0.50 $\mu$ m Rtx®-CLPesticides (cat.# 11139)  
 1 $\mu$ L US EPA Method 8141A Custom Standard Mixes (200ng/mL)  
 Triphenylphosphate Standard (cat.# 32281)  
 Tributylphosphate Standard (cat.# 32280)  
 8140/8141 OP Pesticides Calibration Mix A  
 (cat.# 32277)  
 8141 OP Pesticides Calibration Mix B (cat.# 32278)

splitless hold time: 1 min.  
 Oven temp.: 100°C to 180°C @ 10°C/min.  
 (hold 2 min.), to 300°C @ 18°C/min. (hold 3 min.)  
 Inj. / det. temp.: 250°C / 280°C FPD



- |                             |                              |
|-----------------------------|------------------------------|
| 1. dichlorvos               | 28. fenthion                 |
| 2. hexamethylphosphoramide  | 29. aspon                    |
| 3. trichlorfon              | 30. parathion-methyl         |
| 4. mevinphos                | 31. trichloronate            |
| 5. demeton-O                | 32. malathion                |
| 6. thionazin                | 33. fenitrothion             |
| 7. ethoprop                 | 34. phosphamidon             |
| 8. phorate                  | 35. parathion-ethyl          |
| 9. naled                    | 36. chlорfenvinphos          |
| 10. tributyl phosphate (SS) | 37. tokuthion                |
| 11. TEPP                    | 38. merphos oxone            |
| 12. sulfotep                | 39. crotoxyphos              |
| 13. demeton-S               | 40. stirofos                 |
| 14. turbufos                | 41. bolstar                  |
| 15. fonophos                | 42. famphur                  |
| 16. dicrotophos             | 43. carbopethion             |
| 17. diazinon                | 44. fensulfothion            |
| 18. disulfoton              | 45. triphenyl phosphate (SS) |
| 19. dioxathion              | 46. leptophos                |
| 20. monocrotophos           | 47. ethion                   |
| 21. dimethoate              | 48. phosmet                  |
| 22. dichlorfenthion         | 49. EPN                      |
| 23. chlorpyrifos methyl     | 50. tri-o-cresyl phosphate   |
| 24. ronnel                  | 51. azinphos-methyl          |
| 25. phosphamidon isomer     | 52. azinphos-ethyl           |
| 26. merphos                 | 53. coumaphos                |
| 27. chlorpyrifos            |                              |

**Organophosphorus Pesticides**  
**US EPA Method 8140/8141/8141A**  
**Rtx®-CLPesticides2**



30m, 0.32mm ID, 0.25 $\mu$ m Rtx®-CLPesticides2 (cat.# 11324)  
 1 $\mu$ L US EPA Method 8141A Custom Standard Mixes (200ng/mL)

Triphenylphosphate Standard (cat.# 32281)

Tributylphosphate Standard (cat.# 32280)

8140/8141 OP Pesticides Calibration

Mix A (cat.# 32277)

8141 OP Pesticides Calibration Mix B

(cat.# 32278)

splitless hold time: 1 min.

Oven temp.: 100°C to 180°C @

10°C/min. (hold 2 min.),

to 300°C @ 18°C/min.

(hold 3 min.)

Inj. / det. temp.: 250°C / 280°C FPD

- |                            |                              |
|----------------------------|------------------------------|
| 1. dichlorvos              | 28. aspon                    |
| 2. hexamethylphosphoramide | 29. chlorpyrifos             |
| 3. mevinphos               | 30. trichloronate            |
| 4. trichlorfon             | 31. merphos                  |
| 5. demeton-O               | 32. fenitrothion             |
| 6. thionazin               | 33. fenthion                 |
| 7. tributyl phosphate (SS) | 34. malathion                |
| 8. ethoprop                | 35. parathion-ethyl          |
| 9. TEPP                    | 36. chlornvinphos            |
| 10. naled                  | 37. crotoxyphos              |
| 11. phorate                | 38. tokuthion                |
| 12. sulfotep               | 39. merphos oxone            |
| 13. demeton-S              | 40. stirofos                 |
| 14. dicrotophos            | 41. famphur                  |
| 15. dioxathion             | 42. bolstar                  |
| 16. terbufos               | 43. carbophenothion          |
| 17. monocrotophos          | 44. fensulfothion            |
| 18. fonophos               | 45. triphenyl phosphate (SS) |
| 19. diazinon               | 46. ethion                   |
| 20. disulfoton             | 47. EPN                      |
| 21. dimethoate             | 48. phosmet                  |
| 22. dichlorofenthion       | 49. leptophos                |
| 23. phosphamidon isomer    | 50. tri-o-cresyl phosphate   |
| 24. chlorpyrifos methyl    | 51. azinphos-methyl          |
| 25. ronnel                 | 52. azinphos-ethyl           |
| 26. parathion-methyl       | 53. coumaphos                |
| 27. phosphamidon           |                              |

# Volatile Organics

## US EPA Method 8021

### Rtx®-VGC

Primary column, dual-column analysis. Polymer specially designed for volatiles analysis by PID/ELCD.

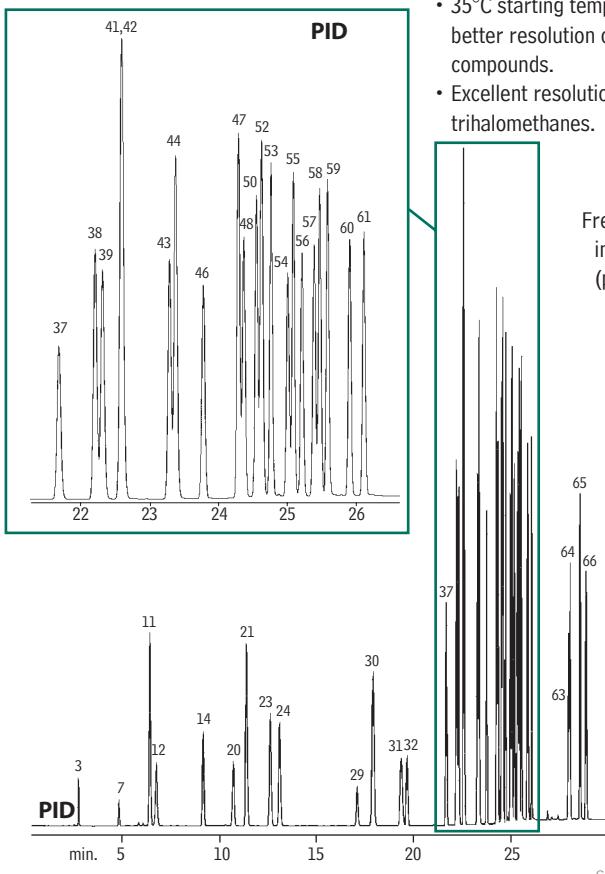
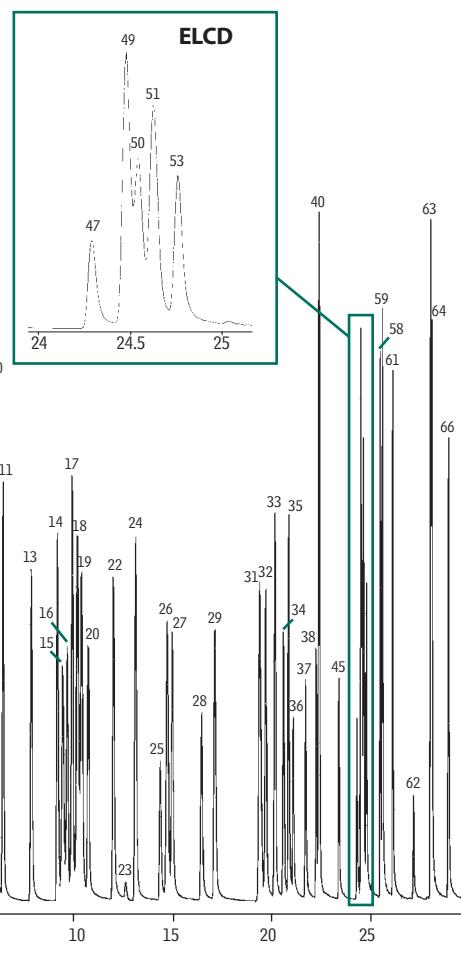
#### Rtx®-VGC

75m, 0.45mm ID, 2.55 $\mu$ m (cat.# 19409)

### restek innovation!

- 35°C starting temperature for better resolution of early-eluting compounds.
- Excellent resolution of trihalomethanes.

Freon® 113 included (peak 8)



20ppb in 5mL of RO water.

Column:

75m, 0.45mm ID, 2.55 $\mu$ m Rtx®-VGC (cat.# 19409)

Confirmation column:

75m, 0.45mm ID, 2.55 $\mu$ m Rtx®-VRX (cat.# 19309)

Concentrator:

Tekmar LSC-3000 Purge and Trap

Trap:

Vocarb® 3000

Purge:

11 min. @ 40mL/min.

Dry purge:

1 min. @ 40mL/min. (MCS by-passed with Silcosteel® tubing [cat.# 21035])

Desorb preheat:

245°C

Desorb:

250°C for 2 min.

Bake:

260°C for 8 min.

Interface:

direct

Transfer line:

0.32mm ID Siltek® tubing

GC: Finnigan 9001

Oven temp.: 35°C (hold 4 min.) to 75°C @ 3°C/min. (hold 2 min.)

to 175°C @ 21°C/min. to 205°C @

35°C/min. (hold 5 min.)

Carrier gas: helium 11mL/min., constant pressure

Adjust dichlorodifluoromethane to a retention time of 2.28 min.

@ 35°C on the Rtx®-VGC column.

Detectors:  $\mu$ Gold Tandem PID/HALL 2000

PID: makeup 7mL/min., purge 7mL/min., set @ 0.35mV,

base temp. 200°C.

ELCD Hall 2000: RxnGas 25mL/min., RxnTemp. 940°C,

propanol flow 470 $\mu$ L/min.

1. dichlorodifluoromethane

15. 2,2-dichloropropane

29. *cis*-1,3-dichloropropene

57. *p*-isopropyltoluene

2. chloromethane

16. bromochloromethane

30. toluene

58. 1,3-dichlorobenzene

3. vinyl chloride

17. chloroform

31. tetrachloroethene

59. 1,4-dichlorobenzene

4. bromomethane

18. carbon tetrachloride

32. *trans*-1,3-dichloropropene

60. *n*-butylbenzene

5. chloroethane

19. 1,1,1-trichloroethane

33. 1,1,2-trichloroethane

61. 1,2-dichlorobenzene

6. trichlorofluoromethane

20. 1,1-dichloropropene

34. dibromochloromethane

62. 1,2-dibromo-3-chloropropane

7. 1,1-dichloroethene

21. benzene

35. 1,3-dichloropropane

63. hexachlorobutadiene

8. Freon® 113

22. 1,2-dichloroethane

36. 1,2-dibromoethane

64. 1,2,4-trichlorobenzene

9. allyl chloride

23. fluorobenzene (SS)

37. 1-chloro-3-fluorobenzene (SS)

65. naphthalene

10. methylene chloride

24. trichloroethene

38. chlorobenzene

66. 1,2,3-trichlorobenzene

11. *trans*-1,2-dichloroethene

25. dibromomethane

39. ethylbenzene

53. 4-chlorotoluene

12. methyl *tert*-butyl ether

26. 1,2-dichloropropane

40. 1,1,1,2-tetrachloroethane

54. *tert*-butylbenzene

13. 1,1-dichloroethane

27. bromodichloromethane

41. *m*-xylene

55. 1,2,4-trimethylbenzene

14. *cis*-1,2-dichloroethene

28. 1-bromo-2-chloroethane (SS)

42. *p*-xylene

Acknowledgement: Finnigan 9001 GC,  $\mu$ Gold Tandem Photoionization/HALL® 2000 Electrolytic Conductivity Detector provided courtesy of Thermo Finnigan GC & GC/MS Division, 2215 Grand Avenue Pkwy, Austin, Texas 78728

# Volatile Organics

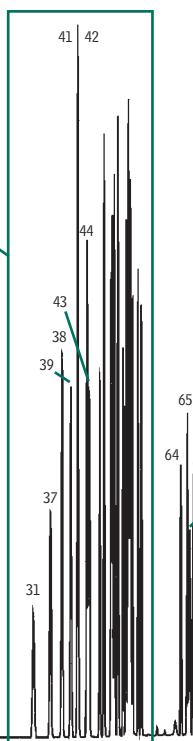
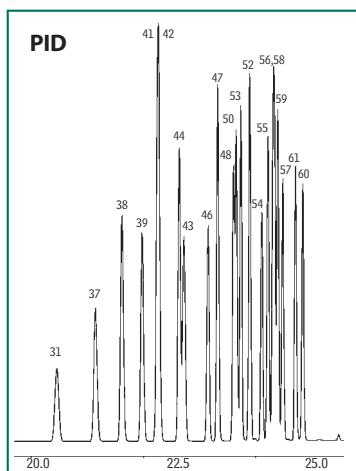
## US EPA Method 8021

### Rtx®-VRX

Excellent confirmation column to Rtx®-VGC.

#### Rtx®-VRX

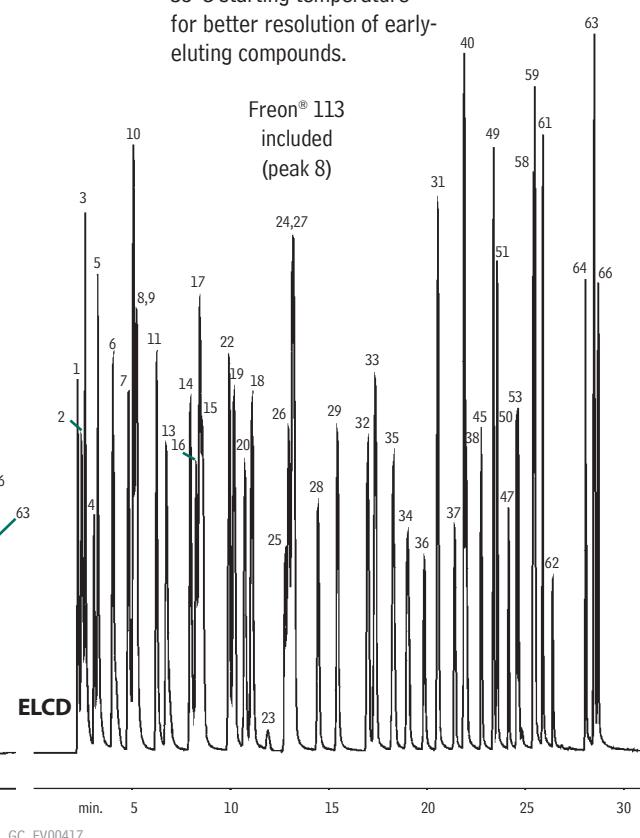
75m, 0.45mm ID, 2.55μm (cat.# 19309)



#### restek innovation!

- 35°C starting temperature for better resolution of early-eluting compounds.

#### Freon® 113 included (peak 8)



20ppb in 5mL of RO water.

Column:

Primary column: 75m, 0.45mm ID, 2.55μm Rtx®-VRX (cat.# 19309)

Concentrator:

75m, 0.45mm ID, 2.55μm Rtx®-VGC (cat.# 19409)

Tekmar LSC-3000 Purge and Trap

Trap: Vocarb™ 3000

Purge:

11 min. @ 40mL/min.

Dry purge:

1 min. @ 40mL/min. (MCS by-passed with SilcoSteel® tubing [cat.# 21035])

Desorb preheat:

245°C

Desorb:

250°C for 2 min.

Bake:

260°C for 8 min.

Interface:

direct

Transfer line: 0.32mm ID Siltek® tubing

GC: Finnigan 9001

Oven temp.: 35°C (hold 4 min.) to 75°C @ 3°C/min. (hold 2 min.) to 175°C @ 21°C/min. to 205°C @ 35°C/min. (hold 5 min.)

Carrier: helium 11mL/min., constant pressure

Adjust dichlorodifluoromethane to a retention time of 2.28 min. @ 35°C on the Rtx®-VGC column.

μGold Tandem PID/HALL 2000

PID: makeup 7mL/min., purge 7mL/min., set @ 0.35mV, base temp. 200°C.

ELCD Hall 2000: RxnGas 25mL/min., RxnTemp. 940°C, propanol flow 470μL/min.

1. dichlorodifluoromethane

2. chloromethane

3. vinyl chloride

4. bromomethane

5. chloroethane

6. trichlorofluoromethane

7. 1,1-dichloroethene

8. Freon® 113

9. allyl chloride

10. methylene chloride

11. *trans*-1,2-dichloroethene

12. methyl *tert*-butyl ether

13. 1,1-dichloroethane

14. *cis*-1,2-dichloroethene

15. 2,2-dichloropropane

16. bromochloromethane

17. chloroform

18. carbon tetrachloride

19. 1,1,1-trichloroethane

20. 1,1-dichloropropene

21. benzene

22. 1,2-dichloroethane

23. fluorobenzene (SS)

24. trichloroethene

25. dibromomethane

26. 1,2-dichloropropane

27. bromodichloromethane

28. 1-bromo-2-chloroethane (SS)

29. *cis*-1,3-dichloropropene

30. toluene

31. tetrachloroethene

32. *trans*-1,3-dichloropropene

33. 1,1,2-trichloroethane

34. dibromochloromethane

35. 1,3-dichloropropane

36. 1,2-dibromoethane

37. 1-chloro-3-fluorobenzene (SS)

38. chlorobenzene

39. ethylbenzene

40. 1,1,2-tetrachloroethane

41. *m*-xylene

42. *p*-xylene

43. *o*-xylene

44. styrene

45. bromoform

46. isopropylbenzene

47. bromobenzene

48. *n*-propylbenzene

49. 1,1,2,2-tetrachloroethane

50. 2-chlorotoluene

51. 1,2,3-trichloropropane

52. 1,3,5-trimethylbenzene

53. 4-chlorotoluene

54. *tert*-butylbenzene

55. 1,2,4-trimethylbenzene

56. *sec*-butylbenzene

57. *p*-isopropyltoluene

58. 1,3-dichlorobenzene

59. 1,4-dichlorobenzene

60. *n*-butylbenzene

61. 1,2-dichlorobenzene

62. 1,2-dibromo-3-chloropropane

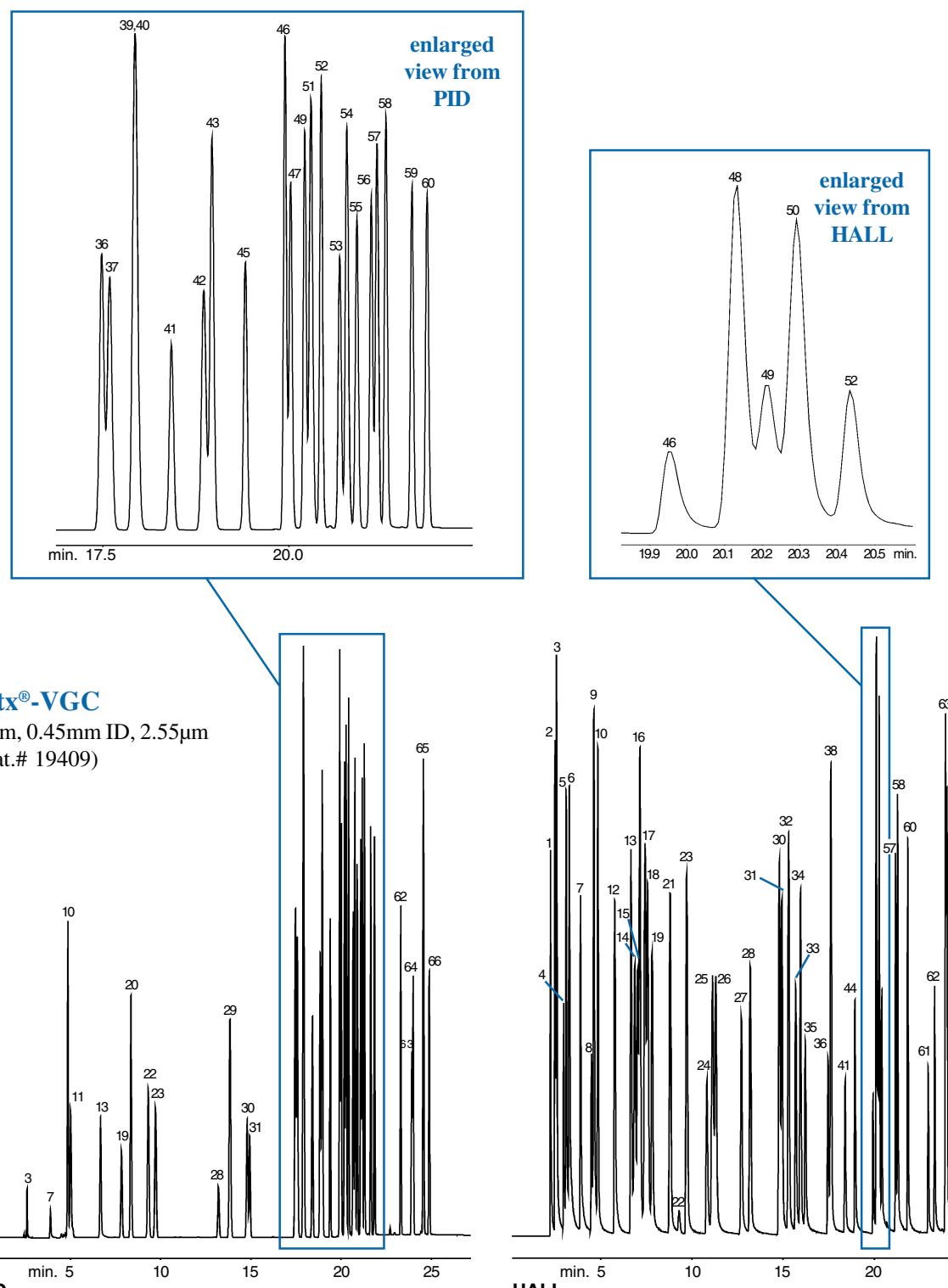
63. hexachlorobutadiene

64. 1,2,4-trichlorobenzene

65. naphthalene

66. 1,2,3-trichlorobenzene

Acknowledgement: Finnigan 9001 GC, μGold Tandem Photoionization/HALL® 2000 Electrolytic Conductivity Detector provided courtesy of Thermo Finnigan GC & GC/MS Division, 2215 Grand Avenue Pkwy, Austin, Texas 78728



**Acknowledgement:** Finnigan 9001 GC, μGold Tandem Photoionization Detector & Hall 2000 Detector provided courtesy of ThermoQuest/CE Instruments, 2215 Grand Avenue Parkway, Austin, TX 78728.

1. dichlorodifluoromethane
2. chloromethane
3. vinyl chloride
4. bromomethane
5. chloroethane
6. trichlorofluoromethane
7. 1,1-dichloroethene
8. allyl chloride
9. methylene chloride
10. *trans*-1,2-dichloroethene
11. methyl *tert*-butyl ether
12. 1,1-dichloroethane
13. *cis*-1,2-dichloroethene
14. 2,2-dichloropropane
15. bromochloromethane
16. chloroform
17. carbon tetrachloride
18. 1,1,1-trichloroethane
19. 1,1-dichloropropene
20. benzene
21. 1,2-dichloroethane
22. fluorobenzene (SS)
23. trichloroethene
24. dibromomethane
25. 1,2-dichloropropane
26. bromodichloromethane
27. 1-bromo-2-chloroethane (SS)
28. *cis*-1,3-dichloropropene
29. toluene
30. tetrachloroethene
31. *trans*-1,3-dichloropropene
32. 1,1,2-trichloroethane
33. dibromochloromethane
34. 1,3-dichloropropane
35. 1,2-dibromoethane
36. chlorobenzene
37. ethylbenzene
38. 1,1,2-tetrachloroethane
39. *m*-xylene
40. *p*-xylene
41. 1-chloro-2-fluorobenzene(SS)
42. *o*-xylene
43. styrene
44. bromoform
45. isopropylbenzene
46. bromobenzene
47. *n*-propylbenzene
48. 1,1,2,2-tetrachloroethane
49. 2-chlorotoluene
50. 1,2,3-trichloropropane
51. 1,3,5-trimethylbenzene
52. 4-chlorotoluene
53. *tert*-butylbenzene
54. 1,2,4-trimethylbenzene
55. *sec*-butylbenzene
56. *p*-isopropyltoluene
57. 1,3-dichlorobenzene
58. 1,4-dichlorobenzene
59. *n*-butylbenzene
60. 1,2-dichlorobenzene
61. 1,2-dibromo-3-chloropropane
62. 2-bromo-1-chlorobenzene (SS)
63. hexachlorobutadiene
64. 1,2,4-trichlorobenzene
65. naphthalene
66. 1,2,3-trichlorobenzene

**primary column:** 75m, 0.45mm ID, 2.55μm Rtx-VGC (cat.# 19409)  
**confirmation column:** 75m, 0.45mm ID, 2.55μm Rtx-502.2 (cat.# 10986)  
**Concentration of Analytes:** 10ppb in 5mL of RO water  
**Concentrator:** Tekmar LSC3100 Purge and Trap  
**Trap:** Vocarb3000  
**Purge:** 11 min. @ 40mL/min.  
**DryPurge:** 1 min. @ 40mL/min.  
**Desorb Preheat:** 245°C  
**Desorb:** 250°C for 2 min  
**Bake:** 260°C for 8 min  
**Interface:** direct connection from concentrator to column  
**Transfer line:** Siltek 0.32 fused silica transfer line direct to columns w/ Press-Tight "Y" connector

**Gas Chromatograph:** Finnigan 9001  
**Carrier Gas:** Helium @ ~10 mL/min. constant pressure  
 Adjust dichlorodifluoromethane to a retention time of 2.28 min. @ 50°C on the Rtx-VGC column.

**Oven temp.:** 50°C (hold 2 min.) to 70 @ 2°C/min. to 130 @ 9°C/min. to 200 @ 40°C/min. (final hold 5 min.)

**Detectors:** μGold Tandem PID/Hall  
 PID: makeup 7mL/min., purge 7mL/min., set @ 0.35mV  
 base temp 200°C.  
 Hall2000: RxnGas 25mL/min., RxnTemp.940°C,  
 Propanol Flow 470 μL/min.

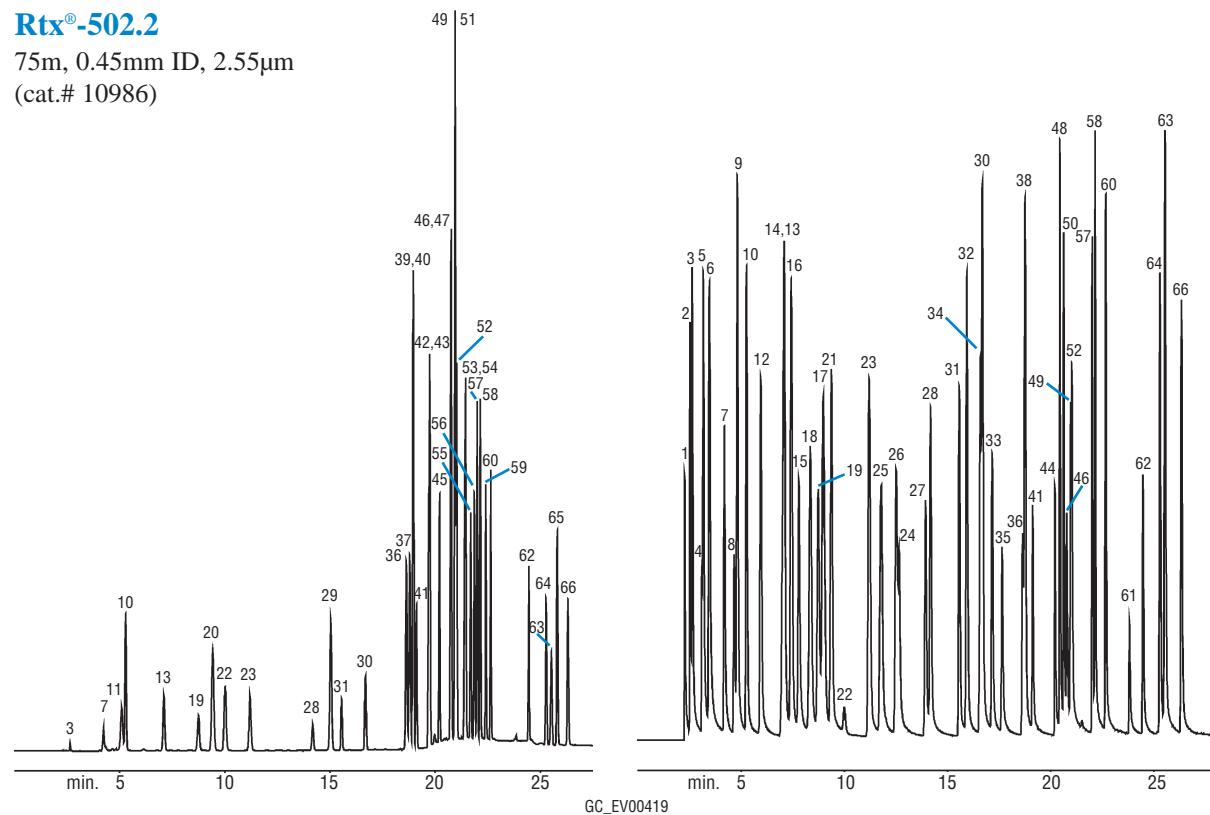
**Acknowledgement:** Finnigan 9001 GC, μGold Tandem Photoionization Detector & Hall 2000 Detector provided courtesy of ThermoQuest/CE Instruments, 2215 Grand Avenue Parkway, Austin, TX 78728.

**Volatile Organics**  
**EPA Method 8021A/502.2**  
**Rtx®-502.2**

Confirmational column to the Rtx®-VGC.

**Rtx®-502.2**

75m, 0.45mm ID, 2.55μm  
(cat.# 10986)

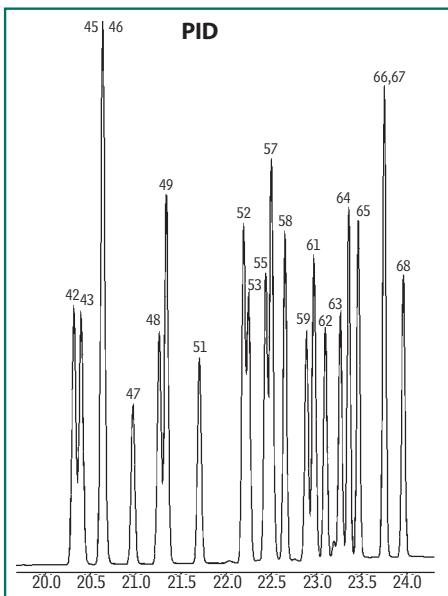


1. dichlorodifluoromethane	34. 1,3-dichloropropane	Primary column: Confirmation column:
2. chloromethane	35. 1,2-dibromoethane	75m, 0.45mm ID, 2.55μm Rtx®-VGC (cat.# 19409)
3. vinyl chloride	36. chlorobenzene	75m, 0.45mm ID, 2.55μm Rtx®-502.2 (cat.# 10986)
4. bromomethane	37. ethylbenzene	10ppb in 5mL of RO water
5. chloroethane	38. 1,1,1,2-tetrachloroethane	Tekmar LSC3100 Purge and Trap
6. trichlorofluoromethane	39. m-xylene	Vocarb 3000
7. 1,1-dichloroethene	40. p-xylene	Purge: 11 min. @ 40mL/min.
8. allyl chloride	41. 1-chloro-2-fluorobenzene(SS)	Dry purge: 1 min. @ 40mL/min.
9. methylene chloride	42. o-xylene	Desorb preheat: 245°C
10. <i>trans</i> -1,2-dichloroethene	43. styrene	Desorb: 250°C for 2 min.
11. methyl <i>tert</i> -butyl ether	44. bromoform	Bake: 260°C for 8 min.
12. 1,1-dichloroethane	45. isopropylbenzene	Interface: direct connection from concentrator to column
13. <i>cis</i> -1,2-dichloroethene	46. bromobenzene	Transfer line: Silitk 0.32mm fused silica transfer line direct to
14. 2,2-dichloropropane	47. n-propylbenzene	columns w/ Press-Tight "Y" connector
15. bromochloromethane	48. 1,1,2,2-tetrachloroethane	Gas chromatograph: Finnigan 9001
16. chloroform	49. 2-chlorotoluene	Carrier gas: helium @ ~10 mL/min. constant pressure
17. carbon tetrachloride	50. 1,2,3-trichloropropane	Adjust dichlorodifluoromethane to a retention time of 2.28 min. @ 50°C on the Rtx®-VGC column.
18. 1,1,1-trichloroethane	51. 1,3,5-trimethylbenzene	Oven temp.: 50°C (hold 2 min.) to 70 @ 2°C/min. to 130 @ 9°C/min. to 200 @ 40°C/min. (final hold 5 min.)
19. 1,1-dichloropropene	52. 4-chlorotoluene	Detectors: μGold Tandem PID/Hall 2000
20. benzene	53. <i>tert</i> -butylbenzene	PID: makeup 7mL/min., purge 7mL/min., set @ 0.35mV
21. 1,2-dichloroethane	54. 1,2,4-trimethylbenzene	base temp 200°C.
22. fluorobenzene (SS)	55. <i>sec</i> -butylbenzene	ELCD Hall 2000: RxnGas 25mL/min., RxnTemp. 940°C, Propanol Flow 470μL/min.
23. trichloroethene	56. <i>p</i> -isopropyltoluene	
24. dibromomethane	57. 1,3-dichlorobenzene	
25. 1,2-dichloropropane	58. 1,4-dichlorobenzene	
26. bromodichloromethane	59. <i>n</i> -butylbenzene	
27. 1-bromo-2-chloroethane (SS)	60. 1,2-dichlorobenzene	
28. <i>cis</i> -1,3-dichloropropene	61. 1,2-dibromo-3-chloropropane	
29. toluene	62. 2-bromo-1-chlorobenzene (SS)	
30. tetrachloroethene	63. hexachlorobutadiene	
31. <i>trans</i> -1,3-dichloropropene	64. 1,2,4-trichlorobenzene	
32. 1,1,2-trichloroethane	65. naphthalene	
33. dibromochloromethane	66. 1,2,3-trichlorobenzene	

Acknowledgement: Finnigan 9001 GC, μGold Tandem Photoionization/HALL® 2000 Electrolytic Conductivity Detector provided courtesy of Thermo Finnigan GC & GC/MS Division, 2215 Grand Avenue Pkwy, Austin, Texas 78728

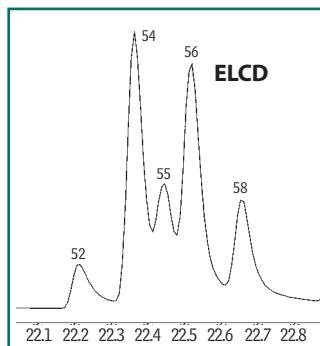
## **Volatile Organics US EPA Method 8021B Expanded List Rtx®-VGC**

Column:	75m, 0.45mm ID, 2.55 $\mu$ m Rtx®-VGC (cat. # 19409)
Confirmation column:	75m, 0.45mm ID, 2.55 $\mu$ m Rtx®-502.2 (cat. # 10986)
Conc.:	10ppb in 5mL of RO water
Concentrator:	Tekmar LSC-3000 Purge and Trap
Trap:	Vocabar 3000
Purge:	11 min. @ 40mL/min.
Dry purge:	1 min. @ 40mL/min. (MCS bypassed using Silcosteel® tubing)
Desorb preheat:	245°C, Flow 10mL/min.
Desorb:	250°C for 2 min.
Bake:	260°C for 8 min.
Interface:	direct using 0.32mm ID Siltek® transfer line
GC:	Finnigan 9001
Carrier gas:	helium @ ~10mL/min. constant pressure
Oven temp.:	Adjust dichlorodifluoromethane to a retention time of 2.40 min. @ 45°C on the Rtx®-VGC column.
Detectors:	45°C (hold 4 min.) to 70°C @ 2°C/min. to 210°C @ 20°C/min. (hold 10 min.) μGold Tandem PID/HALL 2000 PID: makeup 7mL/min., purge 7mL/min., set @ 0.35mV base temp. 200°C. Hall 2000: RxnGas 25mL/min., RxnTemp. 940°C, propanol flow 470 $\mu$ L/min.



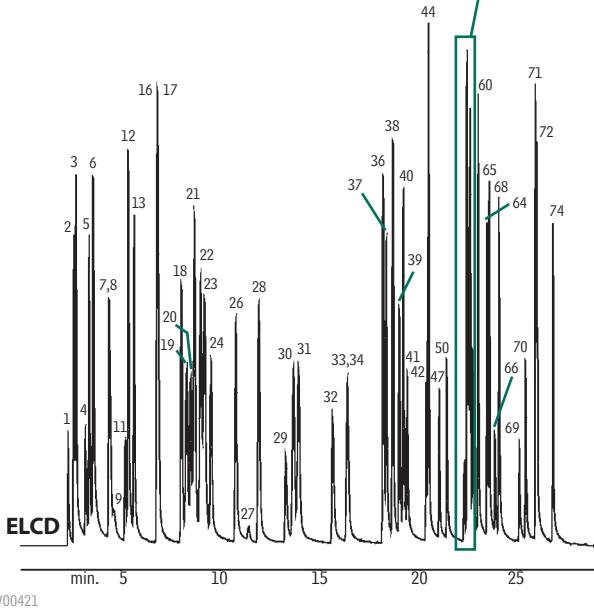
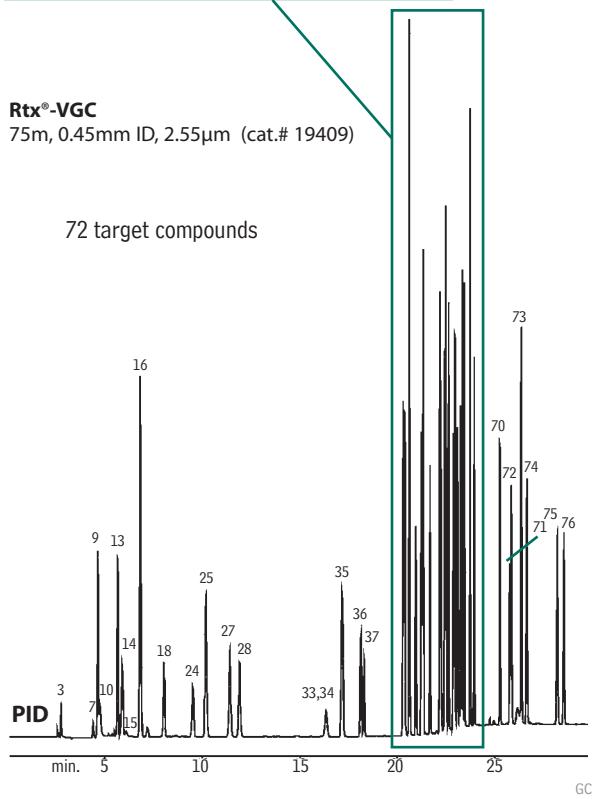
## please **note**

see page 533 for peak identifications.



**Rtx®-VGC**  
75m, 0.45mm ID, 2.55µm (cat.# 19409)

72 target compounds



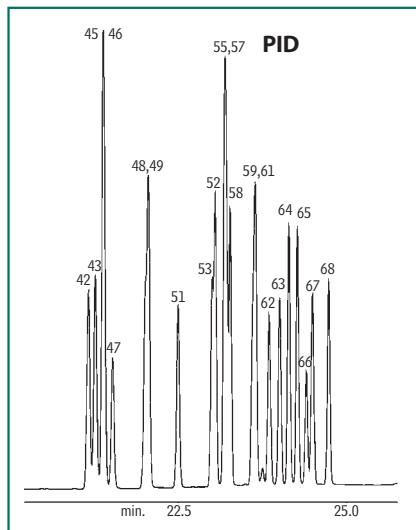
Acknowledgement: Finnigan 9001 GC,  $\mu$ Gold Tandem Photoionization/HALL® 2000 Electrolytic Conductivity Detector provided courtesy of Thermo Finnigan GC & GC/MS Division, 2215 Grand Avenue Pkwy, Austin, Texas 78728

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**Volatile Organics**  
**US EPA Method 8021B Expanded List**  
**Rtx®-502.2**

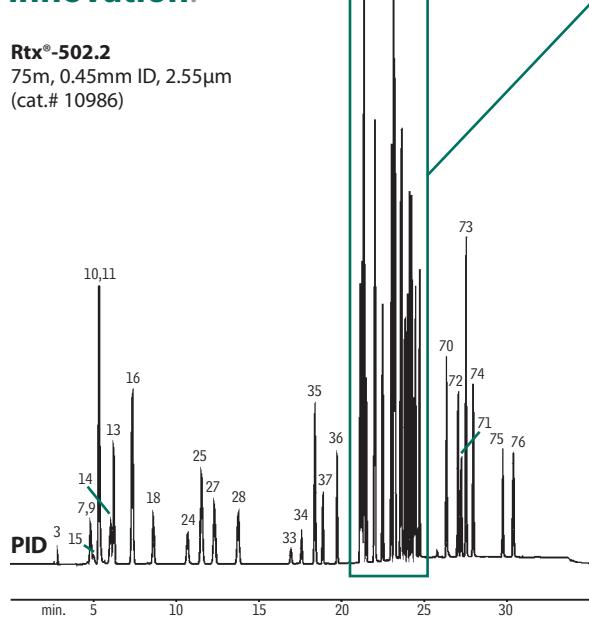
Confirmation column to Rtx®-VGC.

Column: 75m, 0.45mm ID, 2.55 $\mu$ m Rtx®-502.2 (cat.# 10986)  
 Primary column: 75m, 0.45mm ID, 2.55 $\mu$ m Rtx®-VGC (cat.# 19409)  
 Conc.: 10 ppb in 5mL of RO water  
 Concentrator: Tekmar LSC-3000 Purge and Trap  
 Trap: Vocarb 3000  
 Purge: 11 min. @ 40mL/min.  
 Dry purge: 1 min. @ 40mL/min. (MCS bypassed using Silcosteel® tubing)  
 Desorb preheat: 245°C, Flow 10mL/min.  
 Desorb: 250°C for 2 min.  
 Bake: 260°C for 8 min.  
 Interface: direct using 0.32 mm ID Siltek® transfer line  
 GC: Finnigan 9001  
 Carrier gas: helium @ ~10mL/min. constant pressure  
 Adjust dichlorodifluoromethane to a retention time of 2.40 min. @ 45°C on the Rtx®-VGC column.  
 Oven temp.: 45°C (hold 4 min.) to 70°C @ 2°C/min. to 210°C @ 20°C/min. (hold 10 min.)  
 Detectors:  $\mu$ Gold Tandem PID/HALL 2000  
 PID: makeup 7mL/min., purge 7mL/min., set @ 0.35mV base temp. 200°C.  
 Hall 2000: RxnGas 25mL/min., RxnTemp. 940°C, propanol flow 470 $\mu$ L/min.



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**Rtx®-502.2**  
 75m, 0.45mm ID, 2.55 $\mu$ m  
 (cat.# 10986)



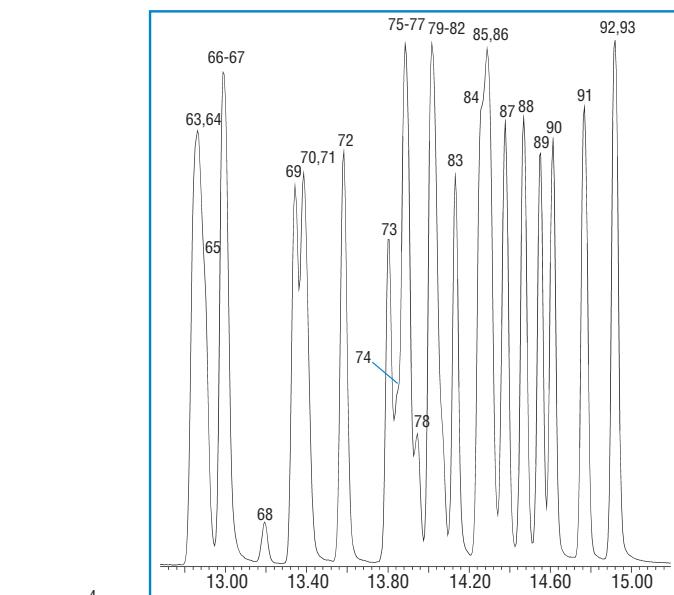
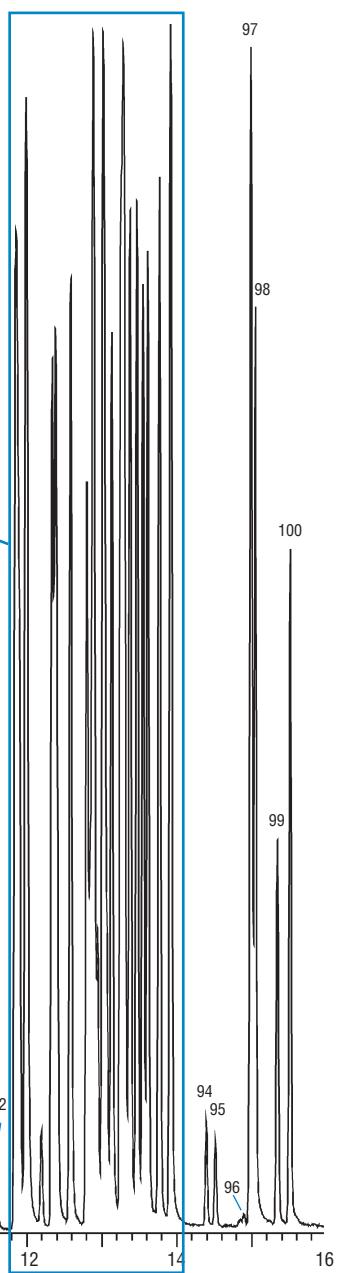
# Volatile Organics

## EPA Method 8260B & Oxygenates

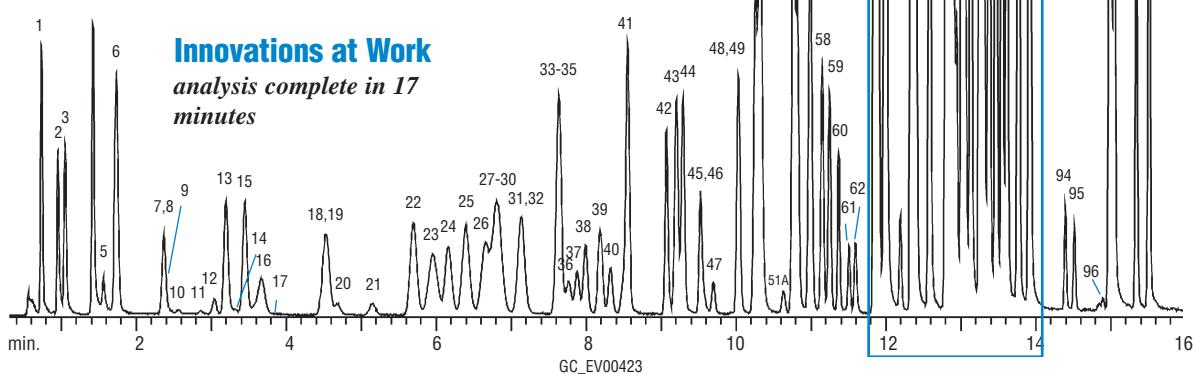
### Rtx®-VMS

1. dichlorodifluoromethane
2. chloromethane
3. vinyl chloride
4. bromomethane
5. chloroethane
6. trichlorofluoromethane
7. 1,1-dichloroethene
8. carbon disulfide (250ppb)
9. Freon® 113
10. iodomethane
11. acrolein (250ppb)
12. allyl chloride
13. methylene chloride
14. acetone
15. *trans*-1,2-dichloroethene
16. methyl *tert*-butyl ether
17. *tert*-butyl alcohol (250ppb)
18. chloroprene
19. 1,1-dichloroethane
20. acrylonitrile
21. vinyl acetate
22. *cis*-1,2-dichloroethene
23. 2,2-dichloropropane
24. bromochloromethane
25. chloroform
26. carbon tetrachloride
27. tetrahydrofuran (250ppb)
28. methyl acrylate
29. ethyl acetate
30. 1,1,1-trichloroethane
31. 2-butanone (250ppb)
32. 1,1-dichloropropene
33. propionitrile
34. benzene
35. methacrylonitrile
36. 1,2-dichloroethane-d4
37. 1,2-dichloroethene
38. isobutyl alcohol (400ppb)
39. fluorobenzene
40. isopropyl acetate
41. trichloroethene
42. dibromomethane
43. 1,2-dichloropropane
44. bromodichloromethane
45. methyl methacrylate
46. 1,4-dioxane (250ppb)
47. *n*-propyl acetate
48. 2-chloroethyl vinyl ether
49. *cis*-1,3-dichloropropene
50. toluene-d8
51. toluene
- 51A. 1,1-dichloro-2-propanone (250ppb)
52. 4-methyl-2-pentanone (250ppb)
53. tetrachloroethene
54. *trans*-1,3-dichloropropene
55. 2-bromo-1-chloropropane
56. 1,1,2-trichloroethane
57. ethyl methacrylate
58. dibromochloromethane
59. 1,3-dichloropropane
60. 1,2-dibromoethane
61. *n*-butyl acetate
62. 2-hexanone (250ppb)
63. chlorobenzene
64. ethylbenzene
65. 1,1,2-tetrachloroethane
66. *m*-xylene
67. *p*-xylene
68. 1-chloro-2-fluorobenzene
69. *o*-xylene
70. styrene
71. bromoform
72. isopropylbenzene
73. 4-bromo-1-fluorobenzene
74. *cis*-1,4-dichloro-2-butene
75. bromobenzene
76. 1,4-dichlorobutane
77. *n*-propylbenzene
78. 1,1,2,2-tetrachloroethane
79. 2-chlorotoluene
80. 1,2,3-trichloropropane
81. 1,3,5-trimethylbenzene
82. *trans*-1,4-dichloro-2-butene
83. 4-chlorotoluene
84. *tert*-butylbenzene
85. pentachloroethane
86. 1,2,4-trimethylbenzene
87. *sec*-butylbenzene
88. *p*-isopropyltoluene
89. 1,3-dichlorobenzene
90. 1,4-dichlorobenzene
91. *n*-butylbenzene
92. 1,2-dichlorobenzene-d4
93. 1,2-dichlorobenzene
94. 4-bromo-1-chlorobenzene
95. 1,2-dibromo-3-chloropropane
96. nitrobenzene (250ppb)
97. hexachlorobutadiene
98. 1,2,4-trichlorobenzene
99. naphthalene
100. 1,2,3-trichlorobenzene

60m, 0.45mm ID, 2.55 $\mu$ m Rtx®-VMS (cat.# 19909)  
100ppb in 25 mL of RO Water (unless otherwise noted).  
Ketones, Acetates & Alcohols in at 2.5 times.  
Concentrator: Tekmar LSC-3000 Purge and Trap  
Trap: Vocarb 3000  
Purge: 11 min. @ 40mL/min.  
Dry purge: 1 min. @ 40mL/min. (MCS bypassed using Silcosteel tubing)  
Desorb preheat: 245°C, Flow 10mL/min.  
Desorb: 250°C for 2 min.  
Bake: 260°C for 8 min.  
Interface: direct using 0.32mm ID Silitk transfer line  
Oven temp.: 40°C (hold 7 min.) to 50°C @ 9°C/min. to 110°C @ 27°C/min. (hold 1 min.) to 225°C @ 40°C/min. (hold 3 min.)  
Carrier gas: helium @ ~10mL/min. constant pressure  
Adjust dichlorodifluoromethane to a retention time of 1.72 min. @ 40°C.  
GC: HP 5890 series II  
Detector: HP 5971A MSD  
Restek's EZVent 3000 @ 1:10 split to source.  
Scan Range: 35 to 300 AMU



**Innovations at Work**  
analysis complete in 17 minutes



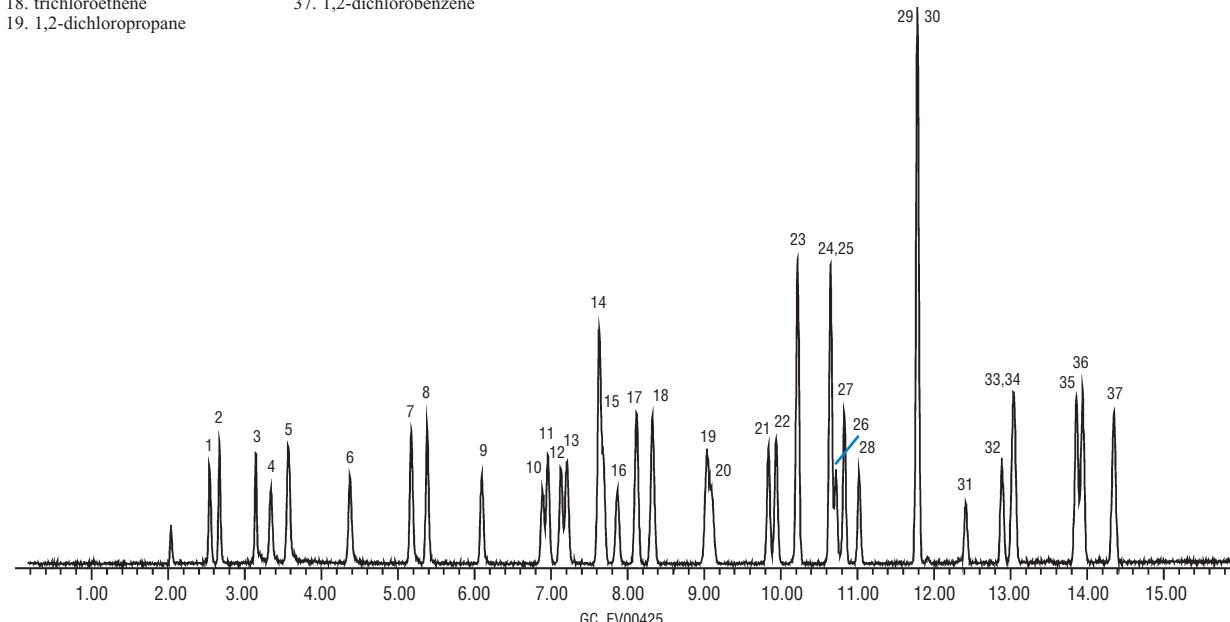
# EPA Method 624

## Rtx®-VMS

1. chloromethane  
 2. vinyl chloride  
 3. bromomethane  
 4. chloroethane  
 5. trichlorofluoromethane  
 6. 1,1-dichloroethene  
 7. methylene chloride  
 8. *trans*-1,2-dichloroethene  
 9. 1,1-dichloroethane  
 10. bromochloromethane  
 11. chloroform  
 12. carbon tetrachloride  
 13. 1,1,1-trichloroethane  
 14. benzene  
 15. pentafluorobenzene  
 16. 1,2-dichloroethane  
 17. fluorobenzene  
 18. trichloroethene  
 19. 1,2-dichloropropane

20. bromodichloromethane  
 21. 2-chloroethyl vinyl ether  
 22. *cis*-1,3-dichloropropene  
 23. toluene  
 24. tetrachloroethene  
 25. *trans*-1,3-dichloropropene  
 26. 2-bromo-1-chloropropane  
 27. 1,1,2-trichloroethane  
 28. dibromochloromethane  
 29. ethylbenzene  
 30. chlorobenzene  
 31. bromoform  
 32. 4-bromofluorobenzene  
 33. 1,4-dichlorobutane  
 34. 1,1,2,2-tetrachloroethane  
 35. 1,3-dichlorobenzene  
 36. 1,4-dichlorobenzene  
 37. 1,2-dichlorobenzene

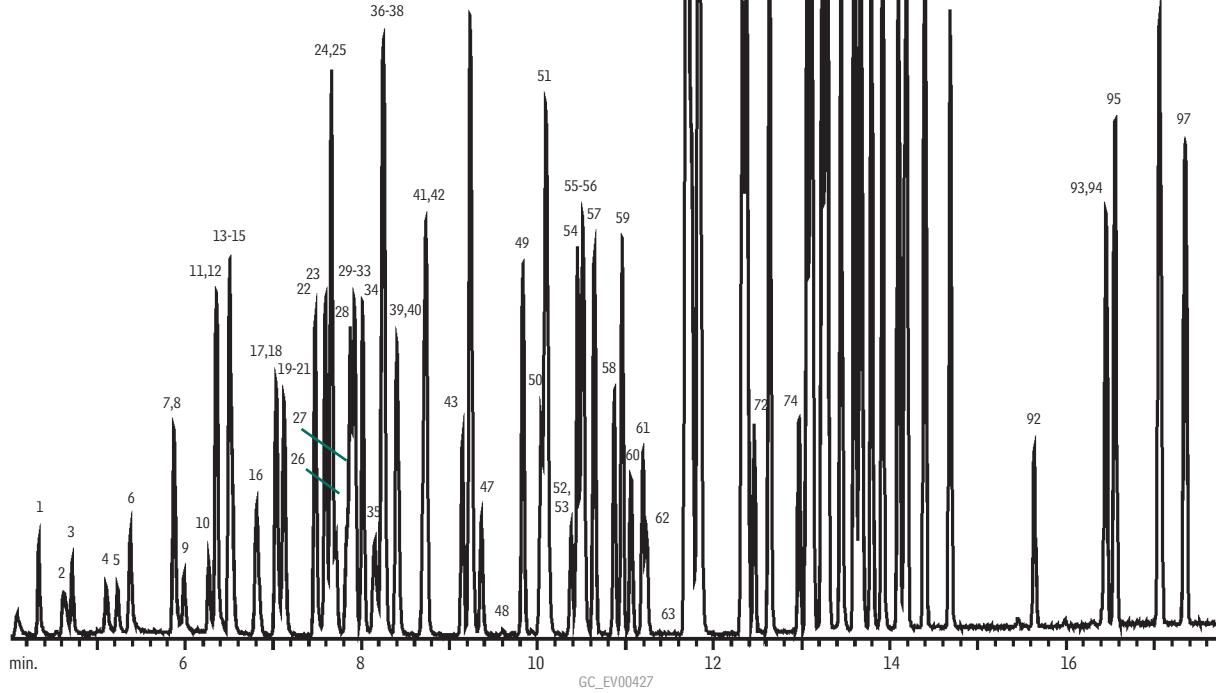
30m, 0.25mm ID, 1.40 $\mu$ m Rtx®-VMS (cat#19915)  
 Conc.: 20 ppb in 5mL of RO water  
 Concentrator: Tekmar LSC-3000 Purge and Trap  
 Trap: Vocarb 3000 (type K)  
 Purge: 11 min. @ 40mL/min. @ ambient temperature.  
 Dry purge: 1 min. @ 40mL/min. (MCS bypassed using Silcosteel® tubing)  
 Desorb preheat: 245°C  
 Desorb: 250°C for 2 min. , Flow 10mL/min.  
 Bake: 260°C for 8 min.  
 GC Interface: 1:10 split at injection port. 1mm ID sleeve.  
 GC: HP 6890  
 Oven temp.: 40°C (hold 4 min.) to 95°C @ 24°C/min. (hold 3 min.), to 210°C @ 40°C/min. (hold 6 min.)  
 Carrier gas: helium @ ~1mL/min. constant flow  
 Adjust dichlorodifluoromethane to a retention time of 2.54 min. @ 40°C  
 Detector: HP 5973 MSD  
 Scan range: 25-300amu



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**Volatile Organics**  
**US EPA Method 8260B**  
**Rtx®-VMS**

60m, 0.25 mm ID, 1.40 $\mu$ m Rtx®-VMS (cat.# 19916)  
 Conc.: 100ppb in 5mL of RO water (unless noted);  
 ketones 2.5X  
 Concentrator: Tekmar LSC-3100 Purge and Trap  
 Trap: Vocarb 3000 (type K)  
 Purge: 11 min. @ 40mL/min. (ambient temperature)  
 Dry purge: 1 min. @ 40mL/min.  
 Desorb preheat: 245°C  
 Desorb: 250°C for 2 min., flow 26mL/min.  
 Bake: 260°C for 8 min.  
 Interface: 0.53mm ID Silcosteel® tubing transfer line  
 1:20 split at injection port. 1mm ID liner.  
 Oven temp.: 60°C (hold 2 min.) to 180°C @ 12°C/min. (hold 0 min.) to  
 225°C @ 45°C/min. (hold 6 min.)  
 Carrier gas: helium @ ~1.3mL/min. constant flow  
 Adjust dichlorodifluoromethane to a retention time of  
 4.03 min. @ 60°C.  
 Detector: Agilent 5973 MSD  
 Scan range: 35-300amu



- |   |                                     |                                       |                                 |
|---|-------------------------------------|---------------------------------------|---------------------------------|
| 1. dichlorodifluoromethane              | 26. ethyl acetate                   | 51. toluene                           | 76. 1,1,2,2-tetrachloroethane   |
| 2. chloromethane                        | 27. methyl acrylate                 | 52. 4-methyl-2-pentanone              | 77. bromobenzene                |
| 3. vinyl chloride                       | 28. propargyl alcohol (500ppb)      | 53. pyridine (250ppb)                 | 78. 1,3,5-trimethylbenzene      |
| 4. bromomethane                         | 29. dibromofluoromethane (SMC)      | 54. <i>trans</i> -1,3-dichloropropene | 79. 2-chlorotoluene             |
| 5. chloroethane                         | 30. tetrahydrofuran                 | 55. ethyl methacrylate                | 80. 1,2,3-trichloropropane      |
| 6. trichlorofluoromethane               | 31. carbon tetrachloride            | 56. tetrachloroethene                 | 81. 4-chlorotoluene             |
| 7. ethanol (2500ppb)                    | 32. 2-butanone                      | 57. 1,1,2-trichloroethane             | 82. <i>tert</i> -butylbenzene   |
| 8. 1,1-dichloroethene                   | 33. 1,1,1-trichloroethane           | 58. dibromochloromethane              | 83. 1,2,4-trimethylbenzene      |
| 9. carbon disulfide (40ppb)             | 34. 1,1-dichloropropene             | 59. 1,3-dichloropropane               | 84. pentachloroethane           |
| 10. allyl chloride                      | 35. pentafluorobenzene (IS)         | 60. <i>n</i> -butyl acetate           | 85. <i>sec</i> -butylbenzene    |
| 11. methylene chloride                  | 36. <i>tert</i> -amyl methyl ether  | 61. 1,2-dibromoethane                 | 86. <i>p</i> -isopropyltoluene  |
| 12. acetone                             | 37. benzene                         | 62. 2-hexanone                        | 87. 1,3-dichlorobenzene         |
| 13. <i>trans</i> -1,2-dichloroethene    | 38. isobutyl alcohol (500ppb)       | 63. 2-picoline (250ppb)               | 88. 1,4-dichlorobenzene-d4 (IS) |
| 14. <i>tert</i> -butyl alcohol (100ppb) | 39. 1,2-dichloroethane              | 64. ethylbenzene                      | 89. 1,4-dichlorobenzene         |
| 15. methyl <i>tert</i> -butyl ether     | 40. isopropyl acetate               | 65. chlorobenzene-D5 (IS)             | 90. <i>n</i> -butylbenzene      |
| 16. diisopropyl ether                   | 41. 1,4-difluorobenzene (SMC)       | 66. chlorobenzene                     | 91. 1,2-dichlorobenzene         |
| 17. 1,1-dichloroethane                  | 42. trichloroethene                 | 67. 1,1,1,2-tetrachloroethane         | 92. 1,2-dibromo-3-chloropropane |
| 18. acrylonitrile                       | 43. dibromomethane                  | 68. <i>m</i> -xylene                  | 93. nitrobenzene (250ppb)       |
| 19. vinyl acetate*                      | 44. bromodichloromethane            | 69. <i>p</i> -xylene                  | 94. hexachlorobutadiene         |
| 20. allyl alcohol (250ppb)              | 45. 1,2-dichloropropane             | 70. <i>o</i> -xylene                  | 95. 1,2,4-trichlorobenzene      |
| 21. ethyl- <i>tert</i> -butyl ether*    | 46. methyl methacrylate             | 71. styrene                           | 96. naphthalene                 |
| 22. <i>cis</i> -1,2-dichloroethene      | 47. <i>n</i> -propyl acetate        | 72. bromoform                         | 97. 1,2,3-trichlorobenzene      |
| 23. 2,2-dichloropropane                 | 48. 2-chloroethanol (2500ppb)       | 73. isopropylbenzene                  |                                 |
| 24. bromochloromethane                  | 49. <i>cis</i> -1,3-dichloropropene | 74. 4-bromo-1-fluorobenzene (SMC)     |                                 |
| 25. chloroform                          | 50. toluene-d8 (SMC)                | 75. <i>n</i> -propylbenzene           |                                 |

\*Peaks 19 & 21 share an ion (43).

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60°C starting temperature

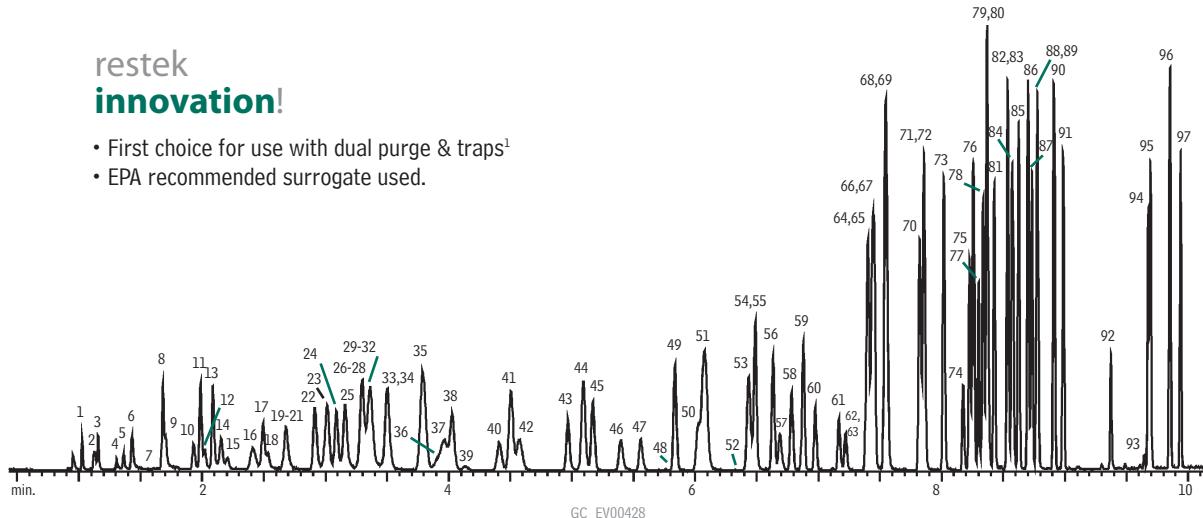
- fast analyses
- fast cycles

Reduce starting temperature to  
best focus the gases

**Volatile Organics**  
**US EPA Method 8260B**  
**Rtx<sup>®</sup>-VMS**

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- First choice for use with dual purge & traps<sup>1</sup>
- EPA recommended surrogate used.

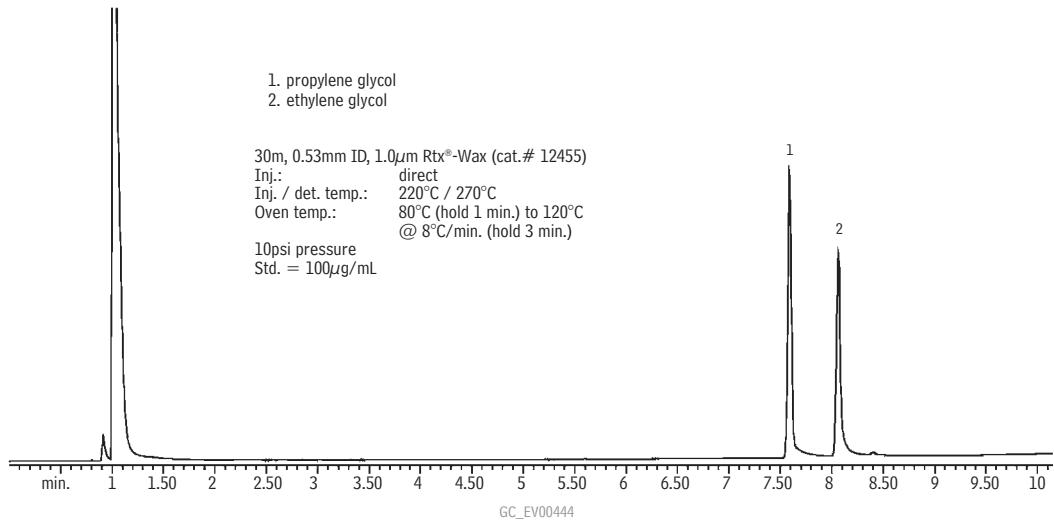


20m, 0.18 mm ID, 1.00 $\mu$ m Rtx<sup>®</sup>-VMS (cat.# 49914)  
 Conc.: 10ppb in 5mL of RO water  
 unless otherwise noted; ketones at 2.5X  
 Concentrator: Tekmar LSC-3100 Purge and Trap  
 Trap: Vocarb 3000 (type K)  
 Purge: 11 min. @ 40mL/min. (ambient temperature)  
 Dry purge: 1 min. @ 40mL/min.  
 Desorb preheat: 245°C  
 Desorb: 250°C for 2 min., flow 40mL/min.  
 Bake: 260°C for 8 min.  
 Interface: 0.53mm ID Silcosteel<sup>®</sup> tubing transfer line  
 1:40 split at injection port. 1mm ID liner.  
 Oven temp.: 50°C (hold 4 min.) to 100°C @ 18°C/min. (hold 0 min.)  
 to 230°C @ 40°C/min. (hold 3 min.)  
 Carrier gas: helium @ ~1.0mL/min. constant flow  
 Adjust dichlorodifluoromethane to a retention time of 1.03 min. @ 50°C.  
 Detector: Agilent 5973 MSD  
 Scan range: 35-300amu

1. dichlorodifluoromethane	26. ethyl acetate	51. toluene	75. bromobenzene
2. chloromethane	27. carbon tetrachloride	52. pyridine	76. <i>n</i> -propylbenzene
3. vinyl chloride	28. methyl acrylate	(250ppb)	77. 1,1,2,2-tetrachloroethane
4. bromomethane	29. propargyl alcohol (500ppb)	53. tetrachloroethene	78. 2-chlorotoluene
5. chloroethane	30. dibromofluoromethane (SMC)	54. 4-methyl-2-pentanone	79. 1,3,5-trimethylbenzene
6. trichlorofluoromethane	31. tetrahydrofuran	55. <i>trans</i> -1,3-dichloropropene	80. 1,2,3-trichloropropane
7. ethanol (2500ppb)	32. 1,1,1-trichloroethane	56. 1,1,2-trichloroethane	81. 4-chlorotoluene
8. 1,1-dichloroethene	33. 2-butanone	57. ethyl methacrylate	82. <i>tert</i> -butylbenzene
9. carbon disulfide (40ppb)	34. 1,1-dichloropropene	58. dibromochloromethane	83. pentachloroethane
10. allyl chloride	35. benzene	59. 1,3-dichloropropane	84. 1,2,4-trimethylbenzene
11. methylene chloride	36. pentafluorobenzene (IS)	60. 1,2-dibromoethane	85. <i>sec</i> -butylbenzene
12. acetone	37. <i>tert</i> -amyl-methyl ether	61. <i>n</i> -butyl acetate	86. <i>p</i> -isopropyltoluene
13. <i>trans</i> -1,2-dichloroethene	38. 1,2-dichloroethane	62. 2-hexanone	87. 1,3-dichlorobenzene
14. methyl <i>tert</i> -butyl ether	39. isobutyl alcohol (500ppb)	63. 2-picoline (250ppb)	88. 1,4-dichlorobenzene-d4 (IS)
15. <i>tert</i> -butyl alcohol (100ppb)	40. isopropyl acetate	64. chlorobenzene-D5 (IS)	89. 1,4-dichlorobenzene
16. diisopropyl ether	41. trichloroethene	65. chlorobenzene	90. <i>n</i> -butylbenzene
17. 1,1-dichloroethane	42. 1,4-difluorobenzene (SMC)	66. ethylbenzene	91. 1,2-dichlorobenzene
18. acrylonitrile	43. dibromomethane	67. 1,1,1,2-tetrachloroethane	92. 1,2-dibromo-3-chloropropane
19. vinyl acetate	44. 1,2-dichloropropane	68. <i>m</i> -xylene	93. nitrobenzene (250ppb)
20. allyl alcohol (250ppb)	45. bromodichloromethane	69. <i>p</i> -xylene	94. hexachlorobutadiene
21. ethyl <i>tert</i> -butyl ether	46. methyl methacrylate	70. <i>o</i> -xylene	95. 1,2,4-trichlorobenzene
22. <i>cis</i> -1,2-dichloroethene	47. <i>n</i> -propyl acetate	71. styrene	96. naphthalene
23. 2,2-dichloropropane	48. 2-chloroethanol (2500ppb)	72. bromoform	97. 1,2,3-trichlorobenzene
24. bromochloromethane	49. <i>cis</i> -1,3-dichloropropene	73. isopropylbenzene	
25. chloroform	50. toluene-d8 (SMC)	74. 4-bromo-1-fluorobenzene (SMC)	

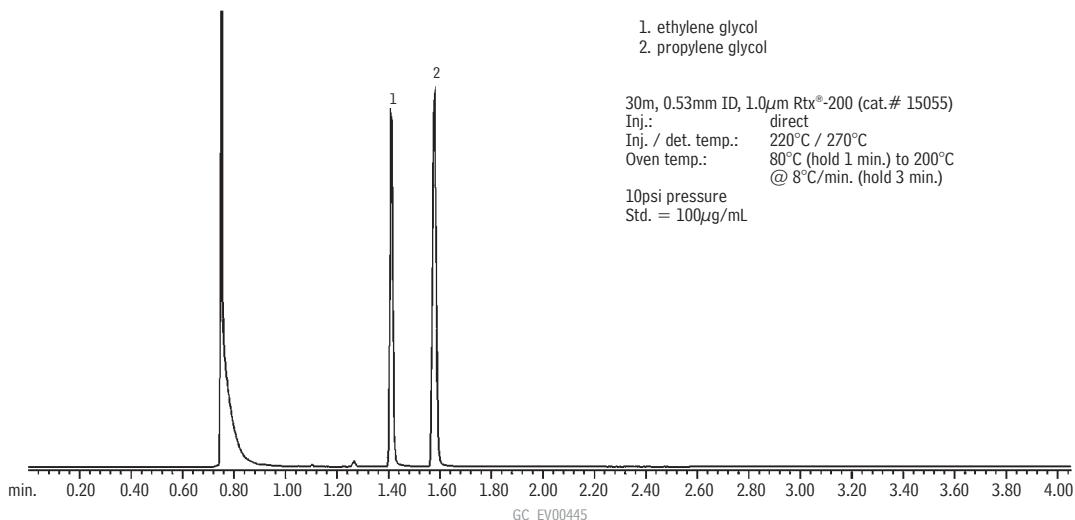
<sup>1</sup>A.L. Hilling and G. Smith, Environmental Testing & Analysis, 10(3), 15-19, 2001.

**Glycols**  
**Rtx®-Wax**



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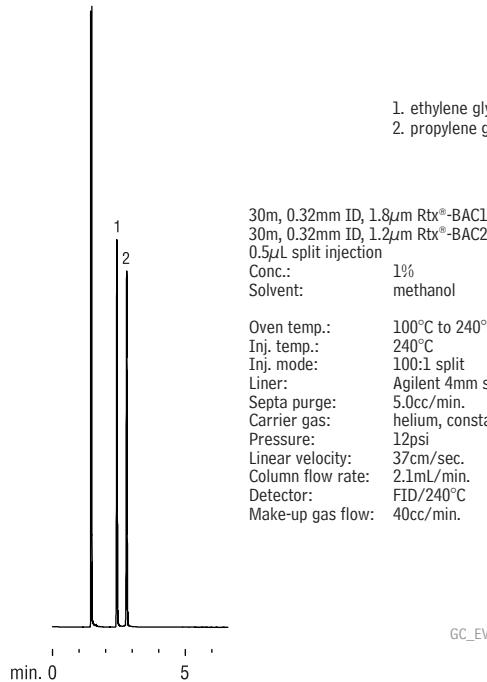
**Glycols**  
**Rtx®-200**



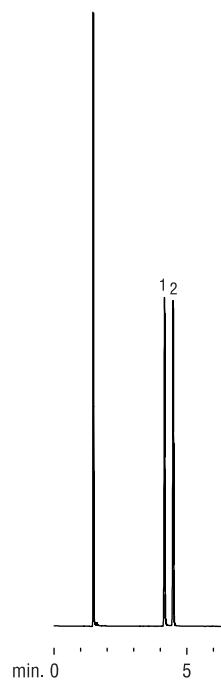
## Glycols

### Rtx®-BAC1 & Rtx®-BAC2

Rtx®-BAC1



Rtx®-BAC2



# Glycols

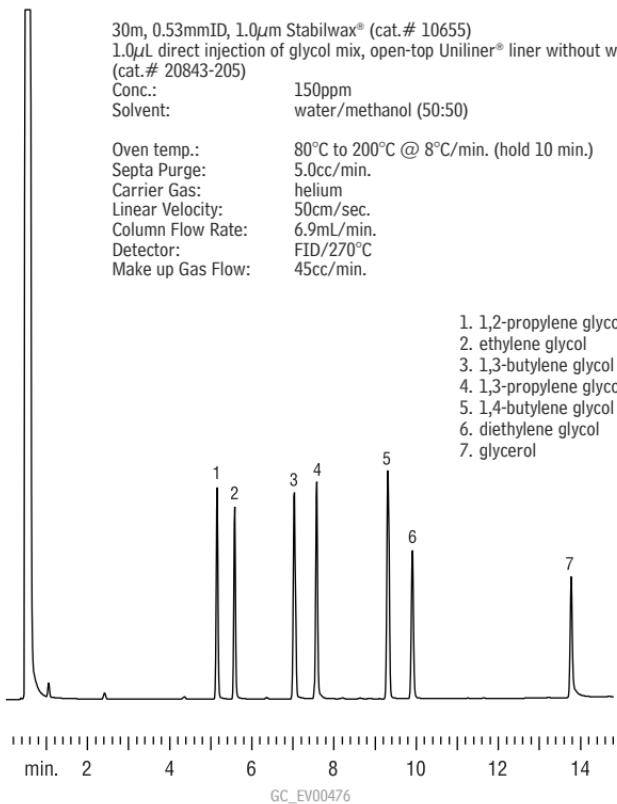
## Stabilwax®

30m, 0.53mmID, 1.0 $\mu$ m Stabilwax® (cat.# 10655)  
1.0 $\mu$ L direct injection of glycol mix, open-top Uniliner® liner without wool  
(cat.# 20843-205)

Conc.: 150ppm  
Solvent: water/methanol (50:50)

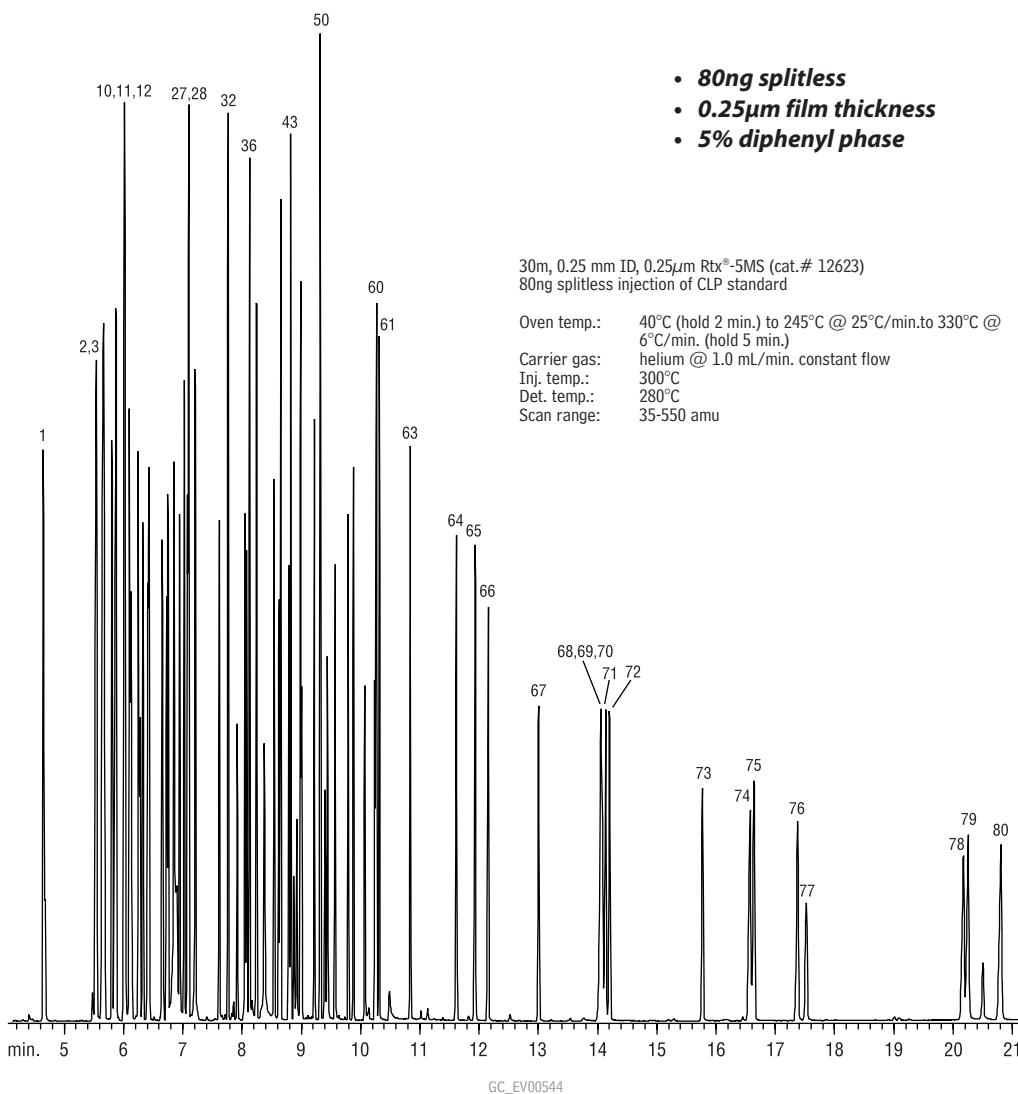
Oven temp.: 80°C to 200°C @ 8°C/min. (hold 10 min.)  
Septa Purge: 5.0cc/min.  
Carrier Gas: helium  
Linear Velocity: 50cm/sec.  
Column Flow Rate: 6.9mL/min.  
Detector: FID/270°C  
Make up Gas Flow: 45cc/min.

1. 1,2-propylene glycol
2. ethylene glycol
3. 1,3-butyleneglycol
4. 1,3-propylene glycol
5. 1,4-butyleneglycol
6. diethylene glycol
7. glycerol



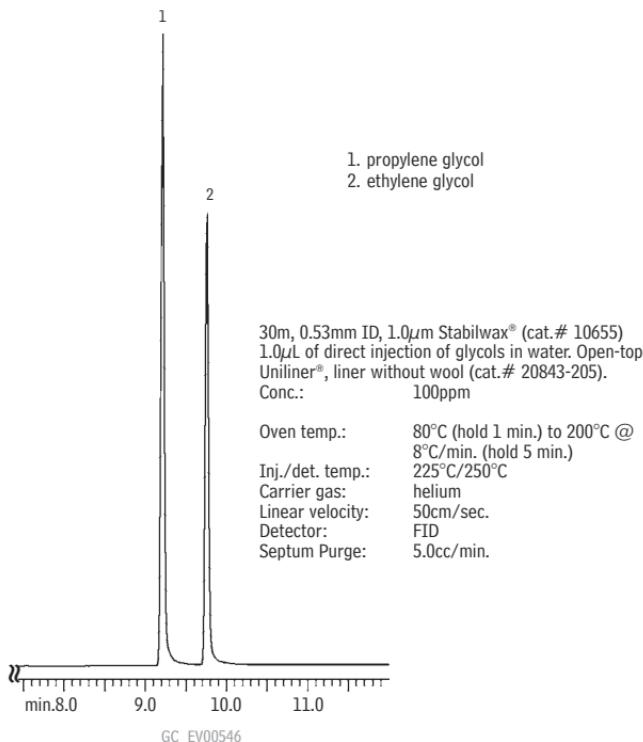
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**Semivolatiles**  
**CLP Method**  
**Rtx®-5MS**



1. 2-fluorophenol (SS)	RT	28. naphthalene	7.10	56. 4-bromophenyl phenyl ether	9.80
2. phenol-d6 (SS)	4.65	29. 4-chloroaniline	7.20	57. hexachlorobenzene	9.88
3. phenol	5.53	30. hexachlorobutadiene	7.21	58. pentachlorophenol	10.07
4. bis(2-chloroethyl)ether	5.55	31. 4-chloro-3-methylphenol	7.62	59. phenanthrene-d10 (IS)	10.24
5. 2-chlorophenol-d4 (SS)	5.64	32. 2-methylnaphthalene	7.77	60. phenanthrene	10.27
6. 2-chlorophenol	5.66	33. hexachlorocyclopentadiene	7.92	61. anthracene	10.32
7. 1,3-dichlorobenzene	5.67	34. 2,4,6-trichlorophenol	8.05	62. carbazole	10.49
8. 1,4-dichlorobenzene-d4 (IS)	5.81	35. 2,4,5-trichlorophenol	8.08	63. di-n-butylphthalate	10.84
9. 1,4-dichlorobenzene	5.86	36. 2-fluorobiphenyl (SS)	8.13	64. fluoranthene	11.62
10. 1,2-dichlorobenzene-d4 (IS)	5.87	37. 2-chloronaphthalene	8.25	65. pyrene	11.94
11. benzyl alcohol	6.01	38. 2-nitroaniline	8.38	66. p-terphenyl-d14 (SS)	12.16
12. 1,2-dichlorobenzene	6.03	39. dimethylphthalate	8.54	67. butyl benzyl phthalate	13.01
13. 2-methylphenol	6.10	40. 2,6-dinitrotoluene	8.62	68. benzo(a)anthracene	14.05
14. bis(2-chloroisopropyl)ether	6.13	41. acenaphthylene	8.66	69. 3,3'-dichlorobenzidine	14.06
15. 4-methylphenol/3-methylphenol	6.25	42. acenaphthene-d10 (IS)	8.79	70. chrysene-d12 (IS)	14.08
16. N-nitroso-di-n-propylamine	6.28	43. acenaphthene	8.83	71. chrysene	14.14
17. hexachloroethane	6.33	44. 3-nitroaniline	8.88	72. bis(2-ethylhexyl)phthalate	14.2
18. nitrobenzene-d5 (SS)	6.41	45. 2,4-dinitrophenol	8.88	73. di-n-octyl phthalate	15.77
19. nitrobenzene	6.43	46. 4-nitrophenol	8.92	74. benzo(b)fluoranthene	16.57
20. isophorone	6.66	47. dibenzofuran	8.99	75. benzo(k)fluoranthene	16.64
21. 2-nitrophenol	6.73	48. 2,4-dinitrotoluene	9.01	76. benzo(a)pyrene	17.38
22. 2,4-dimethylphenol	6.75	49. diethyl phthalate	9.22	77. perylene-d12 (IS)	17.52
23. bis(2-chloroethoxy)methane	6.85	50. 4-chlorophenyl phenyl ether	9.32	78. indeno(1,2,3-cd)pyrene	20.18
24. benzoic acid	6.91	51. fluorene	9.33	79. dibenzo(a,h)anthracene	20.26
25. 2,4-dichlorophenol	6.95	52. 4-nitroaniline	9.39	80. benzo(ghi)perylene	20.81
26. 1,2,4-trichlorobenzene	7.03	53. 2-methyl-4,6-dinitrophenol	9.40		
27. naphthalene-d8 (IS)	7.08	54. diphenylamine	9.44		
		55. 2,4,6-tribromophenol (SS)	9.57		

## Glycols Stabilwax®



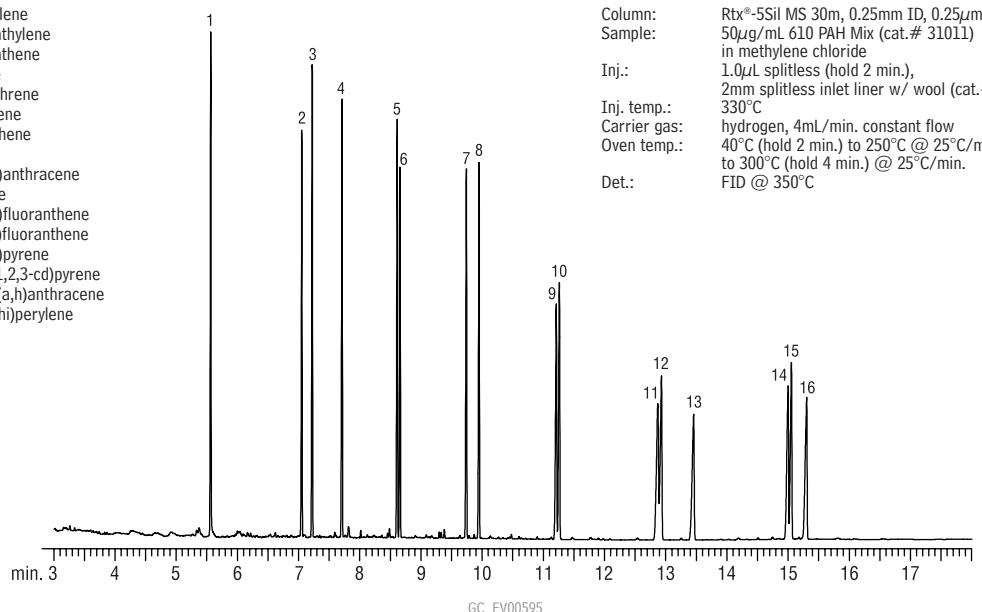
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## Polycyclic Aromatic Hydrocarbons

### US EPA Method 610

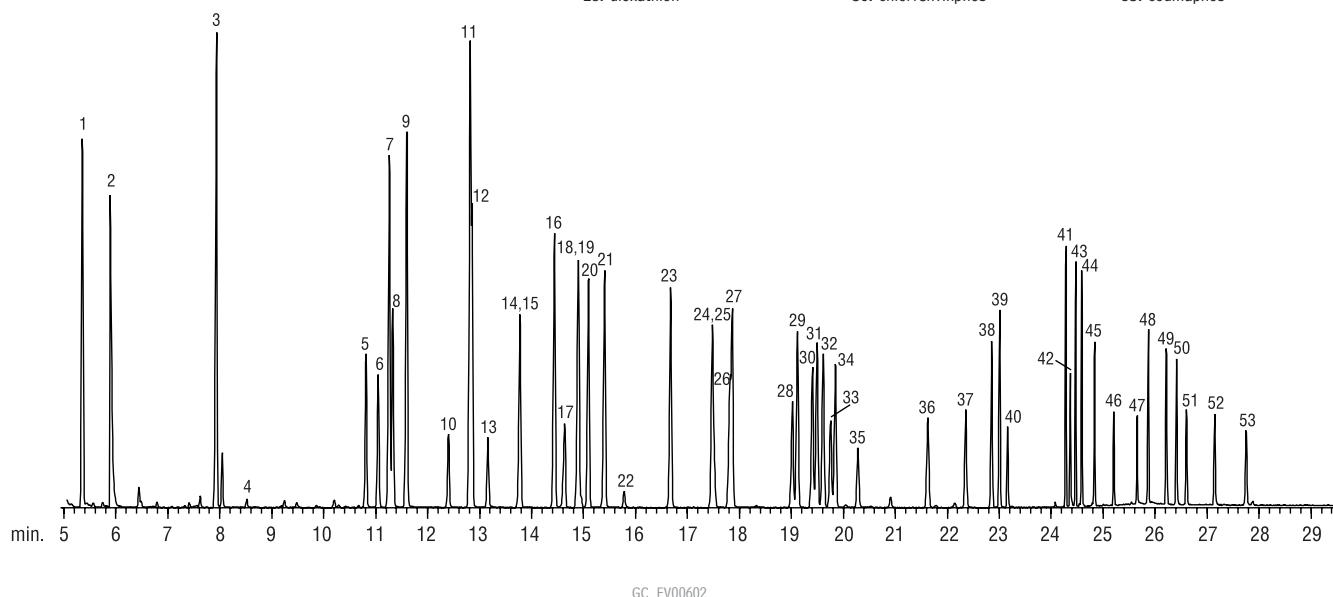
### Rtx®-5Sil MS

1. naphthalene
2. acenaphthylene
3. acenaphthene
4. fluorene
5. phenanthrene
6. anthracene
7. fluoranthene
8. pyrene
9. benzo(a)anthracene
10. chrysene
11. benzo(b)fluoranthene
12. benzo(k)fluoranthene
13. benzo(a)pyrene
14. indeno(1,2,3-cd)pyrene
15. dibenzo(a,h)anthracene
16. benzo(ghi)perylene



**Organophosphorus Pesticides**  
**US EPA Method 8141A**  
**Rtx®-OPPesticides2**

1. dichlorvos	19. fonophos	37. crotoxyphos
2. hexamethylphosphoramide	20. diazinon	38. stirofos
3. mevinphos	21. disulfoton	39. tokuthion
4. trichlorfon	22. phosphamidon isomer	40. merphos oxone (breakdown product)
5. TEPP	23. dichlorofenthion	41. ethion
6. demeton-O	24. chlorpyrifos methyl	42. fensulfothion
7. thionazin	25. phosphamidon	43. bolstar
8. tributyl phosphate (IS)	26. parathion-methyl	44. carbophenothion
9. ethoprop	27. ronnel	45. famphur
10. naled	28. fenitrothion	46. triphenyl phosphate (SS)
11. sulfotep	29. aspon	47. EPN
12. phorate	30. malathion	48. phosmet
13. dicropthos	31. chlorpyrifos	49. leptophos
14. demeton-S	32. trichloronate	50. tri-o-cresyl phosphate
15. monocrotophos	33. parathion-ethyl	51. azinphos-methyl
16. terbufos	34. fenthion	52. azinphos-ethyl
17. dimethoate	35. merphos	53. coumaphos
18. dioxathion	36. chlorfenvinphos	



Column:	Rtx®-OPPesticides2, 30m, 0.25mm ID, 0.25µm (cat.# 11243)	Inj. temp.:	250°C
Sample:	US EPA Method 8141A Custom Standard Mix 1µL 100ppm (100ng on column)	Carrier gas:	helium, constant flow
	Triphenylphosphate Standard (cat.# 32281)	Flow rate:	1.0mL/min.
	Tributylphosphate Standard (cat.# 32280)	Oven temp.:	80°C (hold 0.5 min.) to 140°C @ 20°C/min.
	8140/8141 OP Pesticides Calibration Mix A (cat.# 32277)		to 210°C @ 4°C/min. (hold 1 min.) to 280°C @ 30°C (hold 5 min.)
	8141 OP Pesticides Calibration Mix B (cat.# 32278)	Det:	MS
Inj.:	Custom Standard Mixes: Call Restek for More Information	Transfer line temp.:	280°C
	1.0µL splitless (hold 0.4 min.), 4mm double	Scan range:	35-400amu
	gooseneck inlet liner (cat.# 20785)	Ionization:	EI

## Triazine Herbicides (French) & Degradation Products Rtx®-OPPesticides2

Rtx®-OPPesticides2 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 11243)

Sample: custom standard, 100ng/ $\mu$ L each component

Inj.: 1.0 $\mu$ L splitless (hold 0.5 min.), 4mm single gooseneck inlet liner (cat.# 20904)

Inj. temp.: 300°C

Carrier gas: helium, constant pressure

Flow rate: 1.0mL/min @ 80°C (27.22cm/sec)

Oven temp.: 80°C (hold 1 min.) to 140°C @ 25°C/min. (hold 5 min.) to 165°C @ 1°C/min. to 300°C @ 15°C (hold 1 min.)

Det: Agilent 5971A GC/MS

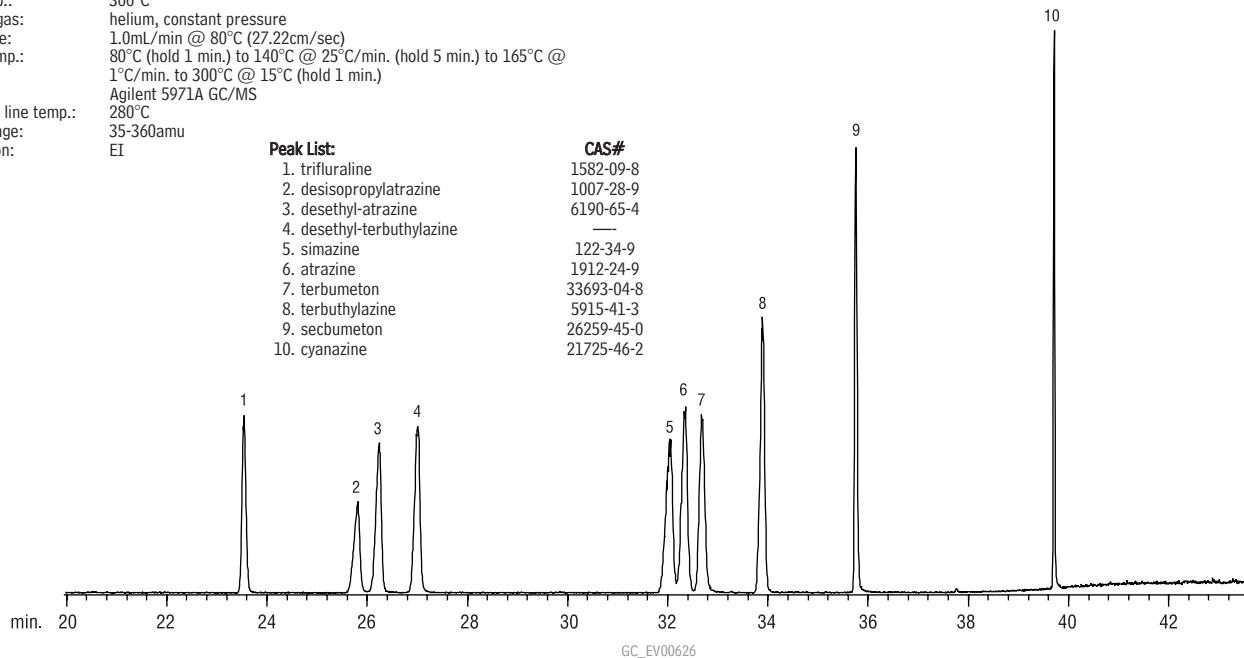
Transfer line temp.: 280°C

Scan range: 35-360amu

Ionization: EI

### Peak List:

	CAS#
1. trifluraline	1582-09-8
2. desisopropylatrazine	1007-28-9
3. desethyl-atrazine	6190-65-4
4. desethyl-terbutylazine	—
5. simazine	122-34-9
6. atrazine	1912-24-9
7. terbumeton	33693-04-8
8. terbutylazine	5915-41-3
9. secbumeton	26259-45-0
10. cyanazine	21725-46-2



# Organophosphorus Pesticides (European)

## Rtx®-CLPesticides

Rtx®-CLPesticides, 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 11123)

Sample: Custom European Mix (call for details)  
 1-bromo-2-nitrobenzene cat.# 32279  
 4-chloro-3-nitrobenzotrifluoride cat.# 32282  
 tributylphosphate cat.# 32280  
 triphenylphosphate cat.# 32281

Inj.: 1.0 $\mu$ L splitless (hold 0.4 min.)  
 4mm double gooseneck inlet liner (cat.# 20785)

Inj. temp.: 250°C

Carrier gas: helium, constant flow, 6 psi head pressure

Flow rate: 0.75mL/min.

Linear velocity: 28cm/sec.\*

Dead time: 1.82 min. @ 80°C

Oven temp.: 80°C (hold 1.0 min.) to 150°C @ 7°C/min. (no hold)  
 to 280°C @ 15°C/min. (hold 7 min.)

Det.: Agilent 5971A GC/MS

Transfer line temp.: 280°C

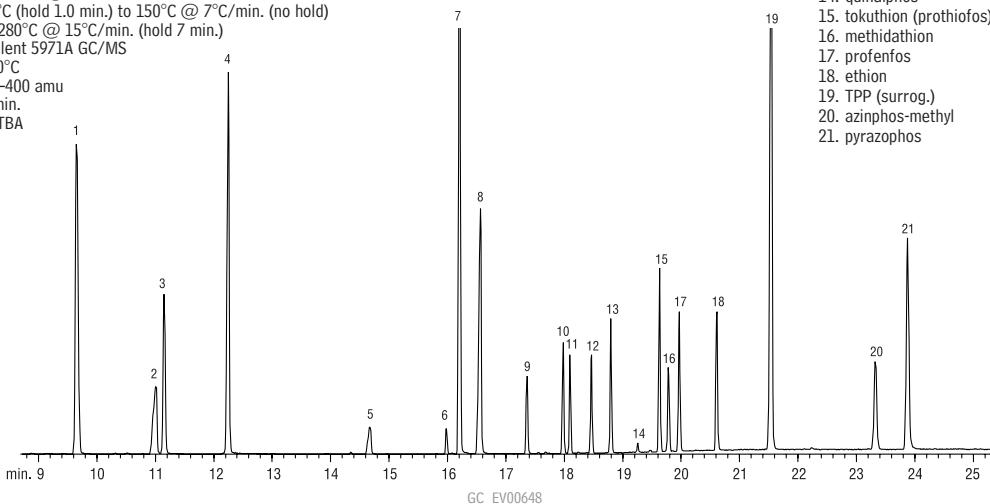
Scan range: 35–400 amu

Solvent Delay 5 min.

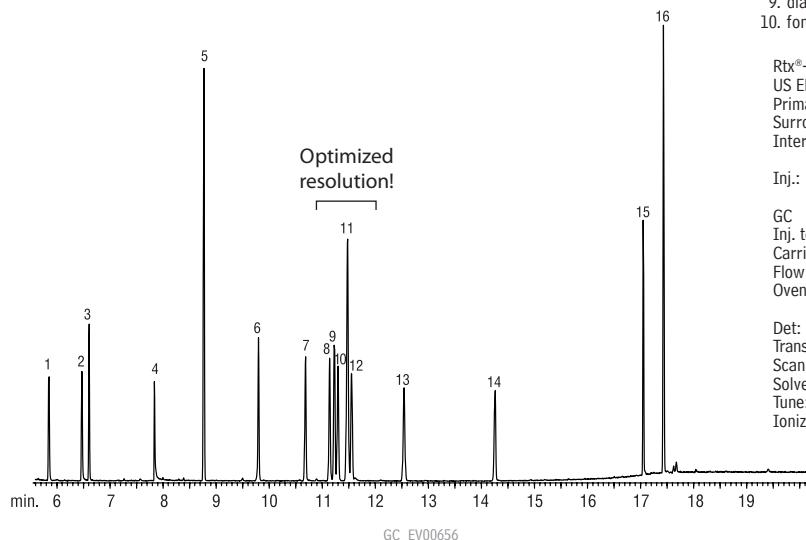
Tune PFTBA

Ionization: EI

Compound	Conc. on-column (ng)
1. 4-chloro-3-nitro-trifluoride	100
2. methamidophos	50
3. dichlorvos	50
4. 1-bromo-2-nitrobenzene	100
5. acephate	20
6. demeton-S-methyl	20
7. TBP (int. std.)	100
8. omethoate	100
9. dimethoate	20
10. tolclofos-methyl	10
11. pirimiphos methyl	10
12. chloryprifos	10
13. malathion	20
14. quinalphos	10
15. tokuthion (prothiofos)	20
16. methidathion	20
17. profenfos	20
18. ethion	20
19. TPP (surrog.)	100
20. azinphos-methyl	40
21. pyrazophos	50



**Semivolatile Organics**  
**US EPA Method 526 (Screening)**  
**Rtx®-5Sil MS**

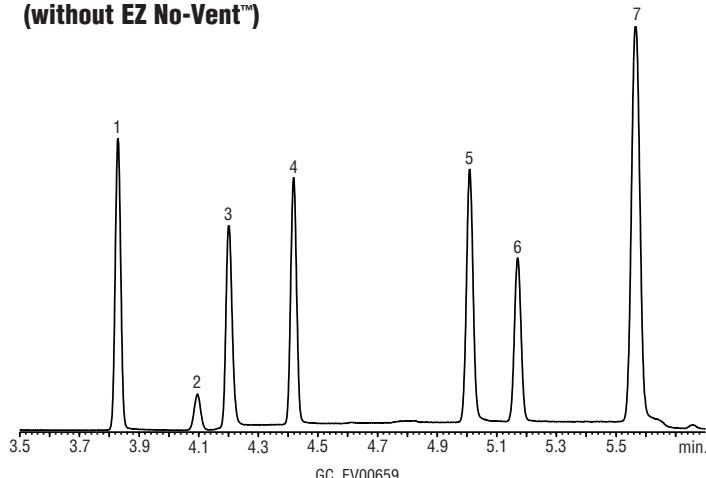


1. nitrobenzene
  2. 2,4-dichlorophenol
  3. 1,3-dimethyl-2-nitrobenzene (ss)
  4. 2,4,6-trichlorophenol
  5. acenaphthene-d10 (IS#1)
  6. azobenzene\*
  7. prometon
  8. terbufos
  9. diazinon
  10. fonofos
  11. phenanthrene-d10 (IS#2)
  12. disulfoton
  13. acetochlor
  14. cyanazine
  15. triphenylphosphate (ss)
  16. chrysene-d12
- \* Compound listed in method,  
1,2-diphenylhydrazine, decomposes to  
azobenzene.

Rtx®-5Sil MS, 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 12723)  
 US EPA Method 526 Mix 1 $\mu$ L 10ppm (20ppm IS)  
 Primary Dilution Standard / Semivolatiles/ EPA 526 cat.# 31691  
 Surrogate Standard / Method 526 cat.# 31693  
 Internal Standard / Method 526 cat.# 31692

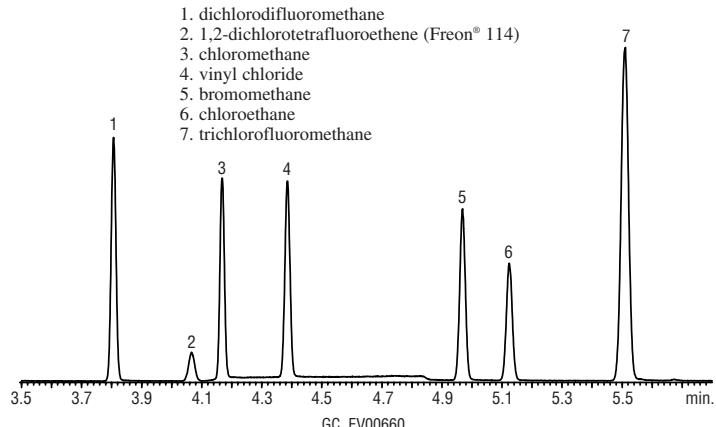
Inj.: 1.0 $\mu$ L splitless (hold 0.3 min.),  
 4mm Drilled Uniliner® (cat.# 21055)  
 GC Agilent 6890  
 Inj. temp.: 300°C  
 Carrier gas: helium, constant flow  
 Flow rate: 0.8 mL/min.  
 Oven temp.: 50°C (hold 1 min.) to 200°C @ 20°C/min. (hold 5 min.)  
 to 310°C @ 30°C/min. (hold 3 min.)  
 Det: Agilent 5973 GC/MS  
 Transfer line temp.: 280°C  
 Scan range: 35-550 amu  
 Solvent delay: 5.5 min.  
 Tune: DFTPP  
 Ionization: EI

**EZ No-Vent™ Chromatogram  
(without EZ No-Vent™)**



Rtx®-624 60m, 0.25mm ID, 1.4 $\mu$ m (cat# 10969), column direct to source.  
Volatile Gas Mix 502.2 Calibration Mix#1 (gases) cat# 30042

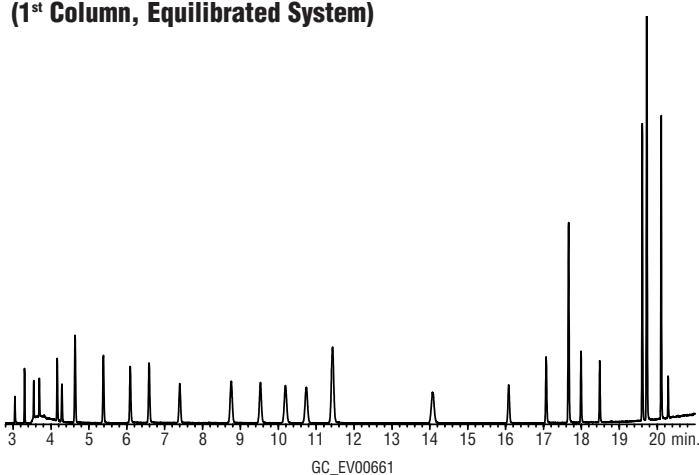
**EZ No-Vent™ Chromatogram  
(with EZ No-Vent™)**



Rtx®-624 60m, 0.25mm ID, 1.4 $\mu$ m (cat# 10969) using EZ NO Vent.  
Volatile Gas Mix 502.2 Calibration Mix#1 (gases) cat# 30042

Inj.: purge & trap  
GC Agilent 6890  
Inj. temp.: 300°C  
Carrier gas: helium, constant flow  
Flow rate: 1.0mL/min.  
Oven temp.: 60°C isothermal  
Det: Agilent 5973 GC/MS  
Transfer line temp.: 280°C  
Scan range: 35-550 amu  
Tune BFB  
Ionization: EI

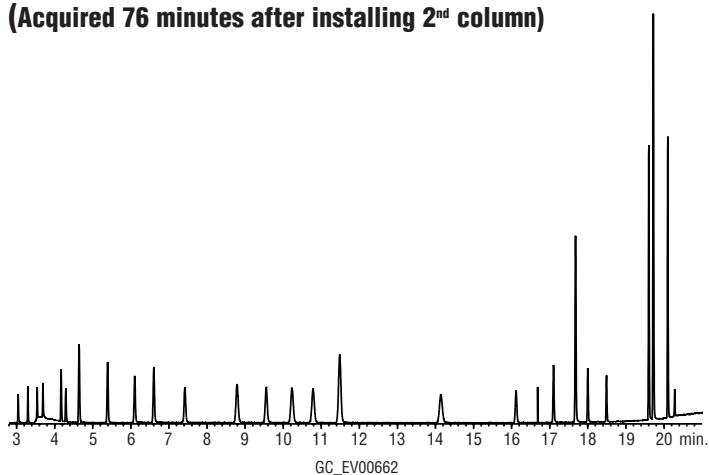
**EZ No-Vent™ Chromatogram  
(1<sup>st</sup> Column, Equilibrated System)**



Rtx®-624 60m, 0.25mm ID, 1.4 $\mu$ m (cat# 10969) using Ez-No Vent™, column #1, equilibrated system.  
Halogenated Volatiles @ 200 ppb in 5mL/RO water.  
502.2 Calibration Mix#1 (gases) cat# 30042  
502.2 Calibration Mix#2 cat# 30043  
BTEX standard cat# 30213

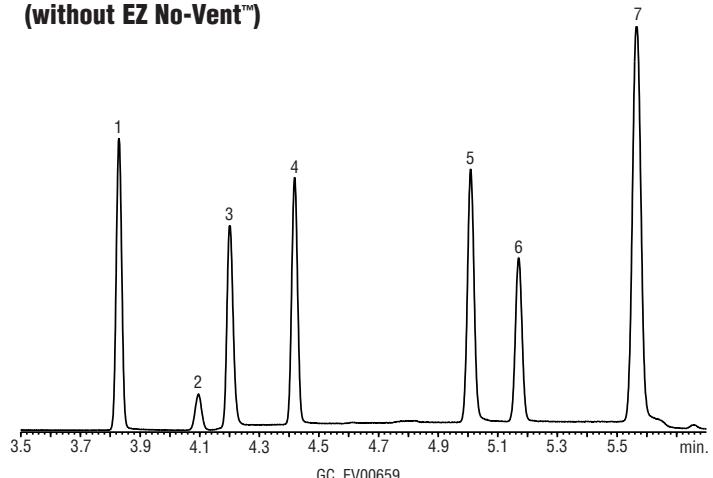
Inj.: purge & trap  
GC Agilent 6890  
Inj. temp.: 300°C  
Carrier gas: helium, constant flow  
Flow rate: 1.0mL/min.  
Oven temp.: 60°C (hold 15 min) to 220°C @ 30°C/min (hold 1 min).  
Det: Agilent 5973 GC/MS  
Transfer line temp.: 280°C  
Scan range: 35-550 amu  
Tune BFB  
Ionization: EI

**EZ No-Vent™ Chromatogram  
(Acquired 76 minutes after installing 2<sup>nd</sup> column)**



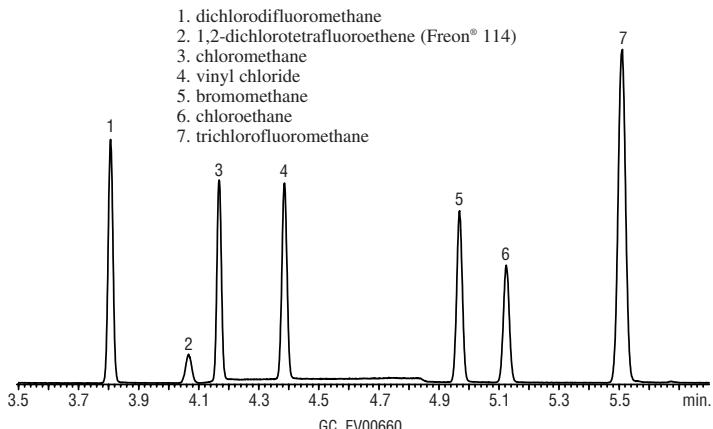
Rtx®-624 60m, 0.25mm ID, 1.4 $\mu$ m (cat# 10969) using Ez-No Vent™,  
acquired 76 min. after installing new column.  
Halogenated Volatiles @ 200 ppb in 5mL/RO water.  
502.2 Calibration Mix#1 (gases) cat# 30042  
502.2 Calibration Mix#2 cat# 30043  
BTEX standard cat# 30213

**EZ No-Vent™ Chromatogram  
(without EZ No-Vent™)**



Rtx®-624 60m, 0.25mm ID, 1.4 $\mu$ m (cat# 10969), column direct to source.  
Volatile Gas Mix 502.2 Calibration Mix#1 (gases) cat# 30042

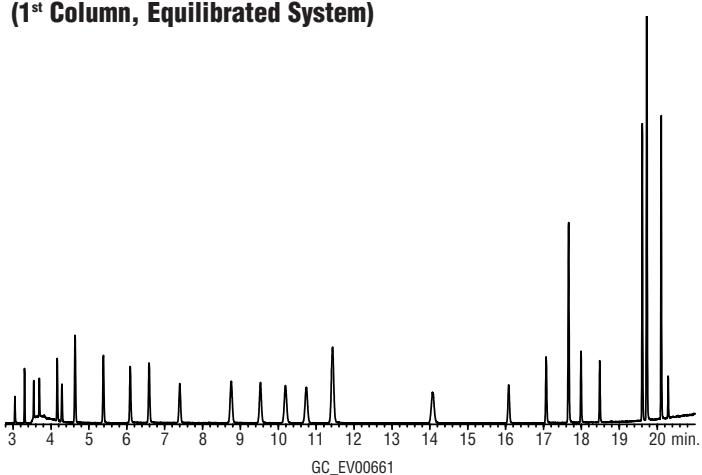
**EZ No-Vent™ Chromatogram  
(with EZ No-Vent™)**



Rtx®-624 60m, 0.25mm ID, 1.4 $\mu$ m (cat# 10969) using EZ NO Vent.  
Volatile Gas Mix 502.2 Calibration Mix#1 (gases) cat# 30042

Inj.: purge & trap  
GC Agilent 6890  
Inj. temp.: 300°C  
Carrier gas: helium, constant flow  
Flow rate: 1.0mL/min.  
Oven temp.: 60°C isothermal  
Det: Agilent 5973 GC/MS  
Transfer line temp.: 280°C  
Scan range: 35-550 amu  
Tune BFB  
Ionization: EI

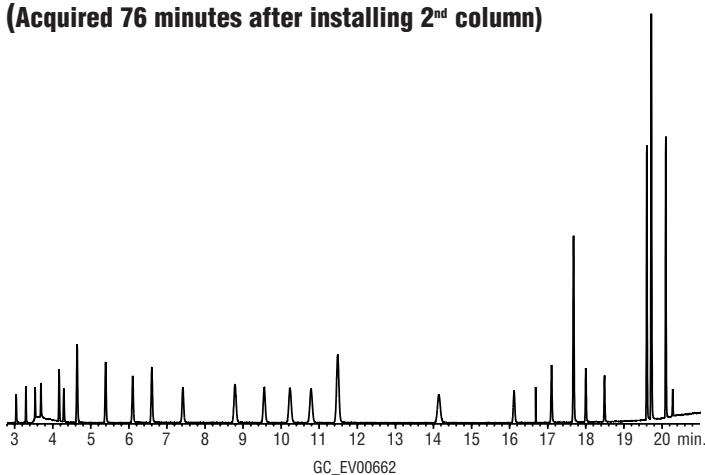
**EZ No-Vent™ Chromatogram  
(1<sup>st</sup> Column, Equilibrated System)**



Rtx®-624 60m, 0.25mm ID, 1.4 $\mu$ m (cat# 10969) using Ez-No Vent™, column #1, equilibrated system.  
Halogenated Volatiles @ 200 ppb in 5mL/RO water.  
502.2 Calibration Mix#1 (gases) cat# 30042  
502.2 Calibration Mix#2 cat# 30043  
BTEX standard cat# 30213

Inj.: purge & trap  
GC Agilent 6890  
Inj. temp.: 300°C  
Carrier gas: helium, constant flow  
Flow rate: 1.0mL/min.  
Oven temp.: 60°C (hold 15 min) to 220°C @ 30°C/min (hold 1 min).  
Det: Agilent 5973 GC/MS  
Transfer line temp.: 280°C  
Scan range: 35-550 amu  
Tune BFB  
Ionization: EI

**EZ No-Vent™ Chromatogram  
(Acquired 76 minutes after installing 2<sup>nd</sup> column)**

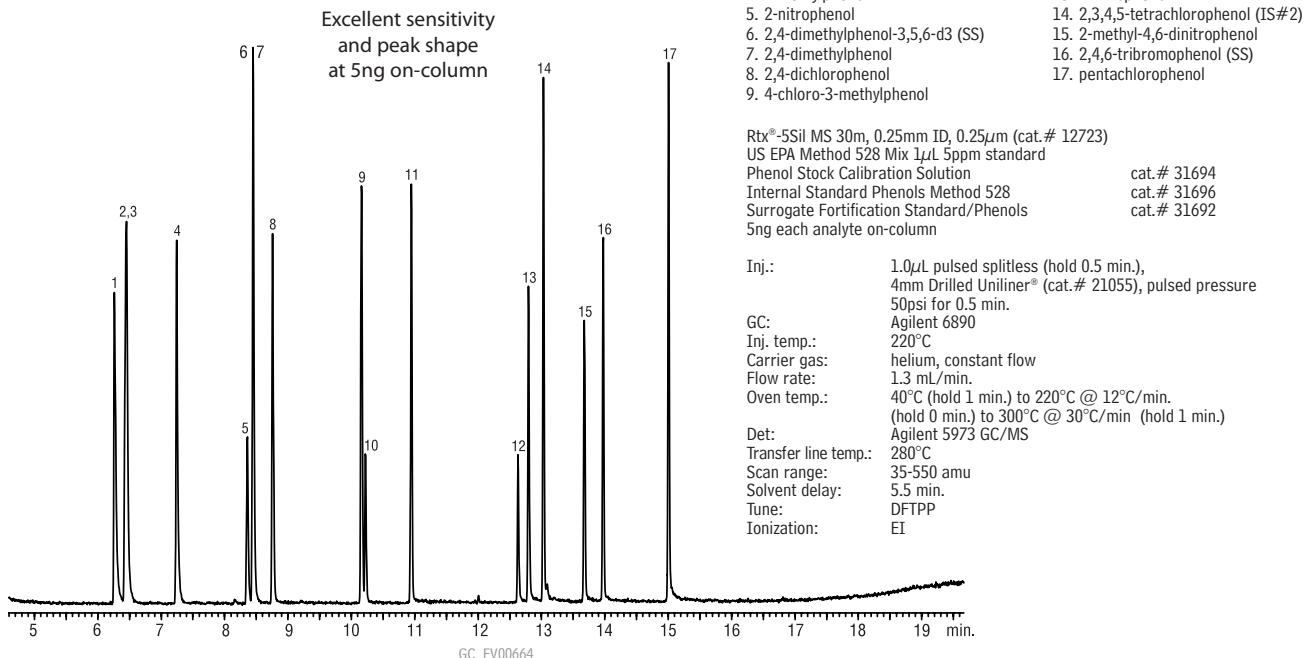


Rtx®-624 60m, 0.25mm ID, 1.4 $\mu$ m (cat# 10969) using Ez-No Vent™,  
acquired 76 min. after installing new column.  
Halogenated Volatiles @ 200 ppb in 5mL/RO water.  
502.2 Calibration Mix#1 (gases) cat# 30042  
502.2 Calibration Mix#2 cat# 30043  
BTEX standard cat# 30213

## Phenols

### US EPA Method 528

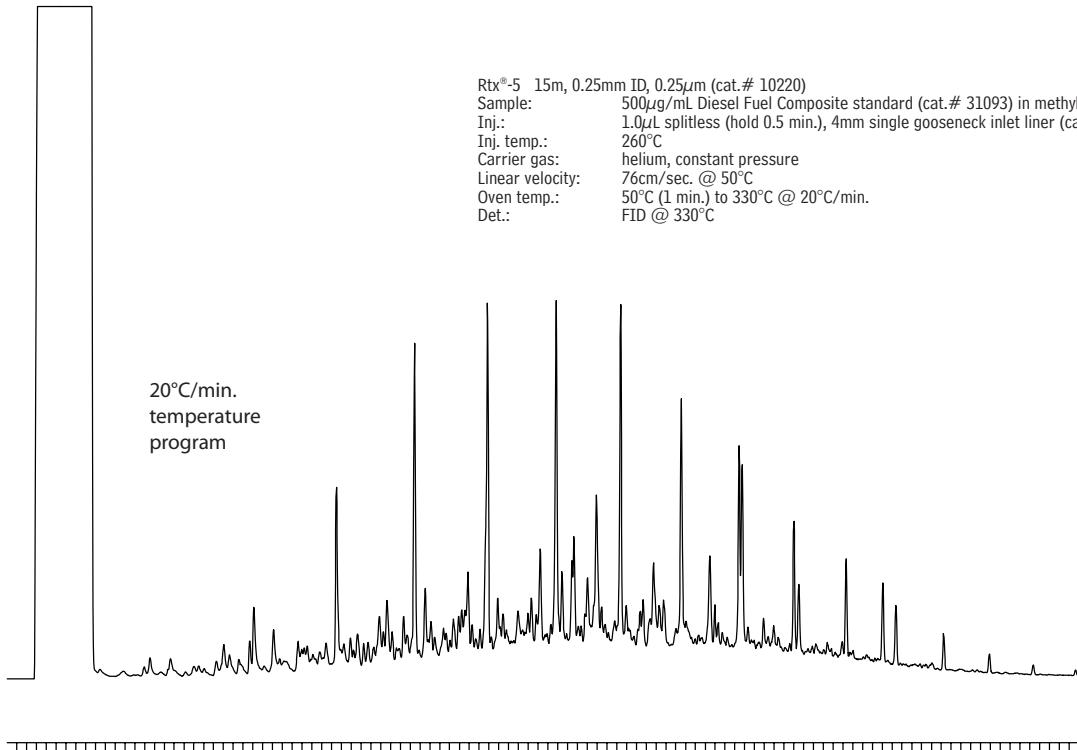
#### Rtx®-5Sil MS



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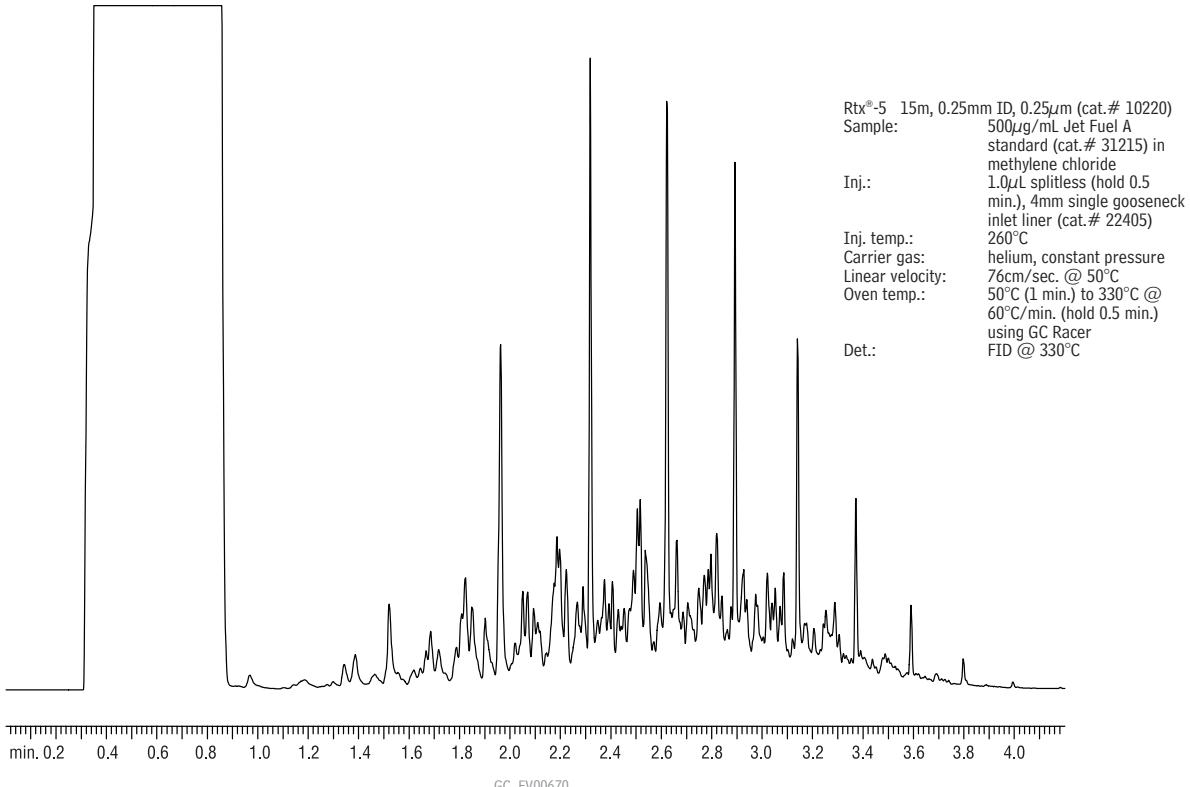
## Diesel Fuel

Rtx®-5



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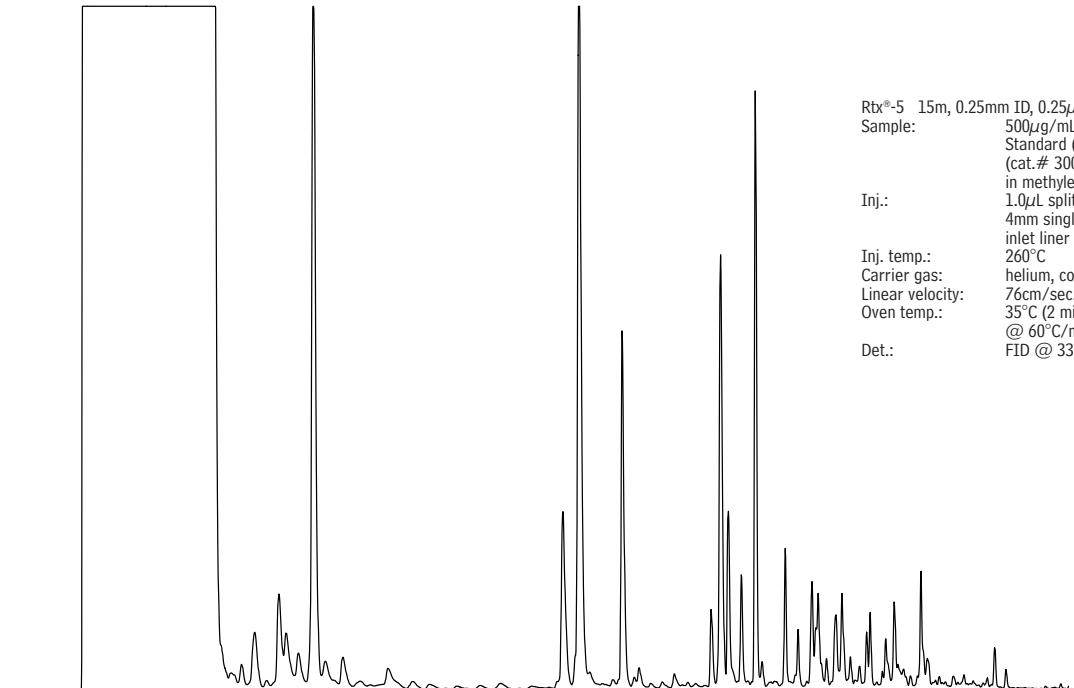
**Jet Fuel  
Rtx®-5**



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## Unleaded Gasoline

Rtx®-5



Rtx®-5 15m, 0.25mm ID, 0.25 $\mu$ m (cat.# 10220)  
Sample: 500 $\mu$ g/mL Unleaded Gasoline  
Standard (unweathered)  
(cat.# 30096)  
in methylene chloride  
Inj.: 1.0 $\mu$ L splitless (hold 0.5 min.),  
4mm single gooseneck  
inlet liner (cat.# 20904)  
Inj. temp.: 260°C  
Carrier gas: helium, constant pressure  
Linear velocity: 76cm/sec. @ 50°C  
Oven temp.: 35°C (2 min.) to 330°C  
@ 60°C/min. using GC Racer  
Det.: FID @ 330°C

min. 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2 4.4

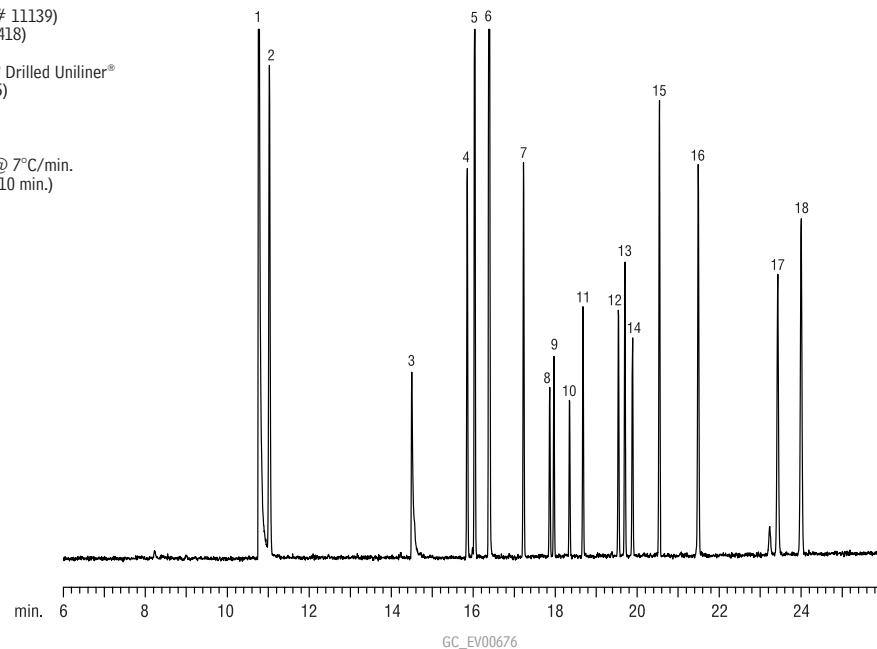
GC\_EV00671

Restek Corporation 110 Benner Circle Bellefonte, PA 16823  
814-353-1300 • 800-356-1688 • Fax: 814-353-1309 • [www.restek.com](http://www.restek.com)

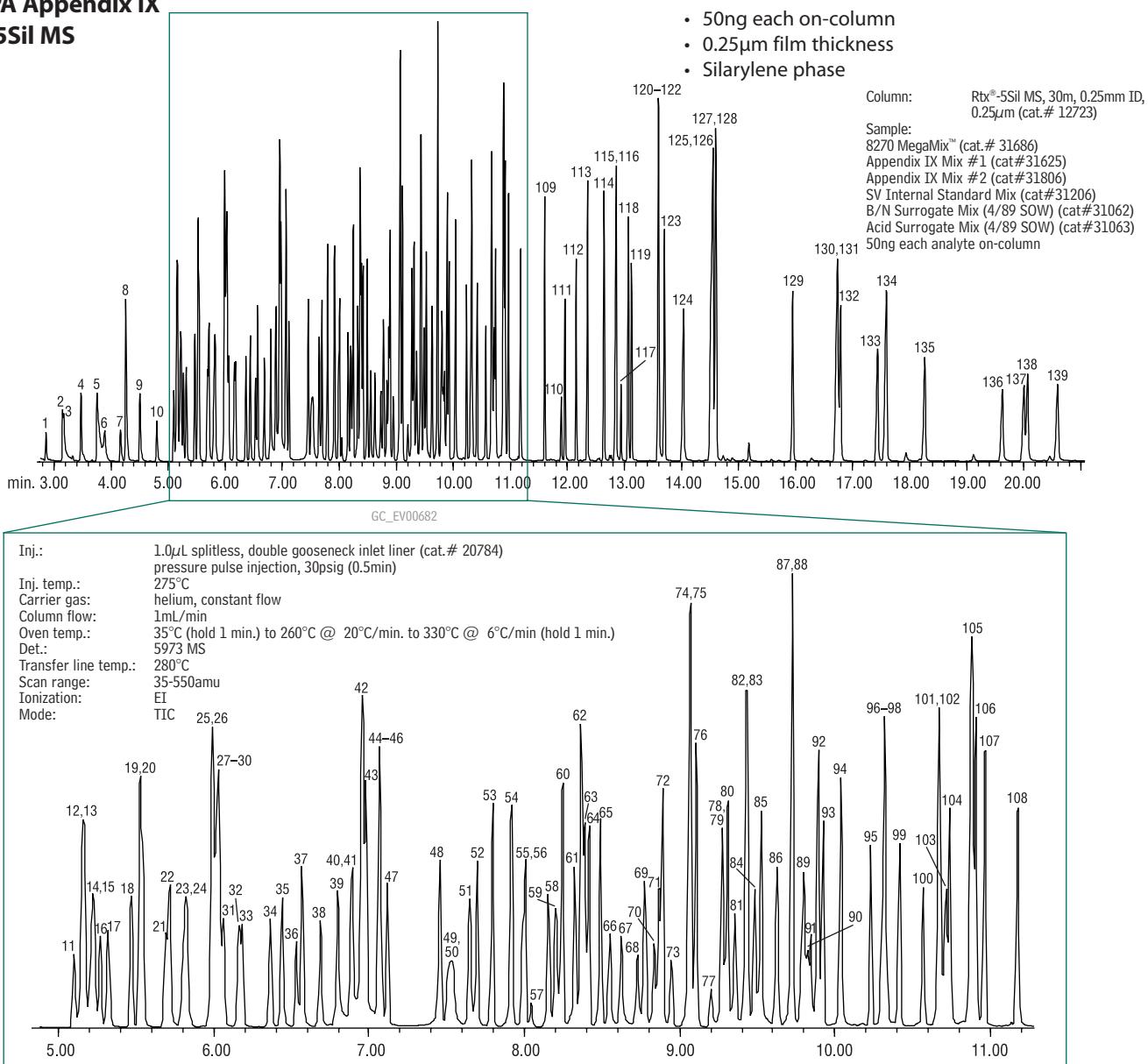
## Organophosphorus Pesticides (European) Rtx®-CLPesticides

Rtx®-CLPesticides 30m, 0.32mm ID, 0.50 $\mu$ m (cat.# 11139)  
Sample: European OPP Mix (cat.# 32418)  
100–1000 $\mu$ g/mL in acetone  
Inj.: 0.5 $\mu$ L direct, open-top Siltek® Drilled Uniliner®  
inlet liner (cat.# 21055-214.5)  
Inj. temp.: 250°C  
Carrier gas: helium, constant pressure  
Linear velocity: 35cm/sec. @ 80°C  
Oven temp.: 80°C (hold 1 min.) to 150°C @ 7°C/min.  
to 280°C @ 15°C/min. (hold 10 min.)  
Det.: FPD @ 280°C

Concentration on-column (ng)	
1. methamidophos	1.25
2. dichlorvos	1.25
3. acephate	0.50
4. demeton-S-methyl	0.50
5. tributylphosphate (IS)	1.25
6. omethoate	2.50
7. dimethoate	0.50
8. tolclofos-methyl	0.25
9. pirimiphos methyl	0.25
10. chlorpyriphos	0.25
11. malathion	0.50
12. tokuthion	0.50
13. methidathion	0.50
14. profenfos	0.50
15. ethion	0.50
16. triphenylphosphate (surrog.)	1.25
17. azinphos-methyl	1.00
18. pyrazophos	1.25

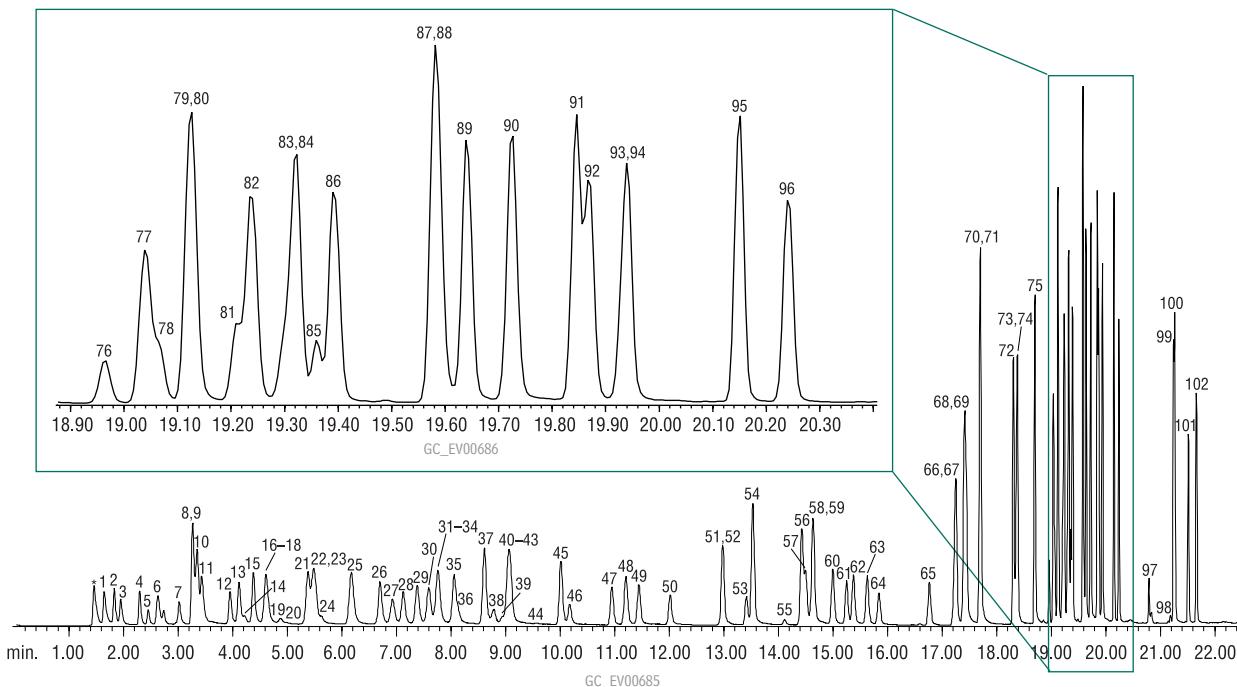


**Semivolatile  
Organics  
US EPA Appendix IX  
Rtx®-5Sil MS**



1. 1,4-dioxane	24. bis(2-chloroisopropyl)ether	47. hexachlorobutadiene	71. 2,6-dinitrotoluene	95. diallate	119. dichlorobenzilate
2. pyridine	25. acetophenone	48. N-nitroso-n-butylamine	72. acenaphthylene	96. 1,3,5-trinitrobenzene	120. 3,3-dimethylbenzidine
3. N-nitrosodimethylamine	26a. 4-methylphenol	49. 1,4-phenylenediamine	73. 1,2-dinitrobenzene	97. phenacetin	121. butyl benzyl phthalate
4. ethyl methacrylate	26b. 3-methylphenol	50. caprolactam	74. 3-nitroaniline	98. 4-bromophenyl phenyl ether	122. Kepone
5. 2-picoline	27. N-nitroso-di-n-propylamine	51. 4-chloro-3-methylphenol	75. acenaphthene-d10 (IS)	99. hexachlorobenzene	123. bis(2-ethylhexyl)adipate
6. N-nitrosomethylethylamine	28. nitrosopyrrolidine	52. isosafrole	76. acenaphthene	100. atrazine	124. 2-acetylaminofluorene
7. methyl methanesulfonate	29. o-toluidine	53. 2-methylnaphthalene	77. 2,4-dinitrophenol	101. 4-aminobiphenyl	125. benz(a)anthracene
8. 2-fluorophenol	30. 4-nitrosomorpholine	54. 1-methylnaphthalene	78. pentachlorobenzene	102. pentachlorophenol	126. chrysene-d12 (IS)
9. N-nitrosodiethylamine	31. hexachloroethane	55. hexachlorocyclopentadiene	79. 4-nitrophenol	103. pentachloronitrobenzene	127. chrysene
10. ethyl methanesulfonate	32. nitrobenzene-d5 (SS)	56. 1,2,4,5-tetrachlorobenzene	80. dibenzofuran	104. propyzamide	128. bis(2-ethylhexyl)phthalate
11. benzaldehyde	33. nitrobenzene	57. isosafole	81. 2,4-dinitrotoluene	105. phenanthrene-d10 (IS)	129. di-n-octyl phthalate
12. phenol-d6 (SS)	34. N-nitrosopiperidine	58. 2,4,6-trichlorophenol	82. 1-naphthalamine	106. phenanthrene	130. benzo(b)fluoranthene
13. phenol	35. isophorone	59. 2,4,5-trichlorophenol	83. 2,3,4,6-tetrachlorophenol	107. anthracene	131. 7,12-dimethylbenzo(a)anthracene
14. aniline	36. 2-nitrophenol	60. 2-fluorobiphenyl (SS)	84. 2,3,5,6-tetrachlorophenol	108. carbazole	132. benzo(k)fluoranthene
15. pentachloroethane	37. 2,4-dimethylphenol	61. safrole	85. 2-naphthylamine	109. di-n-butylphthalate	133. benzo(a)pyrene
16. bis(2-chloroethyl)ether	38. bis(2-chloroethoxy)methane	62. biphenyl	86. diethyl phthalate	110. 4-nitroquinoline-1-oxide	134. perylene-d12 (IS)
17. 2-chlorophenol	39. 2,4-dichlorophenol	63. 2-chloronaphthalene	87. fluorene	111. methapyrilene	135. 3-methylcholanthrene
18. 1,3-dichlorobenzene	40. 1,2,4-trichlorobenzene	64. 1-chloronaphthalene	88. 4-chlorophenyl phenyl ether	112. isodrin	136. dibenz(a,j)acridine
19. 1,4-dichlorobenzene-d4 (IS)	41. $\alpha,\omega$ -dimethylphenylamine	65. diphenyl ether	89. 2-methyl-5-nitroaniline	113. fluoranthene	137. indeno(1,2,3-cd)pyrene
20. 1,4-dichlorobenzene	42. naphthalene-d8 (IS)	66. 2-nitroaniline	90. 4-nitroaniline	114. pyrene	138. dibenz(a,h)anthracene
21. benzyl alcohol	43. naphthalene	67. 1,4-naphthoquinone	91. 4,6-dinitro-2-methylphenol	115. Aramite (isomer)	139. benzo(ghi)perylene
22. 1,2-dichlorobenzene	44. 2,6-dichlorophenol	68. 1,4-dinitrobenzene	92. diphenylamine	116. $\rho$ -terphenyl-d14 (SS)	
23. 2-methylphenol	45. 4-chloroaniline	69. dimethylphthalate	93. azobenzene	117. Aramite (isomer)	
	46. hexachloropropene	70. 1,3-dinitrobenzene	94. 2,4,6-tribromophenol (SS)	118. dimethylaminoazobenzene	

**Volatile Organics**  
**US EPA Method 8260 (80ppb Standard)**  
**Rtx®-VMS**



Column: Rtx®-VMS, 30m, 0.25mm ID, 1.4 $\mu$ m (cat.# 19915)  
 Sample: Calibration, internal standard, surrogate standard mixes (cat.# 30475B, 30465, 30006, 30240, 30074)

Transfer Line: 110°C  
 Sparge Mount: 45°C  
 Desorb Preheat: 150°C  
 Valve Manifold: 50°C  
 Other Conditions: pre-purge, pre-heat, dry purge OFF

**Chromatography:**  
 Trap: #10 (Tenax®/silica gel/carbon molecular sieve)  
 Purge Time: 11 min.  
 Purge Flow Rate: 38mL/min.  
 Desorb Flow Rate: 32mL/min.  
 Desorb Time: 1.0 min.  
 Bake Time: 10 min.  
 Sample Size: 10mL  
 Water Management: 110°C purge, 0°C desorb, 240°C bake  
 Split Ratio: 1:25  
 Det.: Agilent 5971A GC/MS  
 Transfer line temp.: 280°C  
 Scan range: 35-260 amu  
 Tune: PFTBA/BFB

**Purge and trap conditions:**

Trap: #10 (Tenax®/silica gel/carbon molecular sieve)  
 Purge Time: 11 min.  
 Purge Flow Rate: 38mL/min.  
 Desorb Flow Rate: 32mL/min.  
 Desorb Time: 1.0 min.  
 Bake Time: 10 min.  
 Sample Size: 10mL  
 Water Management: 110°C purge, 0°C desorb, 240°C bake  
 Split Ratio: 1:25  
 Temperatures:  
 Sample: 40°C  
 Trap: 20°C purge, 190°C desorb, 210°C bake  
 6-Port Valve: 110°C

\*carbon dioxide

1. dichlorodifluoromethane
2. chloromethane
3. vinyl chloride
4. bromomethane
5. chloroethane
6. trichlorofluoromethane
7. diethylene
8. 1,1-dichloroethene
9. carbon disulfide
10. Freon® 113
11. iodomethane
12. allyl chloride
13. methylene chloride
14. acetone
15. *trans*-1,2-dichloroethene
16. methyl-d3-*tert*-butyl-ether
17. methyl acetate
18. methyl-*tert*-butyl-ether
19. *tert*-butyl alcohol
20. acetonitrile
21. diisopropyl ether
22. chloroprene
23. 1,1-dichloroethane
24. acrylonitrile
25. ethyl-*tert*-butyl ether

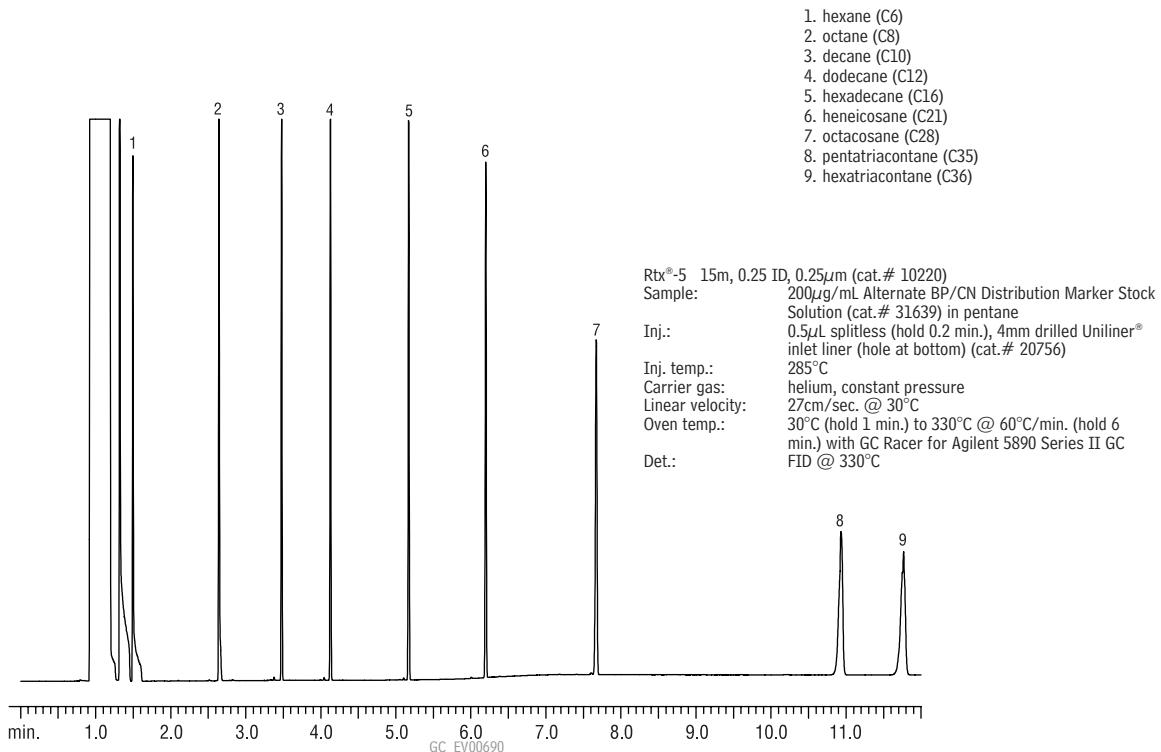
26. *cis*-1,2-dichloroethene
27. 2,2-dichloropropane
28. bromochloromethane
29. chloroform
30. carbon tetrachloride
31. tetrahydrofuran
32. methyl acrylate
33. 1,1,1-trichloroethane
34. dibromofluoromethane
35. 1,1-dichloropropene
36. 2-butanone
37. benzene
38. propionitrile
39. methacrylonitrile
40. 1,2-dichloroethane-d4
41. pentafluorobenzene
42. *tert*-amyl methyl ether
43. 1,2-dichloroethane
44. isobutyl alcohol
45. trichloroethene
46. 1,4-difluorobenzene
47. dibromomethane
48. 1,2-dichloropropene
49. bromodichloromethane
50. methyl methacrylate
51. *cis*-1,3-dichloropropene

52. 2-chloroethyl vinyl ether
53. toluene-d8
54. toluene
55. 2-nitropropane
56. tetrachloroethene
57. 2-bromo-1-chloropropane
58. 4-methyl-2-pentanone
59. *trans*-1,3-dichloropropene
60. 1,1,2-trichloroethane
61. ethyl methacrylate
62. dibromochloromethane
63. 1,3-dichloropropane
64. 1,2-dibromoethane
65. 2-hexanone
66. chlorobenzened-5
67. chlorobenzene
68. ethylbenzene
69. 1,1,2-tetrachloroethane
70. *m*-xylene
71. *p*-xylene
72. *o*-xylene
73. bromoform
74. styrene
75. isopropylbenzene
76. 4-bromo-1-fluorobenzene (SS)
77. bromobenzene

78. *cis*-1,4-dichloro-2-butene
79. 1,4-dichlorobutane
80. *n*-propylbenzene
81. 1,1,2,2-tetrachloroethane
82. 2-chlorotoluene
83. 1,2,3-trichloropropane
84. 1,3,5-trimethylbenzene
85. *trans*-1,4-dichloro-2-butene
86. 4-chlorotoluene
87. *tert*-butylbenzene
88. pentachloroethane
89. 1,2,4-trimethylbenzene
90. sec-butylbenzene
91. *p*-isopropyltoluene
92. 1,3-dichlorobenzene
93. 1,4-dichlorobenzene-d4
94. 1,4-dichlorobenzene
95. *n*-butylbenzene
96. 1,2-dichlorobenzene
97. 1,2-dibromo-3-chloropropane
98. nitrobenzene
99. hexachlorobutadiene
100. 1,2,4-trichlorobenzene
101. naphthalene
102. 1,2,3-trichlorobenzene

Acknowledgments: Purge & trap courtesy of O.I. Analytical.

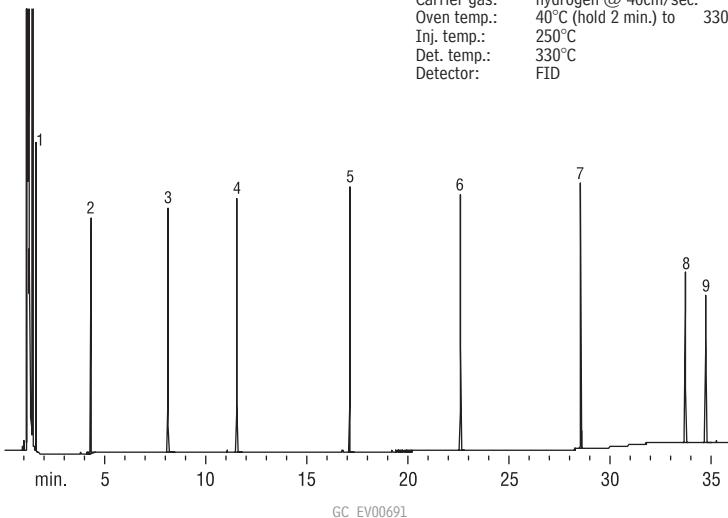
## Texas UST: Alternate Boiling Point/Carbon Number Distribution Marker Rtx®-5



## Texas UST: Alternate BP/CN Distribution Marker Rtx®-5

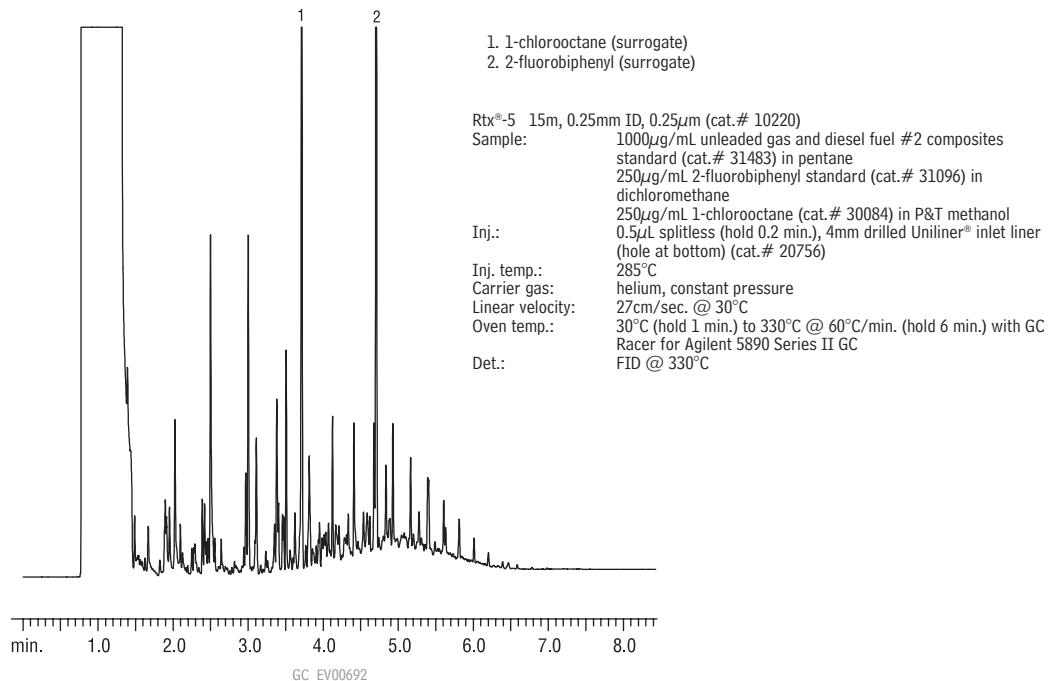
1. *n*-hexane(C6)
2. *n*-octane(C8)
3. *n*-decane(C10)
4. *n*-dodecane(C12)
5. *n*-hexadecane(C16)
6. *n*-heneicosane(C21)
7. *n*-octacosane(C28)
8. *n*-pentatriacontane
9. *n*-hexatriacontane(C36)

Rtx®-5 30m, 0.25mm ID, 0.50 $\mu$ m (cat.# 10238)  
Sample: 1 $\mu$ L Alternate Boiling Point/Carbon Number Distribution Marker Stock  
Solution (cat.# 31639), 200 $\mu$ g/mL each component in pentane  
Carrier gas: hydrogen @ 40cm/sec.  
Oven temp.: 40°C (hold 2 min.) to 330°C @ 10°C/min. (hold 5 min.)  
Inj. temp.: 250°C  
Det. temp.: 330°C  
Detector: FID

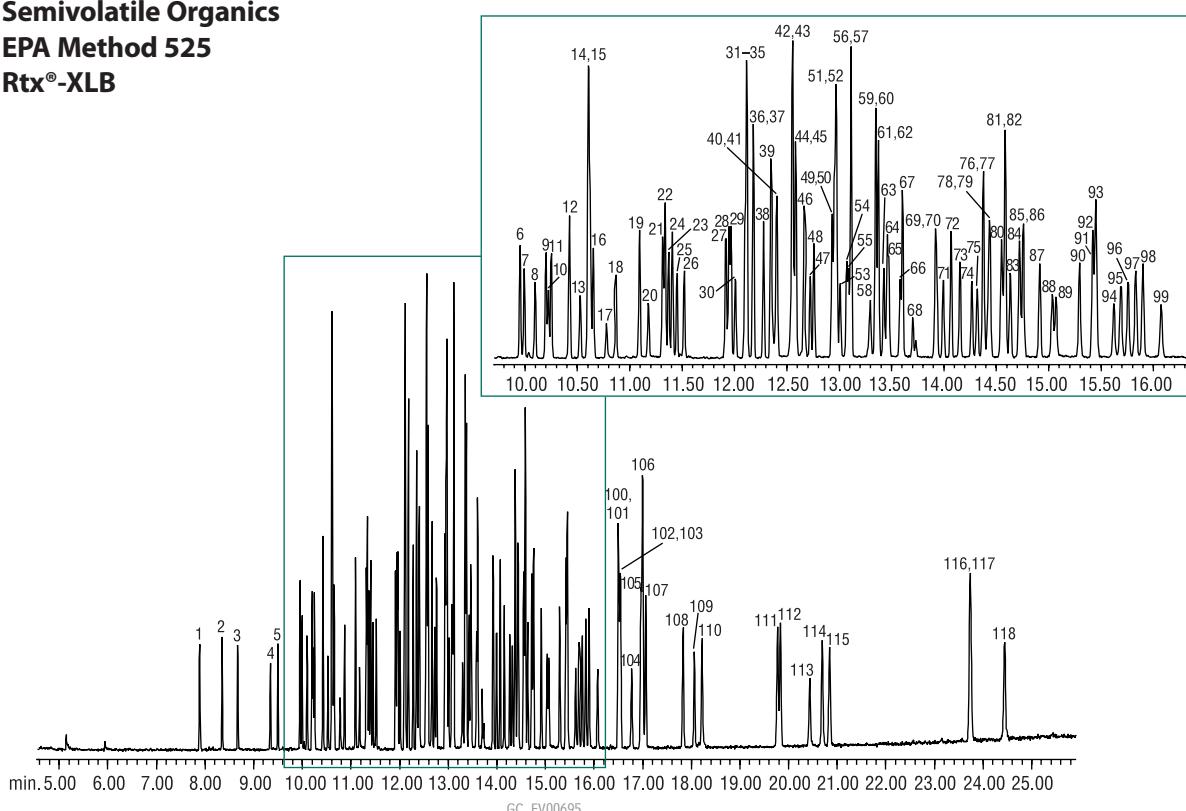


## Texas UST: diesel/gas composites

Rtx®-5



**Semivolatile Organics**  
**EPA Method 525**  
**Rtx®-XLB**



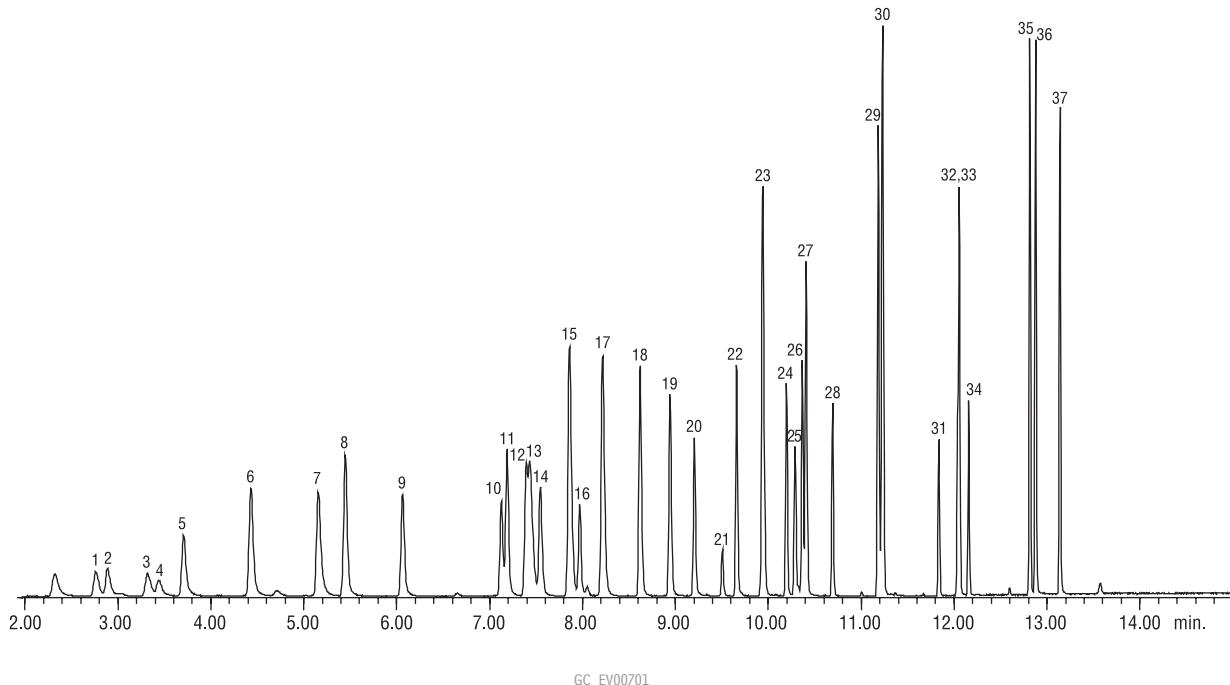
Column: Rtx®-XLB, 30m, 0.25mm ID, 0.25 $\mu$ m (cat. # 12823)  
Sample: 1 $\mu$ L US EPA Method 525 standards, 5ng per analyte  
Inj.: standards used: 31824, 32420, 32421, 32422, 32423, 31825, 31826, 31828, 32291, 32415, 32436.  
Inj. Temp.: pressure pulsed (0.4 min. @ 30psi), splitless (hold 0.4 min.), 4mm Drilled Uniliner® (cat.# 21055)  
Carrier Gas: helium, constant flow  
Flow Rate: 1.0mL/min.  
Oven Temp.: 35°C (hold 2 min.) to 260°C @ 20°C/min. (hold 0 min.) to 330°C @ 6°C/min. (hold 5 min.)  
Det: Agilent 5973 GC/MS  
Transfer Line Temp.: 280°C  
Scan Range: 45–550 amu  
Solvent Delay: 4.7 min.  
Tune: DFTPP

1. isophorone	32. propazine	63. aldrin	92. butyl benzyl phthalate
2. 2-nitro- <i>m</i> -xylene	33. simazine	64. triadimefon	93. endosulfan II
3. dichlorvos	34. atrazine	65. cyanazine (Bladex)	94. endrin aldehyde
4. hexachlorocyclopentadiene	35. metribuzin	66. MGK-264	95. norflurazon
5. EPTC	36. diazinon	67. diphenamid	96. 4,4'-DDT
6. butylate	37. terbufos	68. merphos	97. triphenylphosphate
7. mevinphos	38. pronamide	69. 2,2',3',4,6-pentachlorobiphenyl (BZ#98)	98. hexazinone
8. vernalote	39. pentachlorophenol	70. heptachlor epoxide (isomer B)	99. endosulfan sulfate
9. pebulate	40. $\gamma$ -BHC (lindane)	71. heptachlor epoxide (isomer A)	100. bis(2-ethylhexyl)phthalate
10. etridiazole (terrazole)	41. disulfoton	72. butachlor	101. methoxychlor
11. dimethylphthalate	42. terbacil	73. stirofos (tetrachlorvinphos)	102. 2,2',3',4',6,6'-octachlorobiphenyl (BZ#207)
12. acenaphthene	43. phenanthrene-d10	74. fenamiphos	103. 2,2,3,3',4,4',6-heptachlorobiphenyl (BZ#171)
13. 2,6-dinitrotoluene	44. methyl parathion OA	75. $\alpha$ -chlordane	104. endrin ketone
14. acenaphthene-d10	45. phenanthrene	76. napropamide	105. benzo(a)anthracene
15. 2-chlorobiphenyl (BZ#1)	46. anthracene	77. $\gamma$ -chlordane	106. chrysene-d12
16. chloroneb	47. $\beta$ -BHC	78. endosulfan I	107. chrysene
17. tebutihuron	48. 2,4,5-trichlorobiphenyl (BZ#29)	79. <i>trans</i> -nonachlor	108. fenarimol
18. molinate	49. alachlor	80. pyrene-d10	109. <i>cis</i> -permethrin
19. diethyl phthalate	50. prometryne	81. pyrene	110. <i>trans</i> -permethrin
20. 2,4-dinitrotoluene	51. ametryn	82. 4,4'-DDE	111. benzo(b)fluoranthene
21. propachlor	52. simetryn	83. 2,2',4,4',5,6'-hexachlorobiphenyl (BZ#154)	112. benzo(k)fluoranthene
22. fluorene	53. $\delta$ -BHC	84. <i>p</i> -terphenyl-d14	113. fluridone (Sonar®)
23. ethoprop	54. heptachlor	85. dieldrin	114. benzo(a)pyrene
24. cycloate	55. chlorothalonil	86. carboixin	115. perylene-d12
25. trifluralin	56. di- <i>n</i> -butylphthalate	87. chlorbenzilate	116. dibenzo(a,h)anthracene
26. chlorpropham	57. terbutryn	88. tricyclazole	117. indeno(1,2,3-cd)pyrene
27. 2,3-dichlorobiphenyl (BZ#5)	58. bromacil	89. endrin	118. benzo(ghi)perylene
28. atraton	59. chlorpyrifos	90. 4,4'-DDD	
29. prometon	60. metolachlor	91. bis(2-ethylhexyl)adipate	
30. $\alpha$ -BHC	61. DCPA methyl ester (Dacthal®)		
31. hexachlorobenzene	62. 2,2',4,4'-tetrachlorobiphenyl (BZ#47)		

# Volatiles

## US EPA Method 624

### Rtx®-624



Rtx®-624, 40m, 0.18mm ID, 1.0 $\mu$ m (cat.# 40925)

Sample: 624 Internal Standard Mix (cat.# 30023)  
624 Surrogate Standard Mix (cat.# 30243)  
Volatiles MegaMix™ EPA Method 624 (cat.# 30497)

#### Purge and trap conditions:

Concentrator: Tekmar LSC-3100 Purge and Trap

Trap: Vocarb 3000 (type K)

Purge: compounds at 50 ppb (IS @ 40ppb) in 5mL of RO water  
11 min. @ 40 mL/min. @ ambient temperature

Dry purge: 1 min. @ 40mL/min. (MCS bypassed using SilcoSteel® tubing)

Desorb pPreheat: 245°C

Desorb: 250°C for 2 min., flow 10mL/min.

Bake: 260°C for 8 min.

Interface: SilcoSteel® transfer line, 1: 40 split at injection port.  
1mm ID sleeve.

#### Chromatography:

Inj. temp.: 250°C

Carrier gas: helium, constant flow

Flow rate: 1.1 mL/min.

Dead time: 2.06 minutes @ 50°C

Oven temp.: 50°C (hold 4 min.) to 100°C @ 12°C/min. (no hold)  
to 230°C @ 27°C/min. (hold 2 min.).

Det.: Agilent 5971A GC/MS

Transfer line temp.: 280°C

Scan range: 35-260 amu

Tune PFTBA/BFB

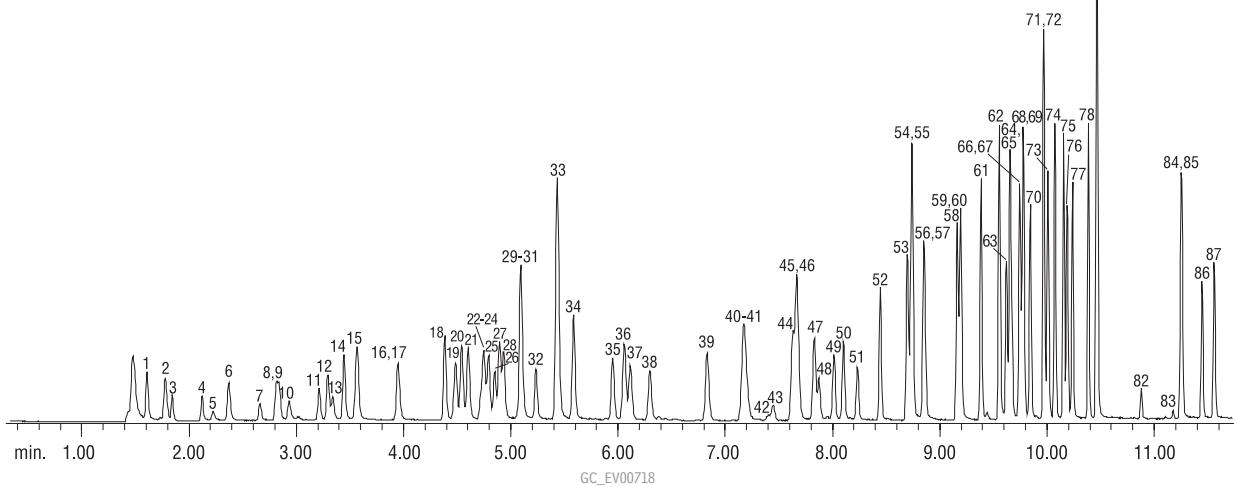
Ionization: EI

1. chloromethane
2. vinyl chloride
3. bromomethane
4. chloroethane
5. trichlorofluoromethane
6. 1,1-dichloroethene
7. methylene chloride
8. *trans*-1,2-dichloroethene
9. 1,1-dichloroethane
10. bromochloromethane
11. chloroform
12. 1,1,1-trichloroethane
13. pentafluorobenzene
14. carbon tetrachloride
15. benzene
16. 1,2-dichloroethane
17. fluorobenzene
18. trichloroethene
19. 1,2-dichloropropane
20. bromodichloromethane
21. 2-chloroethyl vinyl ether
22. *cis*-1,3-dichloropropene
23. toluene
24. 2-bromo-1-chloropropane
25. 1,1,2-trichloroethane
26. tetrachloroethene
27. dibromochloromethane
28. *trans*-1,3-dichloropropene
29. chlorobenzene
30. ethylbenzene
31. bromoform
32. 1,4-dichlorobutane
33. 4-bromofluorobenzene
34. 1,1,2,2-tetrachloroethane
35. 1,3-dichlorobenzene
36. 1,4-dichlorobenzene
37. 1,2-dichlorobenzene

# Volatile Organics

## US EPA Method 524.2 Revision IV

### Rtx<sup>®</sup>-VMS



#### Purge and Trap Conditions:

Concentrator: Tekmar LSC-3100 purge and trap  
 Trap: Vocarb 3000 (type K)  
 Purge: 11 min. @ 40 mL/min. @ ambient temperature.  
 Dry purge: 1 min. @ 40 mL/min. (MCS bypassed using Silcosteel<sup>®</sup> tubing)  
 Desorb preheat: 245°C  
 Desorb: 250°C for 2 min., flow 33mL/min.  
 Bake: 260°C for 8 min.  
 Interface: Silcosteel<sup>®</sup> transfer line  
 1:30 split at injection port. 1mm ID split inlet liner  
 (cat.# 20972).

#### Column:

Sample:

Rtx<sup>®</sup>-VMS, 30m, 0.25mm ID, 1.4 $\mu$ m (cat.# 19915)

502.2 Calibration Mix #1 (cat.# 30042)

Drinking Water VOA MegaMix<sup>®</sup>, 524.2 Rev 4 (cat.# 30601)

524 Internal Standard/Surrogate Mix (cat.# 30201)

Ketone Mix, EPA Method 524.2 Rev 4.1 (cat.# 30602)

Compounds at 20 ppb each in 5mL RO water

(ketones at 50ppb; internal standards at 40ppb)

250°C

helium, constant flow

1.1mL/min.

1.48 min. @ 40°C

40°C (hold 2 min.) to 85°C @ 14°C/min. (hold 2 min.) to

220°C @ 30°C/min. (hold 4 min.).

Agilent 5971A GC/MS

280°C

Scan range: 35-300 amu

Tune

PFTBA/BFB

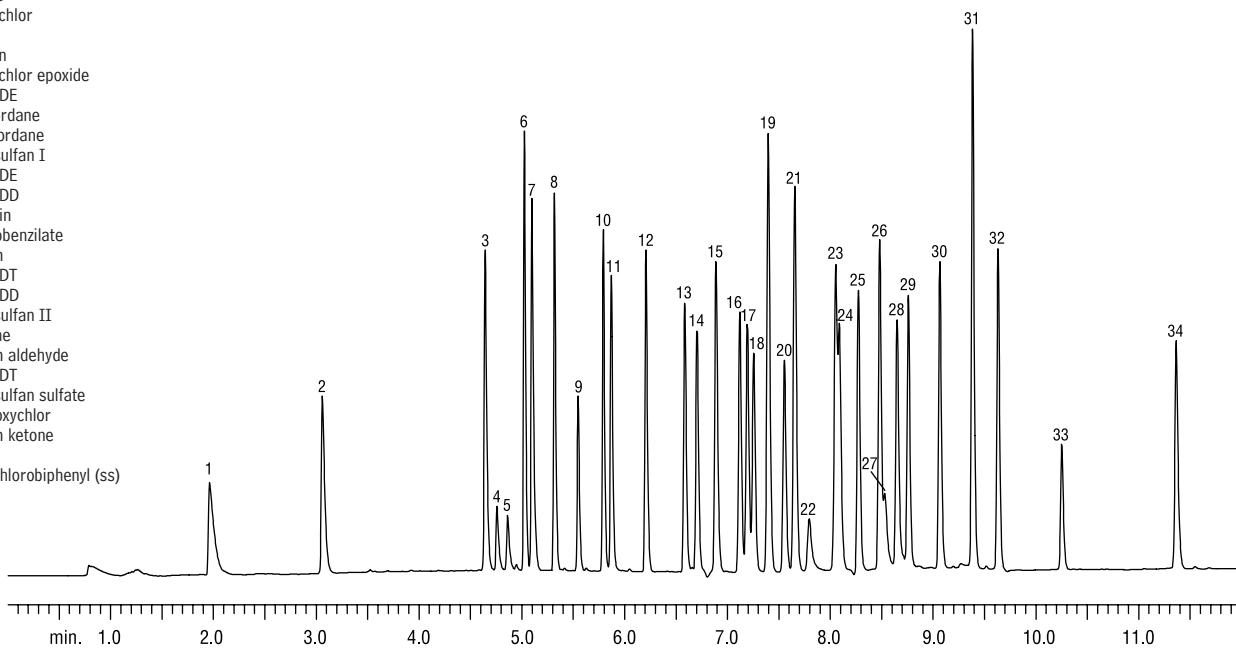
Ionization:

EI

1. dichlorodifluoromethane	19. 2,2-dichloropropane	37. bromodichloromethane	55. 1,1,1,2-tetrachloroethane	73. 1,2,4-trimethylbenzene
2. chloromethane	20. bromochloromethane	38. methyl methacrylate	56. <i>m</i> -xylene	74. sec-butylbenzene
3. vinyl chloride	21. chloroform	39. <i>cis</i> -1,3-dichloropropene	57. <i>p</i> -xylene	75. <i>p</i> -isopropyltoluene
4. bromomethane	22. methyl acrylate	40. toluene	58. <i>o</i> -xylene	76. 1,3-dichlorobenzene
5. chloroethane	23. carbon tetrachloride	41. chloroacetonitrile	59. styrene	77. 1,4-dichlorobenzene
6. trichlorofluoromethane	24. tetrahydrofuran	42. 2-nitropropane	60. bromoform	78. <i>n</i> -butylbenzene
7. diethyl ether	25. 1,1,1-trichloroethane	43. 1,1-dichloropropanone	61. isopropylbenzene	79. hexachloroethane
8. 1,1-dichloroethene	26. 2-butanone	44. 4-methyl-2-pentanone	62. 4-bromofluorobenzene	80. 1,2-dichlorobenzene-d4
9. carbon disulfide	27. 1,1-dichloropropene	45. tetrachloroethene	63. bromobenzene	81. 1,2-dichlorobenzene
10. iodomethane	28. 1-chlorobutane	46. <i>trans</i> -1,3-dichloropropene	64. <i>n</i> -propylbenzene	82. 1,2-dibromo-3-chloropropane
11. allyl chloride	29. propionitrile	47. 1,1,2-trichloroethane	65. 1,1,2,2-tetrachloroethane	83. nitrobenzene
12. methylene chloride	30. methacrylonitrile	48. ethyl methacrylate	66. 2-chlorotoluene	84. hexachlorobutadiene
13. acetone	31. benzene	49. dibromochloromethane	67. 1,2,3-trichloropropane	85. 1,2,4-trichlorobenzene
14. <i>trans</i> -1,2-dichloroethene	32. 1,2-dichloroethane	50. 1,3-dichloropropane	68. 1,3,5-trimethylbenzene	86. naphthalene
15. methyl <i>tert</i> -butyl ether	33. fluorobenzene	51. 1,2-dibromoethane	69. <i>trans</i> -1,4-dichloro-2-butene	87. 1,2,3-trichlorobenzene
16. 1,1-dichloroethane	34. trichloroethene	52. 2-hexanone	70. 4-chlorotoluene	
17. acrylonitrile	35. dibromomethane	53. chlorobenzene	71. <i>tert</i> -butylbenzene	
18. <i>cis</i> -1,2-dichloroethene	36. 1,2-dichloropropane	54. ethylbenzene	72. pentachloroethane	

**Organochlorine Pesticides**  
**US EPA Method 8081A**  
**Rtx®-XLB**

1. 1,2-dibromo-3-chloropropane
2. hexachlorocyclopentadiene
3. 2,4,5,6-tetrachloro-*m*-xylene (ss)
4. *cis*-diallate
5. *trans*-diallate
6.  $\alpha$ -BHC
7. hexachlorobenzene
8.  $\gamma$ -BHC
9.  $\beta$ -BHC
10.  $\delta$ -BHC
11. heptachlor
12. aldrin
13. isodrin
14. heptachlor epoxide
15. 2,4'-DDE
16.  $\gamma$ -chlordane
17.  $\alpha$ -chlordane
18. endosulfan I
19. 4,4'-DDE
20. 2,4'-DDD
21. dieldrin
22. chlorobenzilate
23. endrin
24. 2,4'-DDT
25. 4,4'-DDD
26. endosulfan II
27. Kepone
28. endrin aldehyde
29. 4,4'-DDT
30. endosulfan sulfate
31. methoxychlor
32. endrin ketone
33. Mirex
34. decachlorobiphenyl (ss)



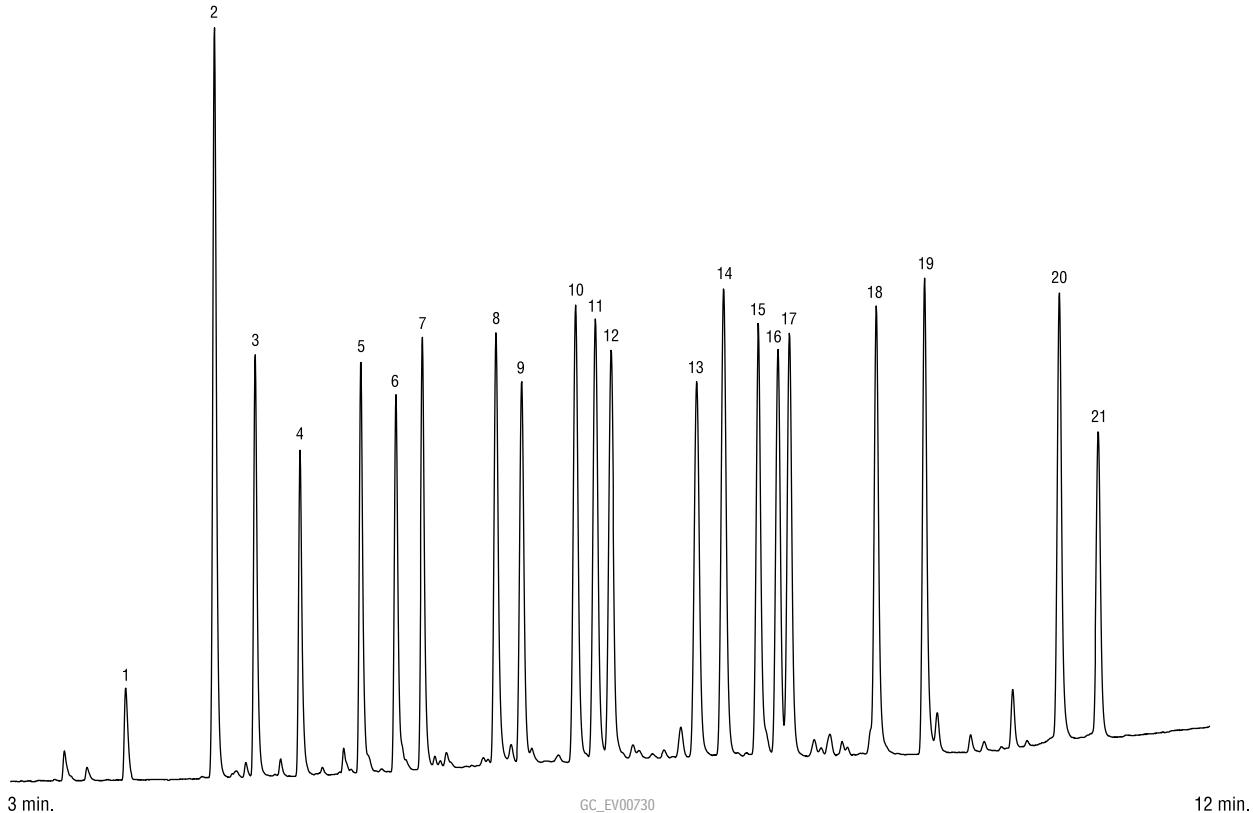
GC\_EV00721

Rtx®-XLB 30m, 0.32mm ID, 0.5 $\mu$ m (cat.# 12839)  
 Sample: 8081A pesticides, 80-160ppb in hexane  
 Inj.: 1.0 $\mu$ L splitless (hold 0.75 min.), 4mm Drilled Uniliner® inlet liner (cat.# 21055)  
 Inj. temp.: 220°C  
 Carrier gas: hydrogen, constant pressure  
 Linear velocity: 60cm/sec. @ 120°C  
 Oven temp.: 120°C (hold 0.5 min.) to 260°C @ 29°C/min. (hold 2.5 min.), to 330°C @ 28°C/min. (hold 3 min.)  
 Det.: ECD @ 320°C

8081A Pesticides/Surrogates	
8080 Organochlorine Pesticide Mix AB #2 (20 components)	cat.# 32292
8081a Organochlorine Pesticide Mix C #2 (7 components)	cat.# 32295
2,4'-DDT	cat.# 32200
2,4'-DDD	cat.# 32098
2,4'-DDE	cat.# 32099
Kepone	custom
Mirex	custom
2,4,5,6-tetrachloro- <i>m</i> -xylene (ss, 20ppb)	cat.# 32027
decachlorobiphenyl (ss, 40ppb)	cat.# 32029

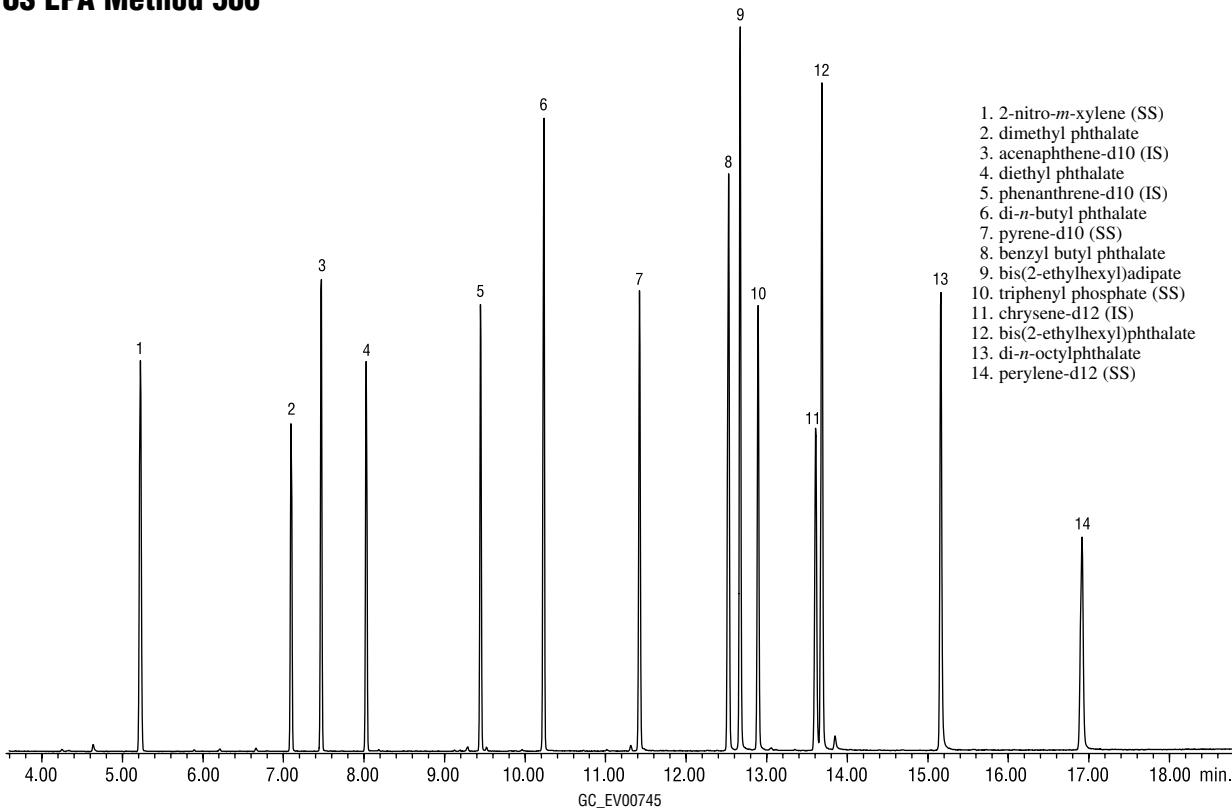
# PCB Congeners

## Rtx®-XLB



Compound	RT (min.)	Column:	Rtx®-XLB 30m, 0.32mm ID, 0.50µm (cat.# 12839)
1. 2-chlorobiphenyl	3.86	Sample:	200ppb each PCB congener in hexane (cat.# 32416), 200ppb 2,4,5,6-tetrachloro- <i>m</i> -xylene (SS) (cat.# 32027), 100ppb decachlorobiphenyl (IS) (cat.# 32289)
2. 2,4,5,6 tetrachloro- <i>m</i> -xylene (SS)	4.53	Inj.:	1.0µL splitless (hold 0.75 min.), 4mm Drilled Uniliner® inlet liner (cat.# 21055)
3. 2,3-dichlorobiphenyl	4.83	Inj. temp.:	220°C
4. 2,2',5-trichlorobiphenyl	5.17	Carrier gas:	hydrogen, constant pressure
5. 2,4',5-trichlorobiphenyl	5.63	Linear velocity:	66cm/sec. @ 120°C
6. 2,2',5,5'-tetrachlorobiphenyl	5.89	Oven temp.:	120°C (hold 0.5 min.) to 260°C @ 29°C/min. (hold 2.5 min.), to 330°C @ 28°C/min. (hold 5 min.)
7. 2,2',5,5'-trichlorobiphenyl	6.09	Det.:	ECD @ 320°C
8. 2,3,4,4'-tetrachlorobiphenyl	6.64		
9. 2,2',4,5,5'-pentachlorobiphenyl	6.84		
10. 2,2',3,4,5-pentachlorobiphenyl	7.24		
11. 2,3,3',4',6-pentachlorobiphenyl	7.39		
12. 2,2',3,5,5,6-hexachlorobiphenyl	7.51		
13. 2,2',4,4',5,5'-hexachlorobiphenyl	8.15		
14. 2,2',3,4,5,5'-hexachlorobiphenyl	8.35		
15. 2,2',3,4,4',5'-hexachlorobiphenyl	8.61		
16. 2,2',3,4',5,5'-heptachlorobiphenyl	8.76		
17. 2,2',3,4,4',5'-heptachlorobiphenyl	8.84		
18. 2,2',3,4,4',5,5'-heptachlorobiphenyl	9.50		
19. 2,2',3,3',4,4',5-heptachlorobiphenyl	9.86		
20. 2,2',3,3',4,4',5,5'-nonachlorobiphenyl	10.87		
21. decachlorobiphenyl (SS)	11.17		

# US EPA Method 506



Column: Rtx®-5Sil MS, 30m, 0.25mm ID, 0.25µm (cat.# 12723)  
Sample: 506 Calibration Mix, 1000µg/mL each analyte (cat.# 31845)  
Method 525.2 Internal Standard Mix (cat.# 31825)  
Method 525.2 Surrogate Standard Mix (cat.# 31826)  
Inj.: 1.0µL, 20ppm each analyte (10ng on column)  
4mm splitless single gooseneck inlet liner (cat.# 20799)  
splitless hold time 0.40 min., 0.45 min. pressure pulse @ 50psi  
GC: Agilent 6890  
Inj. temp.: 270°C  
Carrier gas: helium, constant flow  
Flow rate: 1.0mL/min.  
Oven temp.: 80°C (hold 0.5 min.) to 260°C @ 18°C/min. (hold 1 min.)  
Det.: Agilent 5973 GC/MS  
Transfer  
line temp.: 280°C  
Scan range: 35–550 amu  
Solvent delay: 3 min.  
Tune: DFTPP

# US EPA Method 8270D by GC/MS

## Rtx<sup>®</sup>-XLB

Rtx<sup>®</sup>-XLB, 20m, 0.18mm ID, 0.18 $\mu$ m (cat.# 42802)

Sample: US EPA Method 8270D mix:

8270 MegaMix™ (cat.# 31850), benzoic acid (cat.# 31415), benzidine (cat.# 31441), 2,4-dinitrophenol (cat.# 31291), Acid Surrogate Mix (4/89 SOW) (cat.# 31063),

B/N Surrogate Mix (4/89 SOW) (cat.# 31062)

Inj.: 0.5 $\mu$ L, 5ppm each analyte (2.5ng on column) (2.5ppm/1.25ng on column for 3-methylphenol and 4-methylphenol)

2mm splitless cyclo double gooseneck injector liner (cat.# 20907); splitless hold time 0.15 min.; pressure pulse: 0.20 min. @30psi

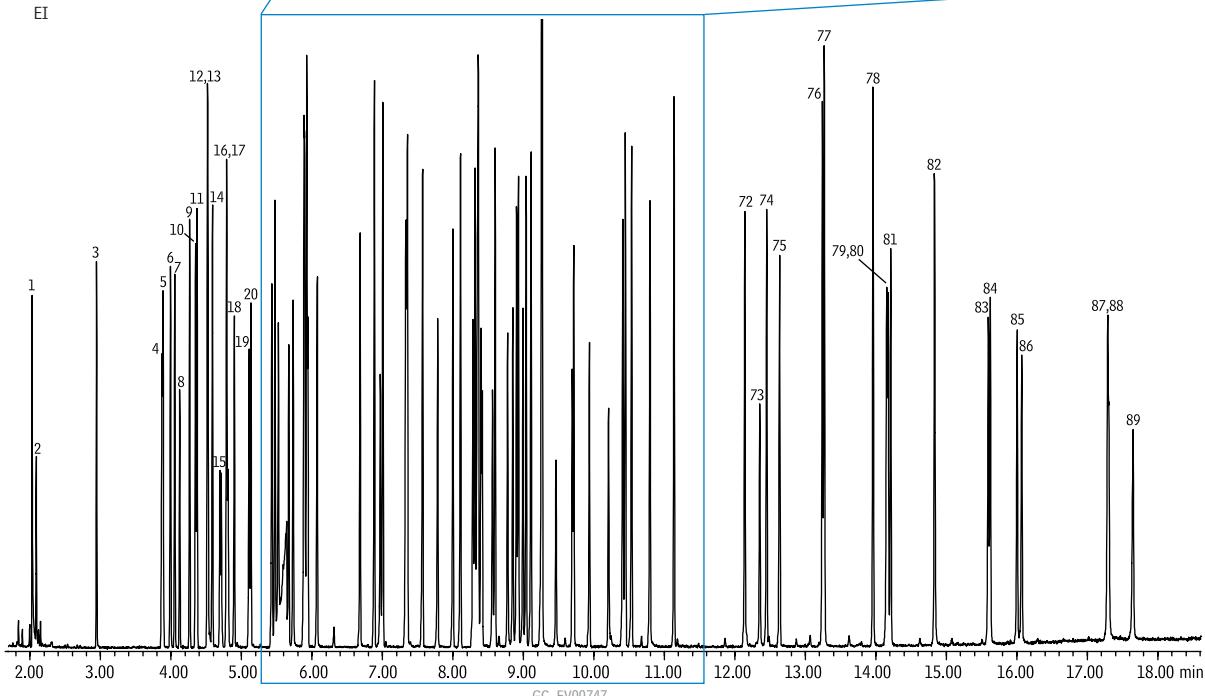
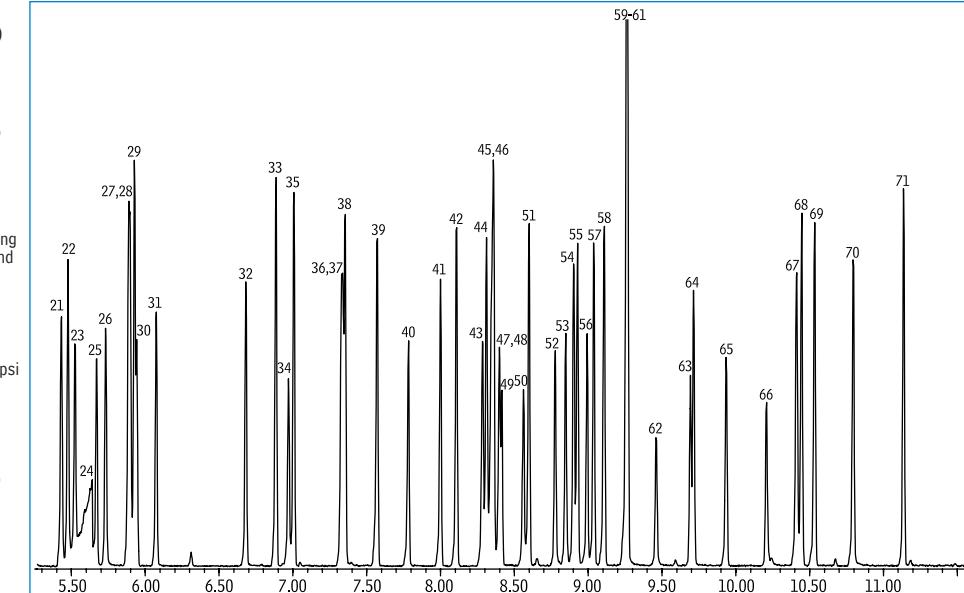
GC: Agilent 6890  
Inj. temp.: 270°C

Carrier gas: helium

Flow rate: 1.2mL/min., constant flow  
Oven temp.: 40°C (hold 0.5 min.) to 90°C @

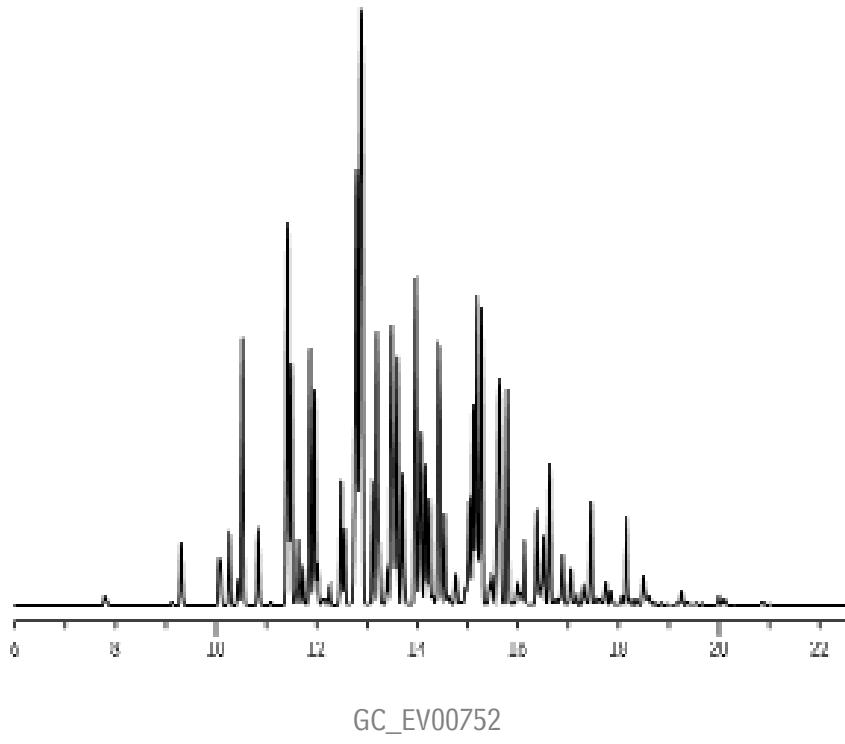
14°C/min. (no hold) to 330°C @ 22°C/min. (hold 1 min.)

Det.: Agilent 5973 GC/MS  
Transfer line temp.: 280°C  
Scan range: 35–550 amu  
Solvent delay: 1 min.  
Tune: DFTPP  
Ionization: EI



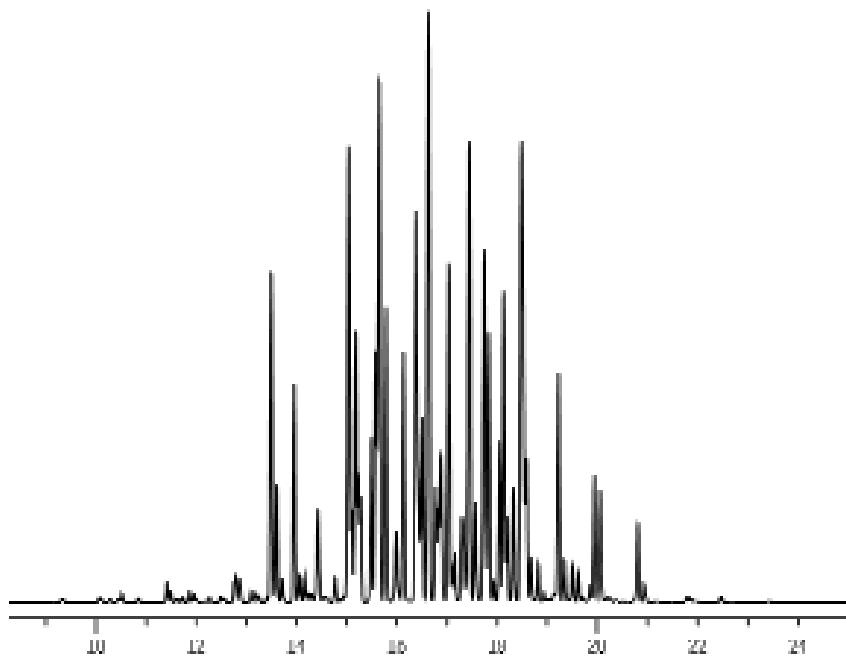
- |                                 |                                |                               |                                 |                                |
|---------------------------------|--------------------------------|-------------------------------|---------------------------------|--------------------------------|
| 1. pyridine                     | 19. nitrobenzene-d5            | 38. 2-fluorobiphenyl          | 57. 4-chlorophenyl phenyl ether | 76. butyl benzyl phthalate     |
| 2. N-nitrosodimethylamine       | 20. nitrobenzene               | 39. 2-chloronaphthalene       | 58. fluorene                    | 77. bis(2-ethylhexyl)adipate   |
| 3. 2-fluorophenol               | 21. isophorone                 | 40. 2-nitroaniline            | 59. diphenylamine               | 78. bis(2-ethylhexyl)phthalate |
| 4. phenol-d6                    | 22. 2,4-dimethylphenol         | 41. dimethylphthalate         | 60. 4-nitroaniline              | 79. benzo(a)anthracene         |
| 5. phenol                       | 23. 2-nitrophenol              | 42. acenaphthylene            | 61. azobenzene                  | 80. chrysene-d12               |
| 6. aniline                      | 24. benzoic acid               | 43. 2,6-dinitrotoluene        | 62. 2,4,6-tribromophenol        | 81. chrysene                   |
| 7. 2-chlorophenol               | 25. bis(2-chloroethoxy)methane | 44. acenaphthene-d10          | 63. 4,6-dinitro-2-methylphenol  | 82. di-n-octyl phthalate       |
| 8. bis(2-chloroethyl)ether      | 26. 2,4-dichlorophenol         | 45. 1,4-dinitrobenzene        | 64. 4-bromophenyl phenyl ether  | 83. benzo(b)fluoranthene       |
| 9. 1,3-dichlorobenzene          | 27. 1,2,4-trichlorobenzene     | 46. acenaphthene              | 65. hexachlorobenzene           | 84. benzo(k)fluoranthene       |
| 10. 1,4-dichlorobenzene-d4      | 28. naphthalene-d8             | 47. 1,3-dinitrobenzene        | 66. pentachlorophenol           | 85. benzo(a)pyrene             |
| 11. 1,4-dichlorobenzene         | 29. naphthalene                | 48. 3-nitroaniline            | 67. phenanthrene-d10            | 86. perylene-d12               |
| 12. 1,2-dichlorobenzene         | 30. hexachlorobutadiene        | 49. 1,2-dinitrobenzene        | 68. phenanthrene                | 87. indeno(1,2,3-cd)pyrene     |
| 13. benzyl alcohol              | 31. 4-chloroaniline            | 50. 4-nitrophenol             | 69. anthracene                  | 88. dibenz(a,h)anthracene      |
| 14. 2-methylphenol              | 32. 4-chloro-3-methylphenol    | 51. dibenzofuran              | 70. carbazole                   | 89. benzo(ghi)perylene         |
| 15. bis(2-chloroisopropyl)ether | 33. 2-methylnaphthalene        | 52. 2,3,4,6-tetrachlorophenol | 71. di-n-butylphthalate         |                                |
| 16. hexachloroethane            | 34. hexachlorocyclopentadiene  | 53. 2,3,5,6-tetrachlorophenol | 72. fluoranthene                |                                |
| 17a. 4-methylphenol             | 35. 1-methylnaphthalene        | 54. 2,4-dinitrophenol         | 73. benzidine                   |                                |
| 17b. 3-methylphenol             | 36. 2,4,6-trichlorophenol      | 55. diethyl phthalate         | 74. pyrene                      |                                |
| 18. N-nitroso-di-n-propylamine  | 37. 2,4,5-trichlorophenol      | 56. 2,4-dinitrotoluene        | 75. p-terphenyl-d14             |                                |

# Aroclor® 1242 on Rtx®-PCB



Column: Rtx®-PCB 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13223)  
Sample: 200ng/mL Aroclor® 1242 (cat.# 32009)  
Inj.: 1.0 $\mu$ L splitless (hold 0.75 min.), 3.5mm ID single gooseneck  
inlet liner (cat.# 20962)  
Inj. temp.: 250°C  
Carrier gas: hydrogen, constant pressure  
Linear velocity: 71cm/sec. @ 110°C  
Oven temp.: 100°C (hold 1.0 min.) to 300°C @ 10°C/min. (hold 4 min.)  
Det.: ECD @ 310°C

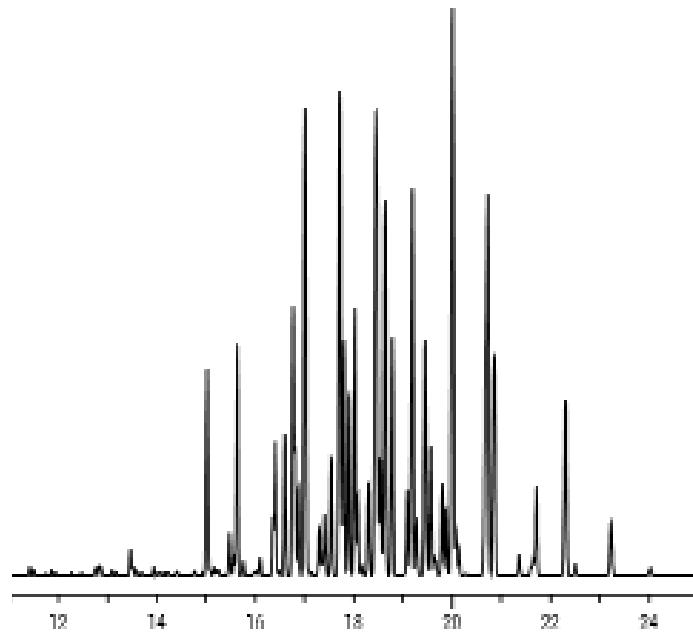
# Aroclor® 1254 on Rtx®-PCB



GC\_EV00753

Column: Rtx®-PCB 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13223)  
Sample: 200ng/mL Aroclor® 1254 (cat.# 32011)  
Inj.: 1.0 $\mu$ L splitless (hold 0.75 min.), 3.5mm ID single goose-neck inlet liner (cat.# 20962)  
Inj. temp.: 250°C  
Carrier gas: hydrogen, constant pressure  
Linear velocity: 71cm/sec. @ 110°C  
Oven temp.: 100°C (hold 1.0 min.) to 300°C @ 10°C/min. (hold 4 min.)  
Det.: ECD @ 310°C

# Aroclor® 1260 on Rtx®-PCB



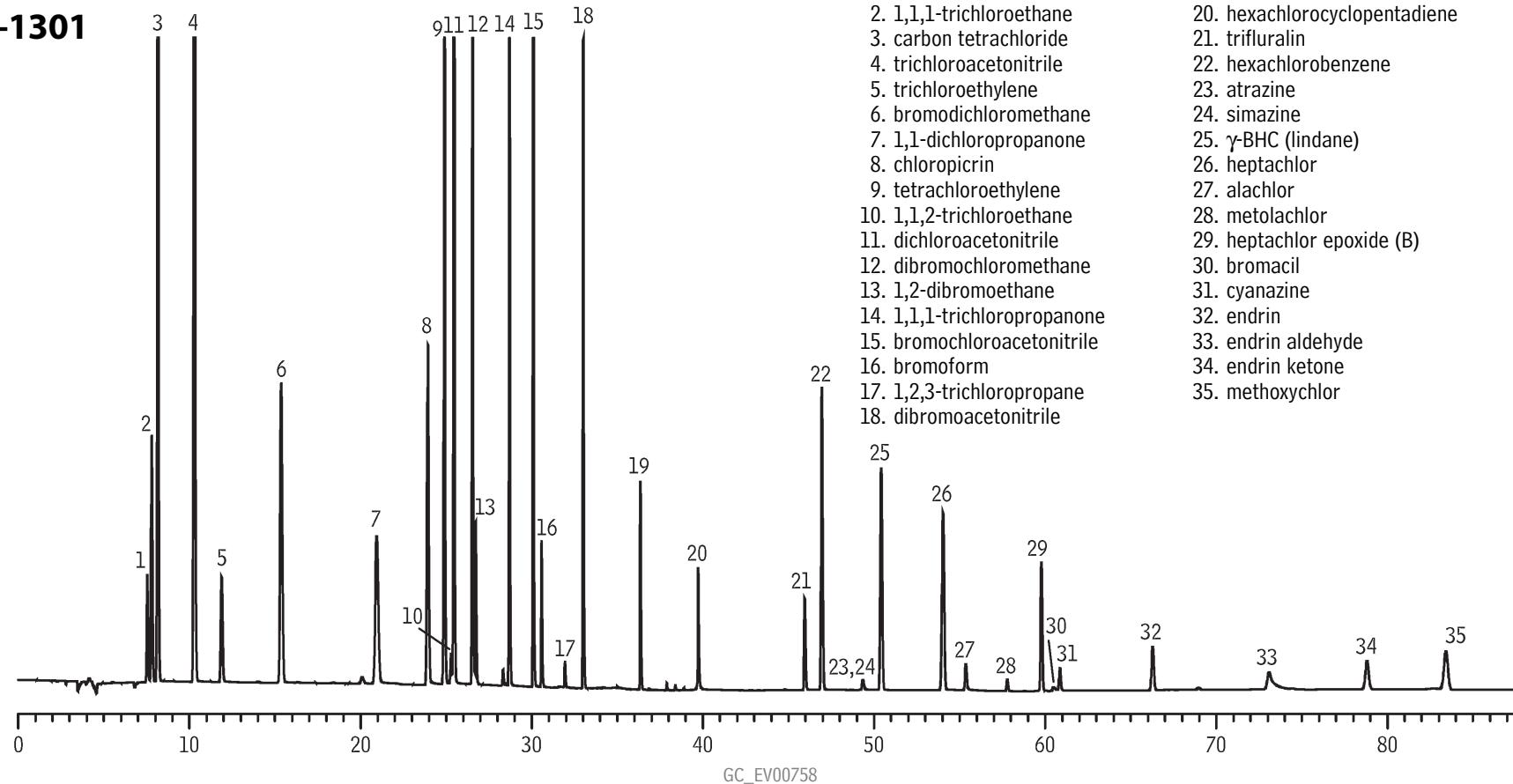
GC\_EV00754

Column: Rtx®-PCB 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13223)  
Sample: 200ng/mL Aroclor® 1260 (cat.# 32012)  
Inj.: 1.0 $\mu$ L splitless (hold 0.75 min.), 3.5mm ID single goose-neck inlet liner (cat.# 20962)  
Inj. temp.: 250°C  
Carrier gas: hydrogen, constant pressure  
Linear velocity: 71cm/sec. @ 110°C  
Oven temp.: 100°C (hold 1.0 min.) to 300°C @ 10°C/min. (hold 4 min.)  
Det.: ECD @ 310°C

# **Chlorinated Disinfection Byproducts, Chlorinated Solvents, and Halogenated Pesticides**

## **US EPA Method 551.1**

**Rtx®-1301**

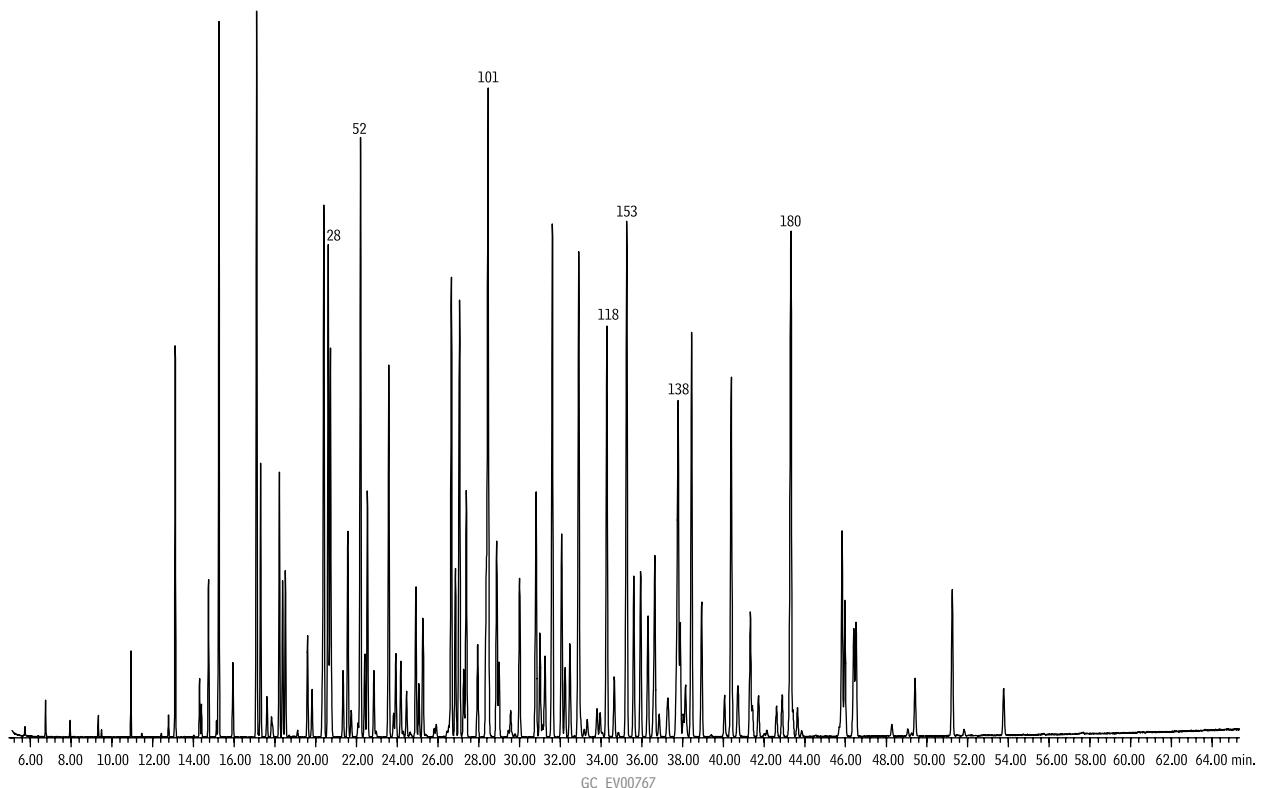


1. chloroform
2. 1,1,1-trichloroethane
3. carbon tetrachloride
4. trichloroacetonitrile
5. trichloroethylene
6. bromodichloromethane
7. 1,1-dichloropropanone
8. chloropicrin
9. tetrachloroethylene
10. 1,1,2-trichloroethane
11. dichloroacetonitrile
12. dibromochloromethane
13. 1,2-dibromoethane
14. 1,1,1-trichloropropanone
15. bromochloroacetonitrile
16. bromoform
17. 1,2,3-trichloropropane
18. dibromoacetonitrile
19. 1,2-dibromo-3-chloropropane
20. hexachlorocyclopentadiene
21. trifluralin
22. hexachlorobenzene
23. atrazine
24. simazine
25.  $\gamma$ -BHC (lindane)
26. heptachlor
27. alachlor
28. metolachlor
29. heptachlor epoxide (B)
30. bromacil
31. cyanazine
32. endrin
33. endrin aldehyde
34. endrin ketone
35. methoxychlor

Column: Rtx®-1301 30m, 0.25mm ID, 1.0 $\mu$ m (cat.# 16053)  
Sample: 5 - 10 $\mu$ g/mL each analyte (Method 551.1 Pesticide/Herbicide Mix, cat.# 32438 and Disinfection Byproducts & Chlorinated Solvents Mix, cat.# 30615)  
Inj.: 1.0 $\mu$ L splitless (hold 0.5 min.), 4mm split injection liner w/fused silica wool (cat.# 20781)  
Inj. temp.: 200°C  
Carrier gas: helium, constant pressure  
Linear velocity: 30cm/sec. @ 35°C  
Oven temp.: 35°C (hold 22 min.) to 145°C @ 10°C/min. (hold 2 min.)  
to 225° @ 20°C/min. (hold 15 min.) to 260° @ 10°C/min. (hold 30 min.)  
Det.: ECD @ 290°C

Restek Corporation 110 Benner Circle Bellefonte, PA 16823  
814-353-1300 • 800-356-1688 • Fax: 814-353-1309 • [www.restek.com](http://www.restek.com)

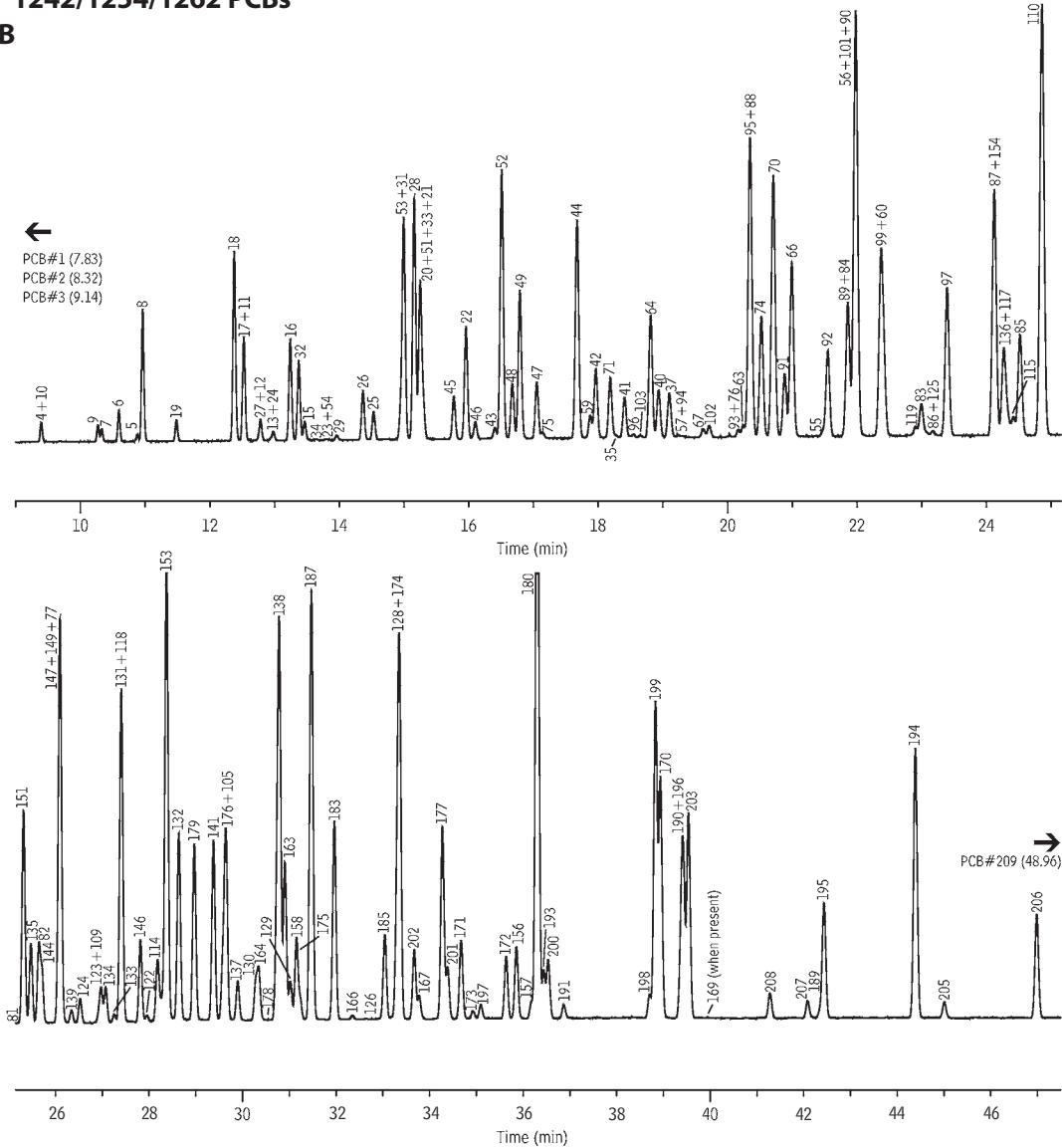
**Aroclor® PCBs**  
**Rtx®-PCB**



Column: Rtx®-PCB 60m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13226)  
Sample: Aroclor® 1242 (cat.# 32009), 1254 (cat.# 32011), 1262 (cat.# 32409), 333ppm each  
Inj.: 1.0 $\mu$ L splitless (hold 0.75 min.), 4mm single gooseneck inlet liner w/ wool (cat.# 22405)  
Inj. temp.: 280°C  
Carrier gas: helium, constant flow  
Flow rate: 1.1mL/min.  
Oven temp.: 100°C (hold 1 min.) to 200°C @ 30°C/min., to 320°C @ 2°C/min. (hold 1 min.)  
Det.: MS  
Transfer line temp.: 280°C  
Scan range: 50 to 550amu  
Ionization: EI  
Mode: scan

## Aroclor® 1242/1254/1262 PCBs

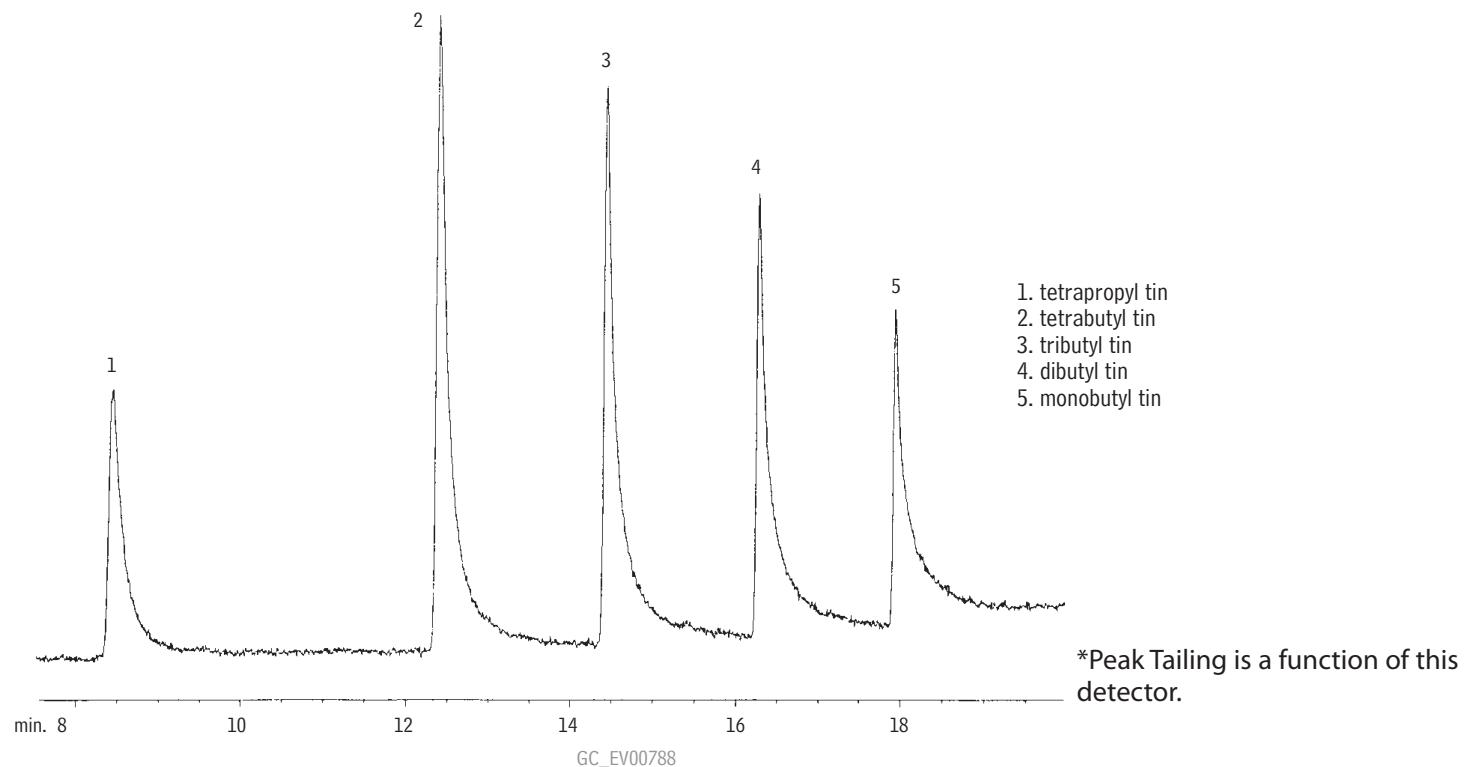
Rtx®-PCB



Column: Rtx®-PCB 40m, 0.18mm ID, 0.18 $\mu$ m (cat.# 41303)  
 Sample: 300ng/mL Aroclor® 1242/1254/1262 in hexane: Aroclor® 1242 (cat.# 32009),  
           Aroclor® 1254 (cat.# 32011), Aroclor® 1262 (cat.# 32409)  
 Inj.: 1.0 $\mu$ L splitless (hold 0.75 min.), 4mm single gooseneck inlet liner (cat.# 20983)  
 Inj. temp.: 230°C  
 Carrier gas: hydrogen, constant pressure  
 Linear velocity: 40cm/sec. @ 100°C  
 Oven temp.: 100°C (hold 1 min.) to 200°C @ 30°C/min., to 320°C @ 2°C/min. (hold 1 min.)  
 Det.: ECD @ 330°C

Restek Corporation 110 Benner Circle Bellefonte, PA 16823  
814-353-1300 • 800-356-1688 • Fax: 814-353-1309 • [www.restek.com](http://www.restek.com)

## PFPD\* Increases Sensitivity by 100 times When Analyzing Organo Tin Compounds By this Method.



**Column:** 30m, 0.32mm ID, 1.0 $\mu$ m Rtx®-35 (cat.# 10454). Direct injection using a Uniliner® inlet liner (cat.# 20335). **Concentration:** 5pg on-column. . **Head pressure:** 15psi, constant.  
**Oven temp.:** 100°C (hold 1 min.) to 285°C @ 10°C/min. (hold 10 min.); **Detector:** PFPD Model 5380 courtesy of O.I. Analytical Corp., College Station, TX.

# Organochlorine Pesticides

## US EPA Method 8081A

### Rtx®-440 (dual column w/ Rtx®-CLPesticides2)

Column: Rtx®-440 30m, 0.25mm ID, 0.50μm (cat.# 12939)

Sample: Organochlorine Pesticides Mix AB #2 (cat.# 32292),

8-80μg/mL each component in ethyl acetate

Chlorobenzilate (cat.# 32211) 1000μg/mL in methanol

Diallate (*cis* & *trans*) (custom) 1000μg/mL in hexane

Hexachlorobenzene (cat.# 32231) 1000μg/mL in acetone

Hexachlorocyclopentadiene (cat.# 32232) 1000μg/mL in methanol

Isodrin (custom) 1000μg/mL in hexane

Kepone (custom) 1000μg/mL in hexane

Mirex (custom) 1000μg/mL in hexane

2,4'-DDD (cat.# 32098) 1000μg/mL in methanol

2,4'-DDE (cat.# 32099) 1000μg/mL in methanol

2,4'-DDT (cat.# 32200) 1000μg/mL in methanol

TCMX (cat.# 32027) 200μg/mL in acetone

DCB (cat.# 32029) 200μg/mL in acetone

Inj.: 1.0μL splitless (hold 0.75 min.), 2mm Siltek® treated single gooseneck inlet liner (cat.# 20961)

Inj. temp.: 275°C

Carrier gas: hydrogen, constant pressure

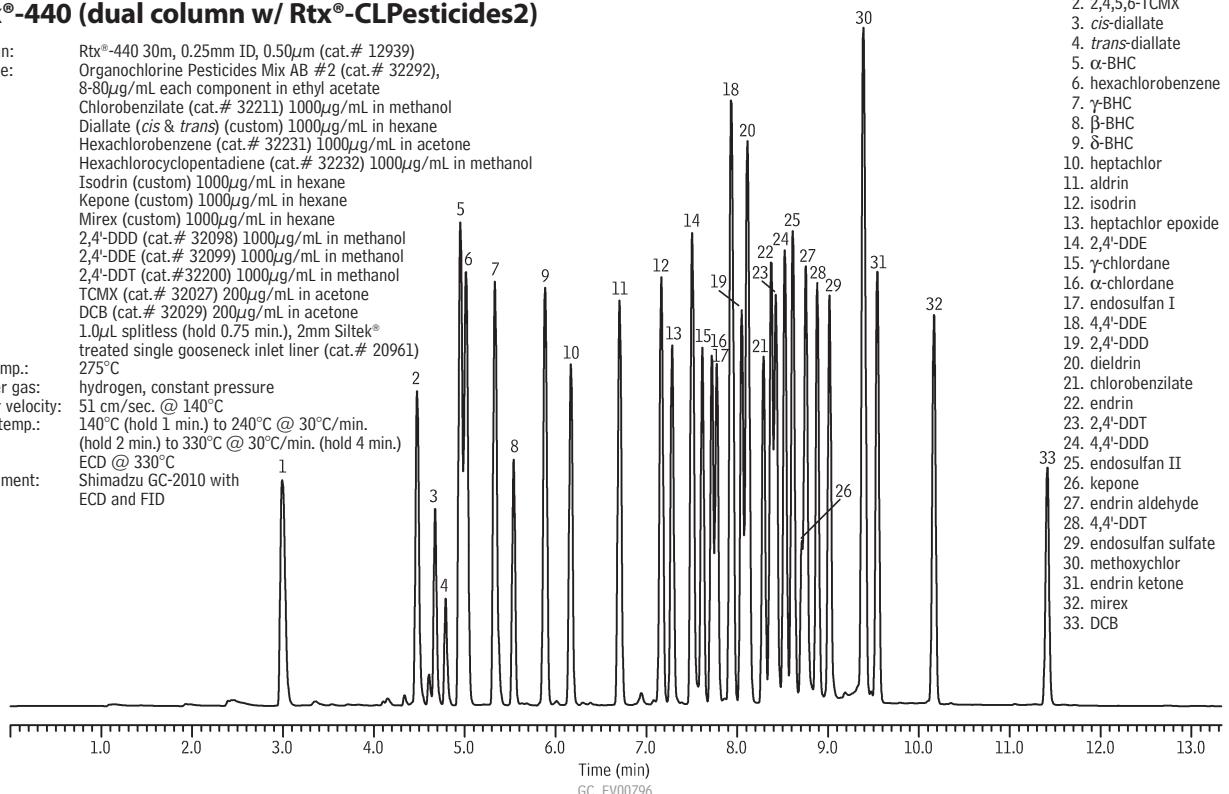
Linear velocity: 51 cm/sec. @ 140°C

Oven temp.: 140°C (hold 1 min.) to 240°C @ 30°C/min.

(hold 2 min.) to 330°C @ 30°C/min. (hold 4 min.)

Det.: ECD @ 330°C

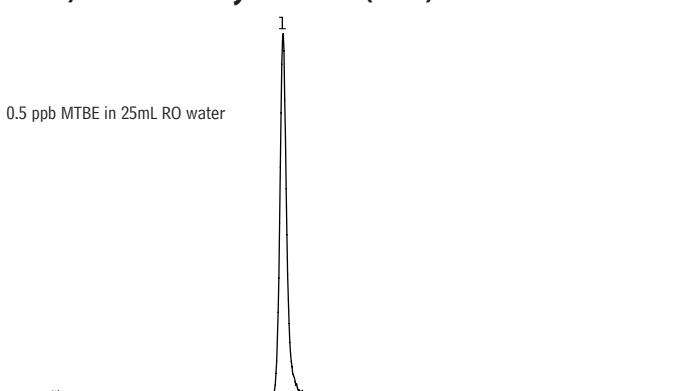
Instrument: Shimadzu GC-2010 with  
ECD and FID



1. hexachlorocyclopentadiene
2. 2,4,5,6-TCMX
3. *cis*-diallate
4. *trans*-diallate
5.  $\alpha$ -BHC
6. hexachlorobenzene
7.  $\gamma$ -BHC
8.  $\beta$ -BHC
9.  $\delta$ -BHC
10. heptachlor
11. aldrin
12. isodrin
13. heptachlor epoxide
14. 2,4'-DDE
15.  $\gamma$ -chlordane
16.  $\alpha$ -chlordane
17. endosulfan I
18. 4,4'-DDE
19. 2,4'-DDD
20. dieldrin
21. chlorobenzilate
22. endrin
23. 2,4'-DDT
24. 4,4'-DDT
25. endosulfan II
26. kepone
27. endrin aldehyde
28. 4,4'-DDT
29. endosulfan sulfate
30. methoxychlor
31. endrin ketone
32. mirex
33. DCB

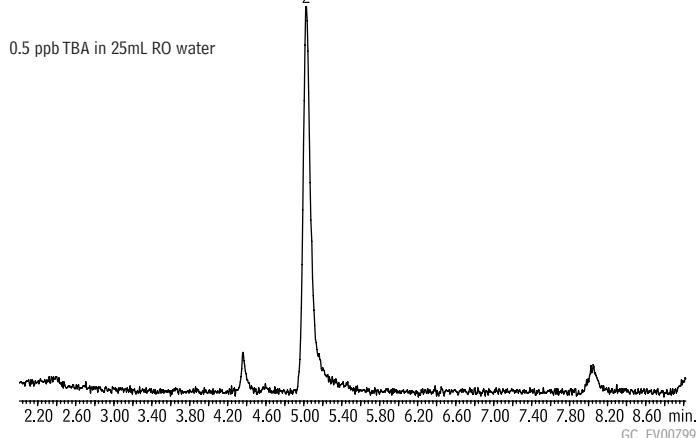
# Methyl *tert*-Butyl Ether (MTBE) and *tert*-Butyl Alcohol (TBA)

Rtx®-VMS



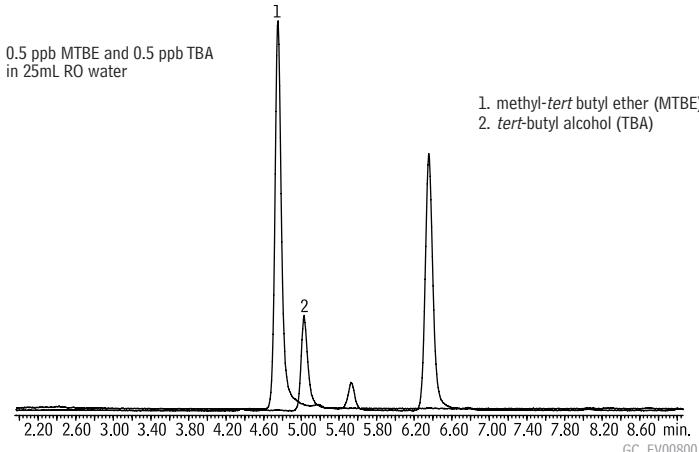
2.20 2.60 3.00 3.40 3.80 4.20 4.60 5.00 5.40 5.80 6.20 6.60 7.00 7.40 7.80 8.20 8.60 min.  
GC\_EV00798

0.5 ppb TBA in 25mL RO water



2.20 2.60 3.00 3.40 3.80 4.20 4.60 5.00 5.40 5.80 6.20 6.60 7.00 7.40 7.80 8.20 8.60 min.  
GC\_EV00799

0.5 ppb MTBE and 0.5 ppb TBA  
in 25mL RO water



1. methyl-*tert* butyl ether (MTBE)  
2. *tert*-butyl alcohol (TBA)

2.20 2.60 3.00 3.40 3.80 4.20 4.60 5.00 5.40 5.80 6.20 6.60 7.00 7.40 7.80 8.20 8.60 min.  
GC\_EV00800

Column: Rtx®-VMS 30m, 0.25mm ID, 1.4 $\mu$ m  
(cat.# 19915)

Interface: split injector  
Transfer line: 2m, 0.25mm ID Siltek® treated tubing (cat.# 22502), temp.: 150°C

Oven temp.: 35°C (hold 7 min.) to 70°C @ 4°C/min. (hold 3 min.) to 220°C @ 20°C/min. (hold 3 min.)

## Purge and Trap

Model: OI 4660 Eclipse Purge and Trap

Trap: #10 (Tenax®/silica gel/carbon molecular sieve)

Purge: 11 min. @ 40mL/min.

Desorb preheat: 185°C

Desorb: 0.5 min. @ 190°C

Desorb flow

rate: 35.0mL/min.

Bake: 6 min. @ 210°C

## Injection

Split ratio:

Inlet liner: 1mm ID Siltek® treated splitless (cat.# 20972)

Inj. temp.:

Carrier gas: helium, constant pressure

Linear velocity: 36cm/sec. @ 35°C

## Detector

Det.:

Transfer line

temp.:

Scan range:

Ionization:

Mode:

MS

150°C

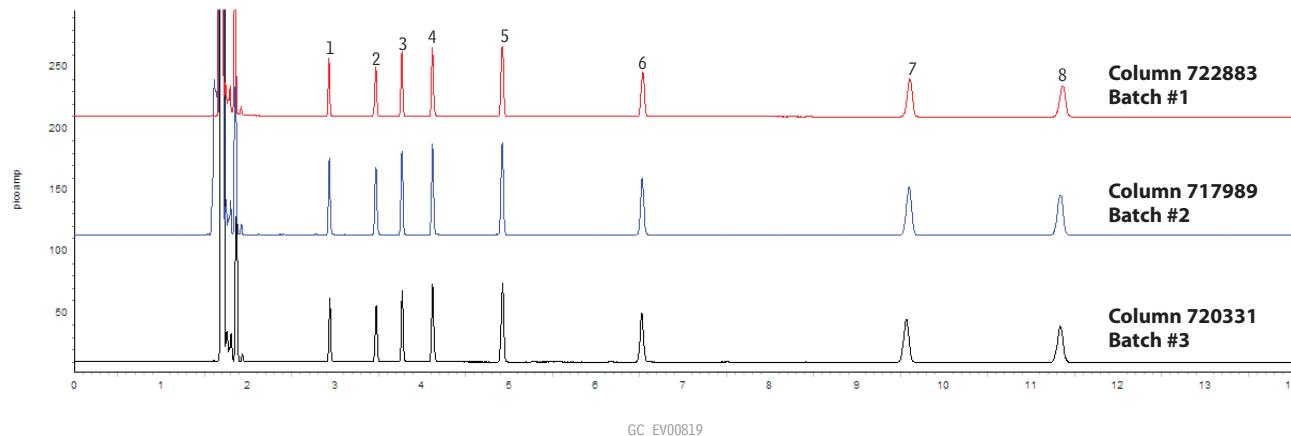
73, 59, 57, & 41 amu

EI

SIM

## Isothermal Test Mix

Rxi®-5ms

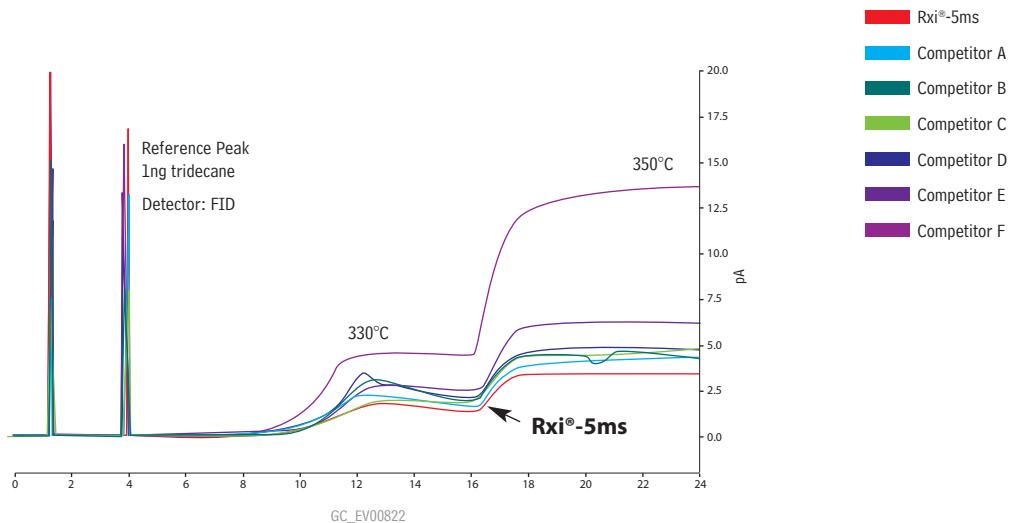


Column: Rxi®-5ms, 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13423)  
Sample: 500 $\mu$ g/mL Isothermal Column Test Mix in toluene  
Inj.: 1.0 $\mu$ L, split injection (split ratio 1:100), 4mm single gooseneck inlet liner  
with wool (cat.# 22405)  
Inj. temp.: 250°C  
Carrier gas: hydrogen, constant flow  
Linear velocity: 38cm/sec. @ 135°C  
Oven temp.: 135°C  
Det.: FID @ 330°C

1. 1,6-hexanediol  
2. 4-chlorophenol  
3. methyl nonanoate  
4. 1-decyldamine  
5. tridecane  
6. 1-undecanol  
7. acenaphthylene  
8. pentadecane

## Rxi®-5ms columns have the lowest bleed among all major brands of columns.

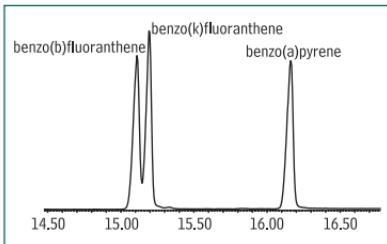
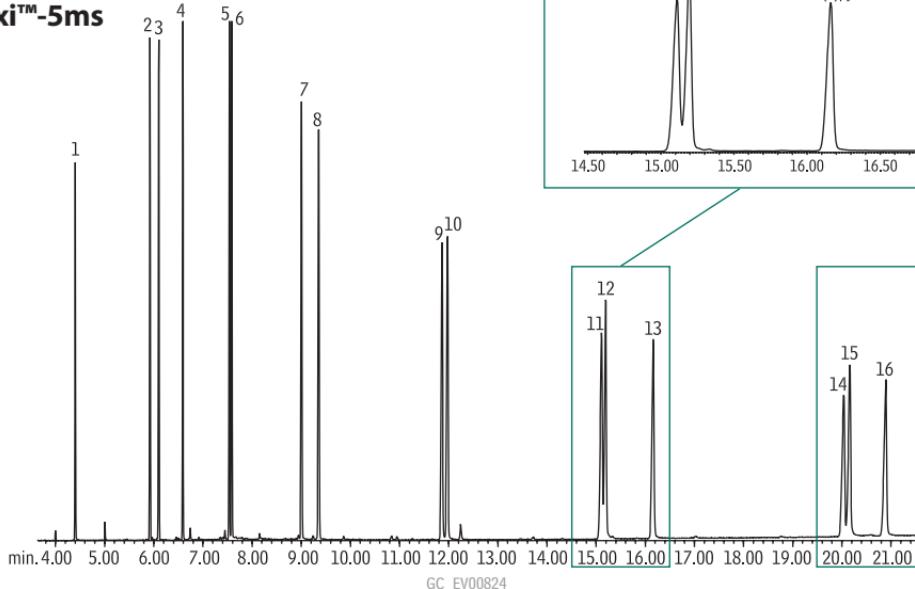
Comparison of 30m x 0.25mm ID, 0.25μm columns at 330°C through 350°C;  
hydrogen carrier gas; flame ionization detection.



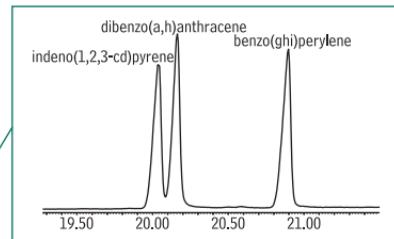
# Polynuclear Aromatic Hydrocarbons

## US EPA Method 610

Rxi™-5ms



1. naphthalene
2. acenaphthylene
3. acenaphthene
4. fluorene
5. phenanthrene
6. anthracene
7. fluoranthene
8. pyrene
9. benzo(a)anthracene
10. chrysene
11. benzo(b)fluoranthene
12. benzo(k)fluoranthene
13. benzo(a)pyrene
14. indeno(1,2,3-cd)pyrene
15. dibenz(a,h)anthracene
16. benzo(ghi)perylene



Column: Rxi™-5ms, 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13423)

Sample: SV Calibration Mix #5 / 610 PAH Mix (cat.# 31011)

Inj.: 1.0 $\mu$ L, 10ppm each analyte (10ng on column), splitless (hold 0.1 min.)  
4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)

Instrument: Agilent 6890

Inj. temp.: 275°C

Carrier gas: helium, constant flow

Flow rate: 1.2mL/min.

Oven temp.: 75°C (hold 0.5 min.) to 245°C @ 25°C/min., to 330°C @ 4°C/min. (hold 1 min.)

Det.: Agilent 5973 GC/MS

Transfer line temp.: 280°C

Scan range: 35-550 amu

Solvent delay: 2 min.

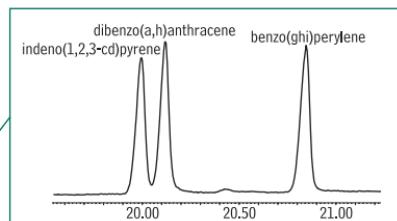
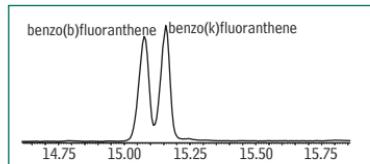
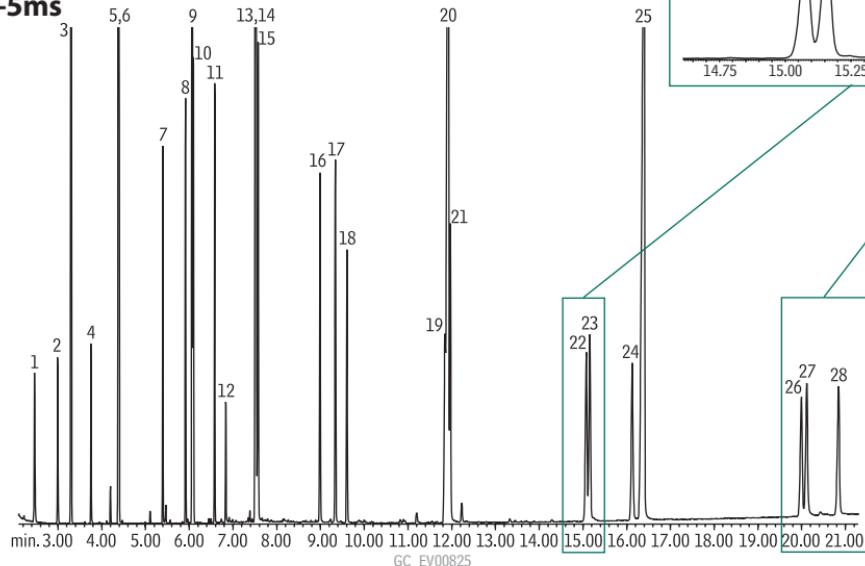
Tune: DFTPP

Ionization: EI

# Polynuclear Aromatic Hydrocarbons

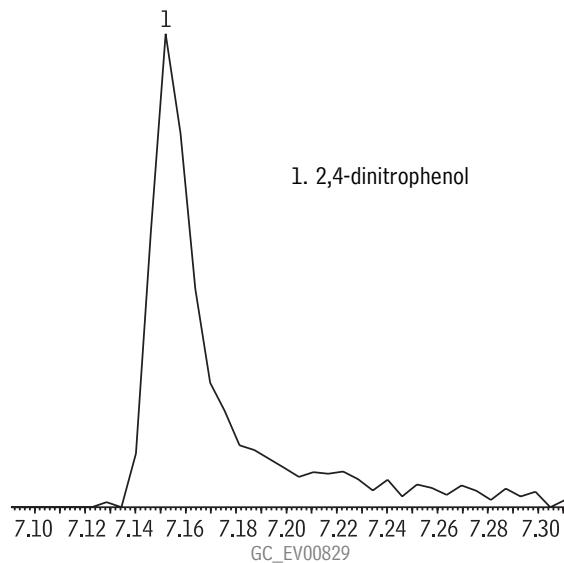
## US EPA Method 610

Rxi™-5ms



Column:	Rxi™-5ms, 30m, 0.25mm ID, 0.25μm (cat.# 13423)	Inj. temp.:	275°C
Sample:	SV Calibration Mix #5 / 610 PAH Mix (cat.# 31011), Acid Surrogate Mix (4/89 SOW) (cat.# 31025), B/N Surrogate Mix (4/89 SOW) (cat.# 31024), SV Internal Standard Mix (cat.# 31206)	Carrier gas:	helium, constant flow
		Flow rate:	1.2mL/min.
		Oven temp.:	75°C (hold 0.5 min.) to 245°C @ 25°C/min., to 330°C @ 4°C/min. (hold 1 min.)
Inj.:	1.0μL, 10ppm each analyte (10ng on column; 40ng each internal standard), splitless (hold 0.1 min.)	Det.:	Agilent 5973 GC/MS
	4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)	Transfer line temp.:	280°C
Instrument:	Agilent 6890	Scan range:	35-550 amu
		Solvent delay:	2 min.
		Tune:	DFTPP
		Ionization:	EI

**2,4-dinitrophenol**  
**EPA Method 8270D**  
**Rxi™-5ms**

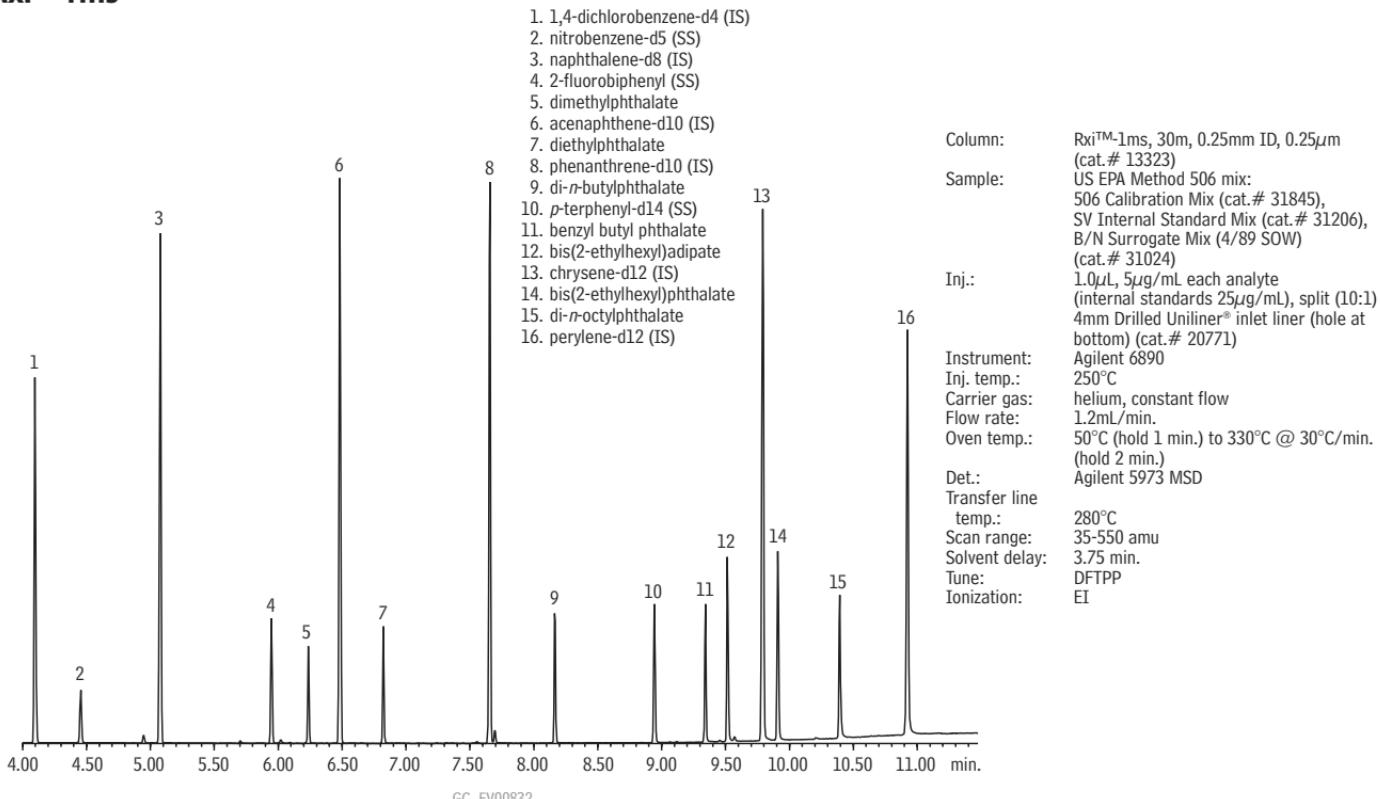


Column: Rxi™-5ms, 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13423)  
Sample: US EPA Method 8270D mix: 8270 MegaMix™ (cat.# 31850),  
Benzoic Acid Standard (cat.# 31879), Benzidine Standard (cat.# 31852),  
Acid Surrogate Mix (cat.# 31025), B/N Surrogate Standard Mix (cat.# 31887),  
1,4-Dioxane (cat.# 31853)  
Inj.: 1.0 $\mu$ L, 0.5ppm each analyte (0.5ng on column), split (10:1)  
4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)  
Instrument: Agilent 6890  
Inj. temp.: 250°C  
Carrier gas: helium, constant flow  
Flow rate: 1.2mL/min.  
Oven temp.: 50°C (hold 0.5 min.) to 245°C @ 25°C/min., to 330°C @ 6°C/min. (hold 5 min.)  
Det.: Agilent 5973 GC/MS  
Transfer line temp.: 280°C  
Scan range: 35-550 amu  
Solvent delay: 2 min.  
Tune: DFTPP  
Ionization: EI

# Phthalate & Adipate Esters

## US EPA Method 506

Rxi™-1ms



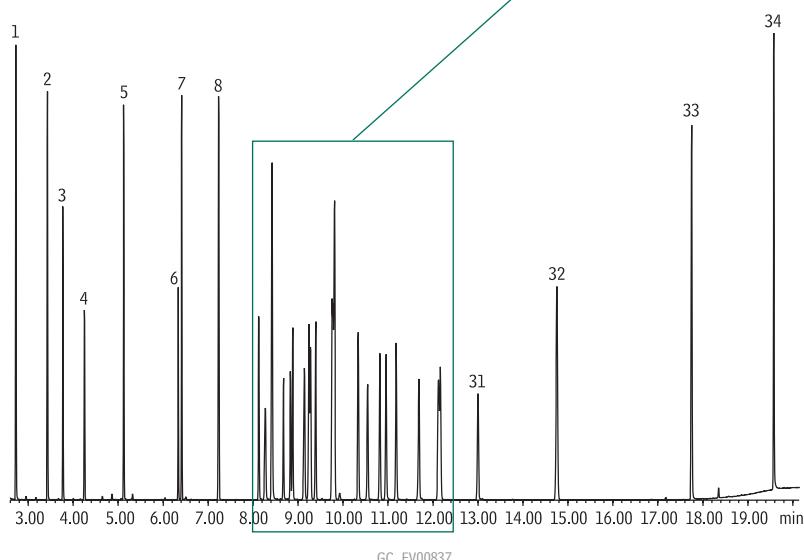
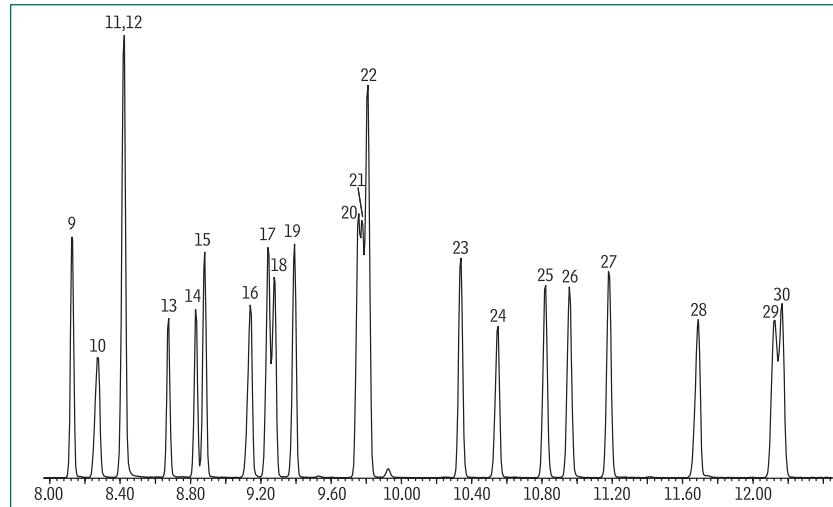
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# Pesticides

## Minnesota Ag List 1

### Rxi™-1ms

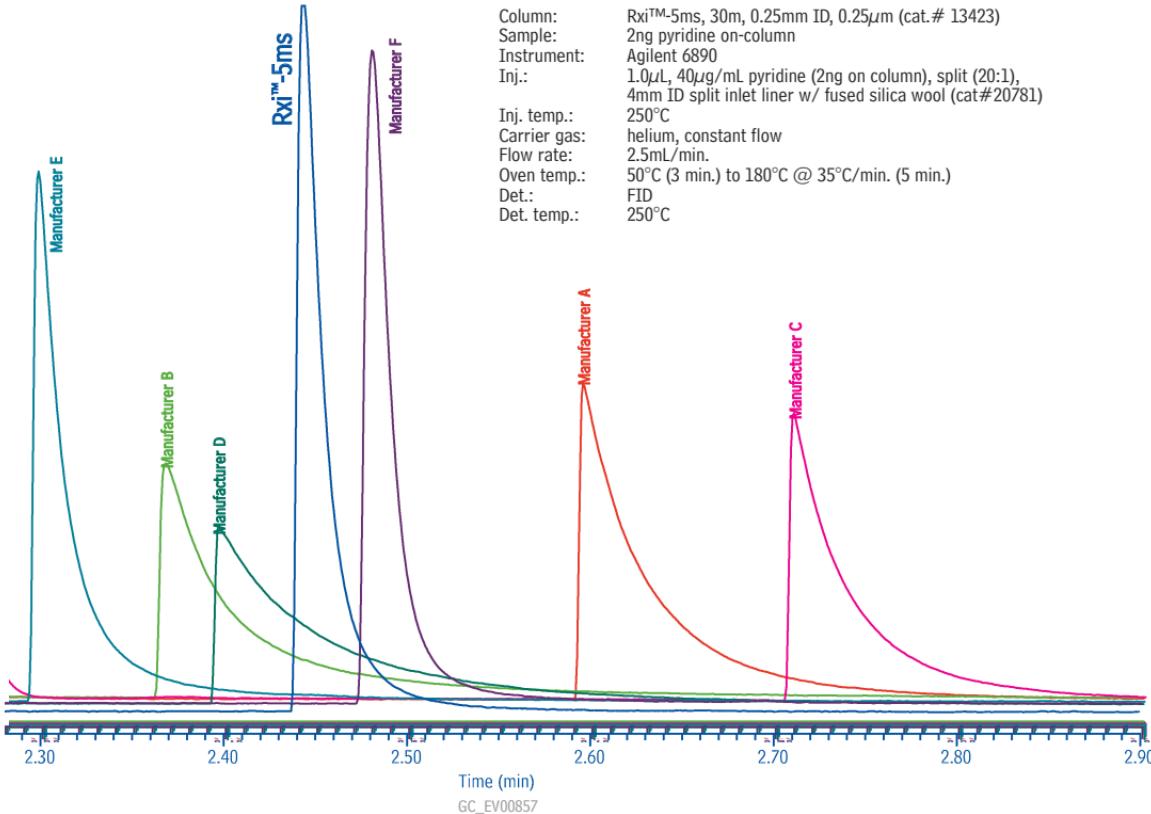
1. 2-fluorophenol (SS)
2. phenol-d6 (SS)
3. 1,4-dichlorobenzene-d4 (IS)
4. nitrobenzene-d5 (SS)
5. naphthalene-d8 (IS)
6. EPTC
7. 2-fluorobiphenyl (SS)
8. acenaphthene-d10 (IS)
9. propachlor
10. desisopropyl atrazine
11. desethyl atrazine
12. 2,4,6-tribromophenol (SS)
13. ethalfluralin
14. trifluralin
15. phorate
16. simazine
17. prometon
18. atrazine
19. propazine
20. terbufos
21. fonofos
22. phenanthrene-d10 (IS)
23. triallate
24. metribuzin
25. dimethenamid
26. acetochlor
27. alachlor
28. cyanazine
29. metolachlor
30. chlorpyrifos
31. pendimethalin
32. *p*-terphenyl-d14 (SS)
33. chrysene-d12 (IS)
34. perylene-d12 (IS)



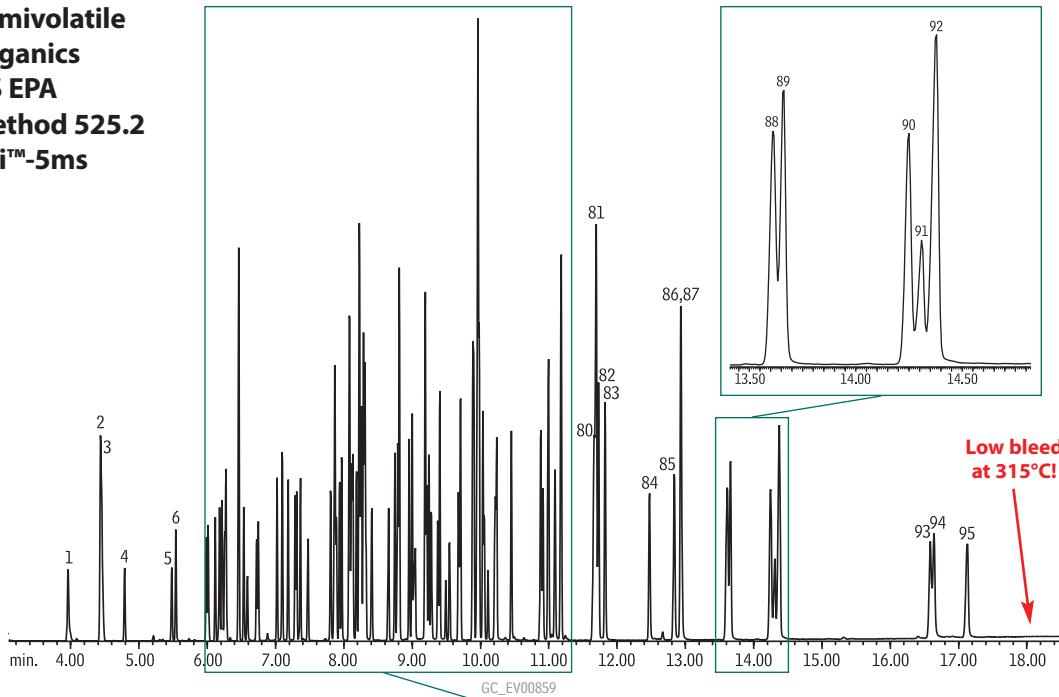
Column: Rxi™-1ms, 30m, 0.25mm ID, 0.25 $\mu$ m (cat.# 13323)  
Sample: Minnesota Ag List 1 Pesticides Mix A (cat.# 32406),  
Minnesota Ag List 1 Pesticides Mix B (cat.# 32407),  
SV Internal Standard Mix (cat.# 31206),  
B/N Surrogate Mix (4/89 SOW) (cat.# 31024),  
Acid Surrogate Mix (4/89 SOW) (cat.# 31025)  
Inj.: 1.0 $\mu$ L, 10 $\mu$ g/mL each analyte (internal standards 25 $\mu$ g/mL), split (10:1)  
4mm Drilled Uniliner® inlet liner (hole at bottom) (cat.# 20771)  
Instrument: Agilent 6890  
Inj. temp.: 250°C  
Carrier gas: helium, constant flow  
Flow rate: 1.2mL/min.  
Oven temp.: 70°C (hold 1 min.) to 180°C @ 20°C/min., to 230°C @ 5°C/min., to 325°C @ 40°C/min. (hold 3.5 min.)  
Det.: Agilent 5973 MSD  
Transfer line temp.: 280°C  
Scan range: 35-550 amu  
Solvent delay: 2.50 min.  
Tune: DFTPP  
Ionization: EI

# Pyridine

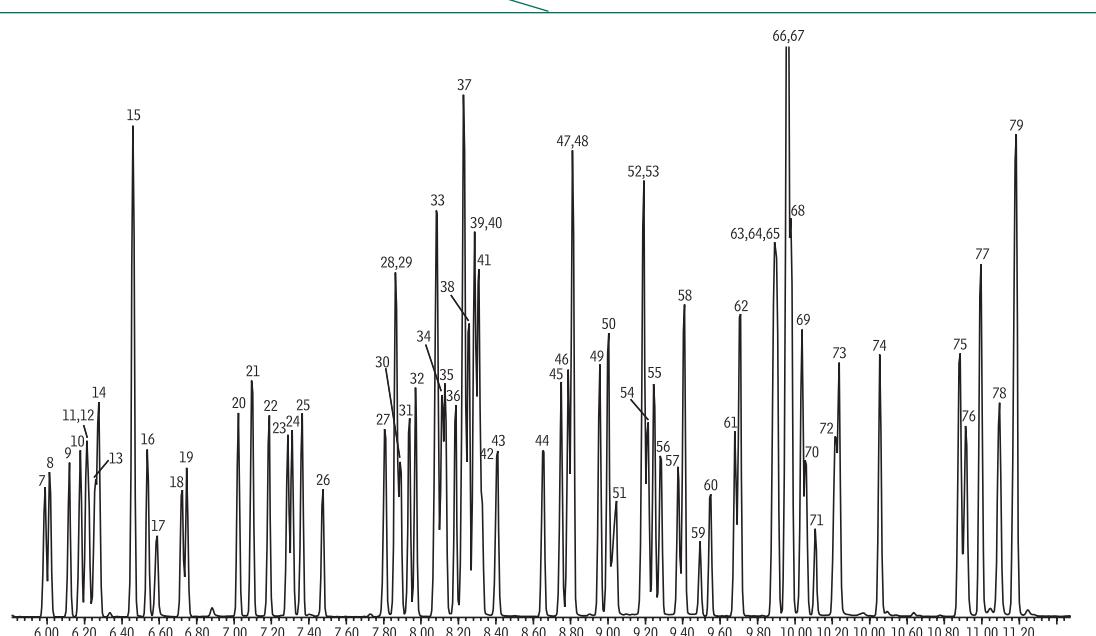
## Rxi™-5ms and Competitive Columns



**Semivolatile  
Organics  
US EPA  
Method 525.2  
Rx<sup>TM</sup>-5ms**



1. isophorone
2. 2-nitro-*m*-xylene (SS)
3. naphthalene
4. dichlorvos (DDVP)
5. hexachlorocyclopentadiene
6. EPTC
7. mevinphos
8. butylate
9. vernalate
10. dimethyl phthalate
11. pebulate
12. etridiazole (Terrazole®)
13. 2,6-dinitrotoluene
14. acenaphthylene
15. acenaphthene-d10 (IS)
16. chlореn
17. tebutiuron
18. 2,4-dinitrotoluene
19. molinate
20. diethyl phthalate
21. fluorene
22. propachlor
23. ethoprop (ethoprophos)
24. cycloate
25. chlorpropham
26. trifluralin
27. atraton
28. hexachlorobenzene
29. prometon
30. simazine
31. atrazine
32. propazine
33. pentachlorophenol
34. triclopyr
35. pronamide (propyzamide)
36. diazinon
37. phenanthrene-d10 (IS)
38. phenanthrene
39. disulfoton
40. methyl paraxon
41. anthracene
42. terbacil
43. chlorothalonil
44. metribuzin
45. simetryn
46. ametryn
47. alachlor
48. prometryn
49. terbutryn
50. di-*n*-butyl phthalate
51. bromacil
52. cyanazine (Bladex)
53. metolochlor
54. chlоруryfros (Dursban®)
55. triadimenfon
56. Dacthal® (DCPA)
57. MGK-264 (isomer A)
58. diphenamid
59. MGK-264 (isomer B)
60. merphos
61. heptachlor epoxide
62. fluoranthene
63. stirofos
64. disulfoton sulfone
65. butachlor
66. pyrene-d10 (SS)
67. fenamiphos
68. pyrene
69. napropamide (Devrinol®)
70. *trans*-nonachlor
71. merphos oxide
72. tricyclozole (Beam)
73. carboxin
74. chlorbenzilate
75. benzyl butyl phthalate
76. norfurazon
77. bis(2-ethylhexyl) adipate
78. hexazinone (Velpar®)
79. triphenylphosphate (SS)
80. benzo(a)anthracene
81. chrysene-d12 (IS)
82. chrysene
83. bis(2-ethylhexyl) phthalate
84. fenamiphos
85. *cis*-permethrin
86. *trans*-permethrin
87. di-*n*-octyl phthalate
88. benzol(b)fluoranthene
89. benzol(k)fluoranthene
90. benzo(a)pyrene
91. fluridone (Sonar®)
92. perylene-d12 (SS)
93. indeno(1,2,3-*c,d*)pyrene
94. dibenzo(a,h)anthracene
95. benzo(ghi)perylene



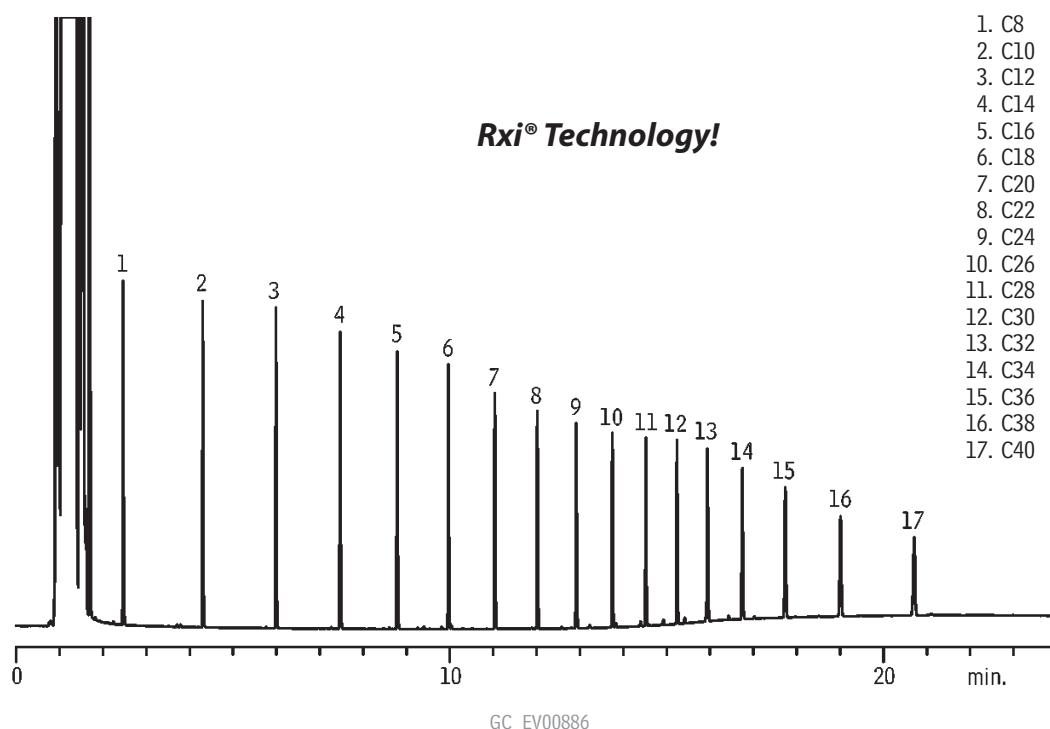
Column: Rx<sup>TM</sup>-5ms, 30m, 0.25mm ID, 0.25μm (cat.# 13423)  
 Sample: US EPA Method 525.2 mix, 10μg/mL each analyte,  
 25μg/mL each internal standard and surrogate:  
 Method 525.2 Semivolatile Mix (cat.# 31899), Organonitrogen Pesticide Mix #1 (cat.# 33012),  
 Organonitrogen Pesticide Mix #2 (cat.# 33011), Organophosphate Pesticide Mix #1 (cat.# 33013),  
 Nitrogen/Phosphorous Pesticide Mix #2 (cat.# 32423), Method 525.2 Internal Standard Mix (cat.# 31825),  
 Method 525.2 Surrogate Standard Mix (cat.# 31826)

Instrument: Agilent 6890  
 Inj.: 1.0μL, pulsed splitless injection: 50psi (0.3 min.), 80mL/min. (0.15 min.), gas saver 15mL/min. (1 min.),  
 4mm Drilled Uniliner® inlet liner, hole in bottom (cat# 20771)

Inj. temp.: 250°C  
 Carrier gas: helium, constant flow  
 Flow rate: 1.2mL/min.  
 Oven temp.: 90°C (1 min.) to 270°C @ 20°C/min., to 315°C @ 6°C/min.  
 Det.: Agilent 5973 MSD  
 Interface line temp.: 280°C  
 Scan range: 35-550 amu  
 Solvent delay: 3.00 min.  
 Tune: DFTPP  
 Ionization: EI

## Petroleum Hydrocarbons (TPH)

Rxi®-1ms



Column: Rxi®-1ms, 20m, 0.18mm ID, 0.18 $\mu$ m (cat.# 13302)  
Sample: Florida TRPH Standard (cat.# 31266), 500 $\mu$ g/mL each component in hexane  
Inj.: 0.5 $\mu$ L, split, split ratio 20:1, 3.5mm Precision™ inlet liner (cat.# 21021)  
Instrument: Shimadzu GC-2010\*  
Inj. temp.: 275°C  
Carrier gas: hydrogen, constant pressure  
Linear velocity: 55cm/sec. @ 40°C  
Oven temp.: 40°C (hold 1 min.) to 330°C @ 20°C/min. (hold 10 min.)  
Det.: FID @ 350°C

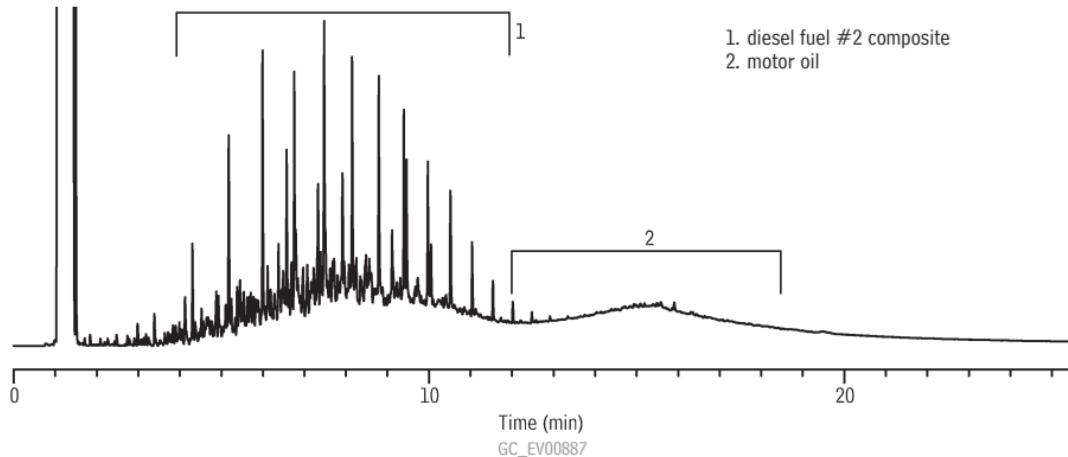
\*GC courtesy of Shimadzu Scientific.

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# Lubrication Range Organics

## Diesel Fuel #2/Motor Oil

Rxi™-1ms



Column: Rxi™-1ms, 20m, 0.18mm ID, 0.18 $\mu$ m (cat.# 13302)  
Sample: Diesel #2/ Motor Oil (cat.# 31682) 5000 $\mu$ g/mL each component in hexane  
Inj.: 0.5 $\mu$ L, split, split ratio 20:1, 3.5mm Precision™ inlet liner (cat.# 21021)  
Instrument: Shimadzu GC-2010  
Inj. temp.: 275°C  
Carrier gas: hydrogen, constant pressure  
Linear velocity: 55cm/sec. @ 40°C  
Oven temp.: 40°C (hold 1 min.) to 330°C @ 20°C/min. (hold 10 min.)  
Det.: FID @ 350°C

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