

**Featured Application:** Optimized volatiles analysis on an Rtx-VMS column with Restek CRMs means better VOC data in less time

## Fast, Optimized GC Purge-and-Trap Analysis of Volatiles for Soil and Water Methods

- Save set-up time—we've optimized volatiles analysis for you!
- Fit-for-purpose Rtx-VMS column separates early eluting gases and critical VOCs, ensuring rugged, accurate volatiles analysis.
- Precisely formulated CRMs ensure accurate quantitation and are backed by Restek's ISO accreditation and rigorous documentation.

Volatile organic compounds (VOCs) pose human health risks and can enter the environment and water supplies through a number of avenues, such as the improper disposal of industrial chemicals (e.g., chlorinated solvents) or the leaking of fuel components from underground storage tanks. Monitoring programs often utilize GC purge-and-trap analysis of volatiles in soil and water samples in order to track VOC contamination. The first fused silica columns used for this analysis were based on diphenyl/dimethyl polysiloxane stationary phases. However, resolution of gases has always been problematic with these columns. In support of labs conducting purge-and-trap analysis of volatiles, Restek designed the Rtx-VMS column specifically to optimize the separation of commonly analyzed VOCs of environmental concern. The Rtx-VMS column features a stationary phase that is selective for VOCs, a film thickness sufficient to retain and resolve the low boiling volatiles, and enough thermal stability to elute the high boiling VOCs.

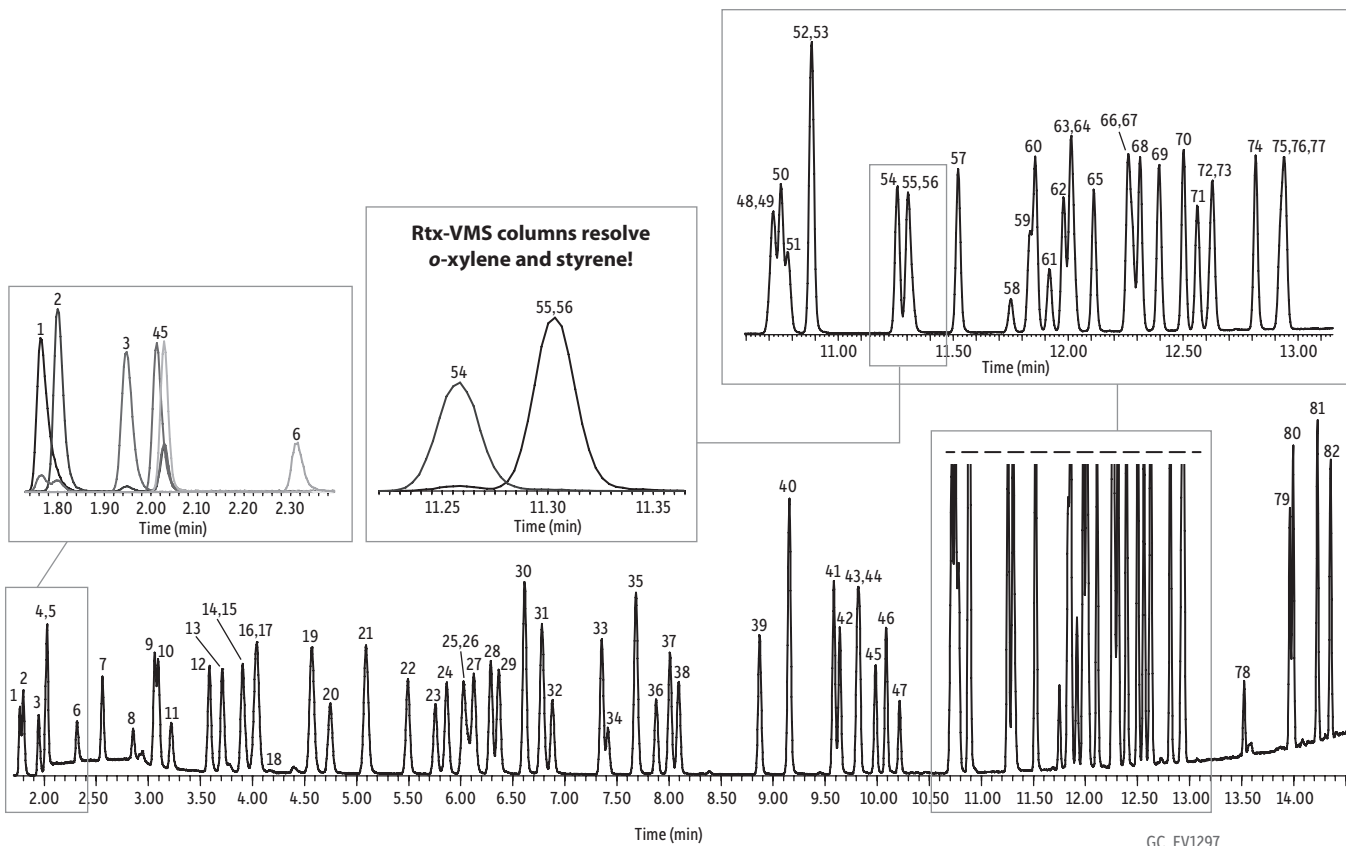
Since the Rtx-VMS column has been optimized for volatiles analysis, it provides excellent resolution of critical VOCs, which ensures more accurate quantification in fast analysis times. As shown in the chromatograms below, data quality and lab productivity can be increased using an Rtx-VMS column paired with Restek certified reference materials (CRMs). In the first example, excellent resolution of the 82 drinking water contaminants listed in EPA Method 524.3 was obtained—including *o*-xylene and styrene, which often coelute on other columns. Labs that include the seven volatiles listed in the Unregulated Contaminant Monitoring Rule 3 (UCMR3) in their drinking water analyses will benefit greatly from this application and these products. Having all VOCs packaged in only three ampuls with CRM documentation simplifies the task of calibration. In addition, separating and detecting volatiles using the Rtx-VMS column delivers the best quality data for purge-and-trap analysis of volatiles in drinking water.

The second chromatogram shown below demonstrates the performance of the Rtx-VMS in separating a longer list of volatiles, specifically the 102 VOCs listed in EPA Method 8260. While EPA Method 524.3 was written for purgeable organic compounds in water samples, EPA Method 8260 can be used for purge-and-trap analysis of volatiles in a much more diverse array of sample types (soil, water, solid waste, etc.) In this example, good chromatographic results are again obtained for both early- and late-eluting volatiles, but the separation of oxygenates is particularly noteworthy. Oxygenates are added to gasolines to enhance fuel performance, and they are target compounds in leaking underground storage tank monitoring. Purge-and-trap GC-MS analysis with a highly selective Rtx-VMS column is recommended for this method because key oxygenates—such as methyl *tert*-butyl ether (MTBE) and *tert*-butyl alcohol (TBA)—coelute on other GC columns and they also share the ions used for identification. In addition to separating these components in the reference standards shown below, the Rtx-VMS column can resolve MTBE and TBA as well as additional oxygenates from other target compounds and potentially interfering matrix components in gasoline. To see the separation and identification of 5 ppb oxygenates in a gasoline sample, visit [www.restek.com](http://www.restek.com) and enter application note EVANI449 in the search.

As shown in the chromatograms, Restek's combination of CRMs and the Rtx-VMS column are highly effective tools that are optimized for GC purge-and-trap analysis of volatiles. The unique Rtx-VMS column phase offers the best separation of critical compound pairs on the market. In addition, Restek CRMs are comprehensive, manufactured and QC-tested in our ISO-accredited labs, and come complete with all necessary documentation to make your job easier.

Peaks	17. MTBE	34. 1,4-Difluorobenzene	51. 1,1,1,2-Tetrachloroethane	68. 1,2,4-Trimethylbenzene
1. Dichlorodifluoromethane	18. <i>tert</i> -Butyl alcohol (TBA)	35. <i>tert</i> -Amyl ethyl ether (TAEE)	52. <i>m</i> -Xylene	69. <i>sec</i> -Butylbenzene
2. Chlorodifluoromethane	19. Diisopropyl ether (DIPE)	36. Dibromomethane	53. <i>p</i> -Xylene	70. 4-Isopropyltoluene
3. Chloromethane	20. 1,1-Dichloroethane	37. 1,2-Dichloropropane	54. <i>o</i> -Xylene	71. 1,3-Dichlorobenzene
4. Vinyl chloride	21. <i>tert</i> -Butyl ethyl ether (ETBE)	38. Bromodichloromethane	55. Styrene	72. 1,4-Dichlorobenzene-D4
5. 1,3-Butadiene	22. <i>cis</i> -1,2-Dichloroethene	39. <i>cis</i> -1,3-Dichloropropene	56. Bromoform	73. 1,4-Dichlorobenzene
6. Bromomethane	23. Bromochloromethane	40. Toluene	57. Isopropylbenzene	74. <i>n</i> -Butylbenzene
7. Trichlorofluoromethane	24. Chloroform	41. Tetrachloroethene	58. 4-Bromofluorobenzene (SS)	75. Hexachloroethane
8. Diethyl ether	25. Carbon tetrachloride	42. <i>trans</i> -1,3-Dichloropropene	59. Bromobenzene	76. 1,2-Dichlorobenzene-D4 (SS)
9. 1,1-Dichloroethene	26. Tetrahydrofuran	43. 1,1,2-Trichloroethane	60. <i>n</i> -Propylbenzene	77. 1,2-Dichlorobenzene
10. Carbon disulfide	27. 1,1,1-Trichloroethane	44. Ethyl methacrylate	61. 1,1,2,2-Tetrachloroethane	78. 1,2-Dibromo-3-chloropropane
11. Methyl iodide	28. 1,1-Dichloropropene	45. Dibromochloromethane	62. 2-Chlorotoluene	79. Hexachlorobutadiene
12. Allyl chloride	29. 1-Chlorobutane	46. 1,3-Dichloropropane	63. 1,3,5-Trimethylbenzene	80. 1,2,4-Trichlorobenzene
13. Methylene chloride	30. Benzene	47. 1,2-Dibromoethane	64. 1,2,3-Trichloropropane	81. Naphthalene
14. <i>trans</i> -1,2-Dichloroethene	31. <i>tert</i> -Amyl methyl ether (TAME)	48. Chlorobenzene-D5	65. 4-Chlorotoluene	82. 1,2,3-Trichlorobenzene
15. Methyl acetate	32. 1,2-Dichloroethane	49. Chlorobenzene	66. <i>tert</i> -Butylbenzene	
16. MTBE-D3 (SS)	33. Trichloroethene	50. Ethylbenzene	67. Pentachloroethane	

See chromatogram and conditions on page 2



**Rtx-VMS columns resolve  
o-xylene and styrene!**

**Column:** Rtx-VMS, 30 m, 0.25 mm ID, 1.40 µm (cat.# 19915)  
**Sample:** 524.3 internal standard/surrogate mix (cat.# 30017)  
 524.3 gas calibration mix (cat.# 30014)  
 524.3 VOA MegaMix standard (cat.# 30013)

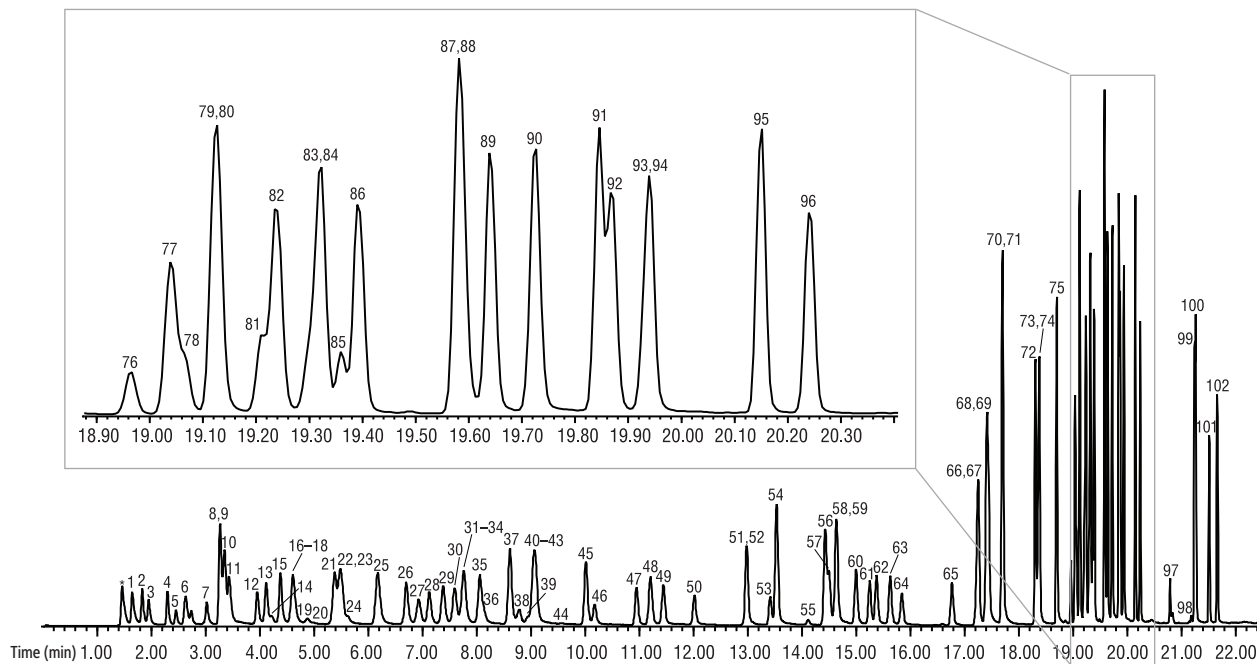
**Diluent:** RO water  
**Conc.:** 5 ng/mL (5 mL sample)  
**Injection:** purge and trap split (split ratio 30:1)  
**Liner:** Restek Premium 1.0 mm ID straight inlet liner (cat.# 23333.1)  
**Inj. Temp.:** 200 °C

**Purge and Trap:**  
**Instrument:** EST Encon Evolution  
**Trap Type:** Vocarb 3000  
**Purge:** 11 min, flow 40 mL/min  
**Dry Purge:** 1 min, flow 50 mL/min  
**Desorb:** 1 min @ 260 °C, flow 30.9 mL/min  
**Bake:** 8 min @ 265 °C  
**Interface Connection:** injection port  
**Transfer Line Temp.:** 150 °C  
**Oven:**  
**Oven Temp.:** 45 °C (hold 4.5 min) to 100 °C at 12 °C/min to 240 °C at 25 °C/min (hold 1.32 min)

**Carrier Gas:** He, constant flow  
**Flow Rate:** 0.9 mL/min  
**Detector:** MS  
**Mode:** Scan  
**Scan Program:**

Group	Start Time (min)	Scan Range (amu)	Scan Rate (scans/sec)
1	1.5	47-300	5.4
2	2.9	35-300	5.19

**Transfer Line Temp.:** 240 °C  
**Analyzer Type:** Quadrupole  
**Source Temp.:** 230 °C  
**Quad Temp.:** 150 °C  
**Electron Energy:** 70 eV  
**Solvent Delay Time:** 1.5 min  
**Tune Type:** BFB  
**Ionization Mode:** EI  
**Instrument:** Agilent 7890A GC & 5975C MSD  
**Acknowledgement:** EST Analytical provided the Centurion robotic autosampler and Encon Evolution P&T concentrator.



GC\_EV00685

**Column** RtX-VMS, 30 m, 0.25 mm ID, 1.4 µm (cat.# 19915)  
**Sample** 8260B MegaMix Calibration Mix Kit (cat.# 30475)  
 California Oxygenates Mix (cat.# 30465)  
 VOA Calibration Mix #1 (ketones) (cat.# 30006)  
 8260A Surrogate Mix (cat.# 30240)  
 8260 Internal Standard Mix (cat.# 30074)

**Injection**  
 Inj. Temp.: 250 °C

**Purge and Trap**

Instrument: O.I. Analytical 4560 with 4551A Autosampler  
 Trap Type: #10 (Tenax/silica gel/carbon molecular sieve)  
 Purge: 11 min @ 20 °C, flow 38 mL/min  
 Desorb Preheat Temp.: 150 °C  
 Desorb: 1.0 min @ 190 °C, flow 32 mL/min  
 Bake: 10 min @ 210 °C  
 Transfer Line Temp.: 110 °C

**Oven**

Oven Temp.: 35 °C (hold 7 min) to 90 °C at 4 °C/min to 220 °C at 45 °C/min (hold 1 min)  
**Carrier Gas** He, constant flow  
 Flow Rate: 1.3 mL/min  
 Dead Time: 1.47 min @ 35 °C  
**Detector** Agilent 5971A GC/MS

**Transfer Line**

Temp.: 280 °C

Tune Type: PFTBA/BFB

Scan Range: 35-260 amu

Sample size: 10 mL

Sample temp: 40 °C

Water Management: 110 °C purge, 0 °C desorb, 240 °C bake

6-Port Valve: 110 °C

Sparge Mount: 45 °C

Valve Manifold: 50 °C

Other Conditions: prepurge, preheat, dry purge OFF

Purge & trap courtesy of O.I. Analytical

**Acknowledgement**

**Peaks**

- |   |                                     |                                       |   |
|---|-------------------------------------|---------------------------------------|---|
| 1. Dichlorodifluoromethane                | 27. 2,2-Dichloropropane             | 54. Toluene                           | 81. 1,1,2,2-Tetrachloroethane           |
| 2. Chloromethane                          | 28. Bromochloromethane              | 55. 2-Nitropropane                    | 82. 2-Chlorotoluene                     |
| 3. Vinyl chloride                         | 29. Chloroform                      | 56. Tetrachloroethene                 | 83. 1,2,3-Trichloropropane              |
| 4. Bromomethane                           | 30. Carbon tetrachloride            | 57. 2-Bromo-1-chloropropane           | 84. 1,3,5-Trimethylbenzene              |
| 5. Chloroethane                           | 31. Tetrahydrofuran                 | 58. 4-Methyl-2-pentanone              | 85. <i>trans</i> -1,4-Dichloro-2-butene |
| 6. Trichlorofluoromethane                 | 32. Methyl acrylate                 | 59. <i>trans</i> -1,3-Dichloropropene | 86. 4-Chlorotoluene                     |
| 7. Diethyl ether                          | 33. 1,1,1-Trichloroethane           | 60. 1,1,2-Trichloroethane             | 87. <i>tert</i> -Butylbenzene           |
| 8. 1,1-Dichloroethene                     | 34. Dibromofluoromethane            | 61. Ethyl methacrylate                | 88. Pentachloroethane                   |
| 9. Carbon disulfide                       | 35. 1,1-Dichloropropene             | 62. Dibromochloromethane              | 89. 1,2,4-Trimethylbenzene              |
| 10. 1,1,2-Trichloro-1,2,2-trifluoroethane | 36. 2-Butanone                      | 63. 1,3-Dichloropropane               | 90. <i>sec</i> -Butylbenzene            |
| 11. Iodomethane                           | 37. Benzene                         | 64. 1,2-Dibromoethane                 | 91. <i>p</i> -Isopropyltoluene          |
| 12. Allyl chloride                        | 38. Propionitrile                   | 65. 2-Hexanone                        | 92. 1,3-Dichlorobenzene                 |
| 13. Methylene chloride                    | 39. Methacrylonitrile               | 66. Chlorobenzene-D5                  | 93. 1,4-Dichlorobenzene-D4              |
| 14. Acetone                               | 40. 1,2-Dichloroethane-D4           | 67. Chlorobenzene                     | 94. 1,4-Dichlorobenzene                 |
| 15. <i>trans</i> -1,2-Dichloroethene      | 41. Pentafluorobenzene              | 68. Ethylbenzene                      | 95. <i>n</i> -Butylbenzene              |
| 16. Methyl-D3- <i>tert</i> -butyl-ether   | 42. <i>tert</i> -Amyl methyl ether  | 69. 1,1,1,2-Tetrachloroethane         | 96. 1,2-Dichlorobenzene                 |
| 17. Methyl acetate                        | 43. 1,2-Dichloroethane              | 70. <i>m</i> -Xylene                  | 97. 1,2-Dibromo-3-chloropropane         |
| 18. Methyl <i>tert</i> -butyl ether       | 44. Isobutyl alcohol                | 71. <i>p</i> -Xylene                  | 98. Nitrobenzene                        |
| 19. <i>tert</i> -Butyl alcohol            | 45. Trichloroethene                 | 72. <i>o</i> -Xylene                  | 99. Hexachlorobutadiene                 |
| 20. Acetonitrile                          | 46. 1,4-Difluorobenzene             | 73. Bromoform                         | 100. 1,2,4-Trichlorobenzene             |
| 21. Diisopropyl ether                     | 47. Dibromomethane                  | 74. Styrene                           | 101. Naphthalene                        |
| 22. Chloroprene                           | 48. 1,2-Dichloropropane             | 75. Isopropylbenzene                  | 102. 1,2,3-Trichlorobenzene             |
| 23. 1,1-Dichloroethane                    | 49. Bromodichloromethane            | 76. 4-bromo-1-fluorobenzene           | *Carbon dioxide                         |
| 24. Acrylonitrile                         | 50. Methyl methacrylate             | 77. Bromobenzene                      |   |
| 25. Ethyl <i>tert</i> -butyl ether        | 51. <i>cis</i> -1,3-Dichloropropene | 78. <i>cis</i> -1,4-Dichloro-2-butene |   |
| 26. <i>cis</i> -1,2-Dichloroethene        | 52. 2-Chloroethyl vinyl ether       | 79. 1,4-Dichlorobutane                |   |
|   | 53. Toluene-d8                      | 80. <i>n</i> -Propylbenzene           |   |

## Rtx-VMS Columns (fused silica)

proprietary Crossbond phase

Description	temp. limits	qty.	cat.#
30 m, 0.25 mm ID, 1.40 µm	-40 to 240/260 °C	ea.	19915

## Topaz 1.0 mm ID Straight Inlet Liner

for Agilent GCs equipped with split/splitless inlets

ID x OD x Length	qty.	cat.#
Straight, Premium Deactivation, Borosilicate Glass		
1.0 mm x 6.3 mm x 78.5 mm	5-pk.	23333

RESTEK

## 8260 MegaMix Calibration Mix Kit

kit

Contains 1 mL each of these mixtures.

30633: 8260 MegaMix Calibration Mix

30265: 2-chloroethyl vinyl ether

<b>30633: 8260 MegaMix Calibration Mix</b>

Acetonitrile (75-05-8)  
Acrylonitrile (107-13-1)  
Allyl chloride (3-chloropropene) (107-05-1)  
Benzene (71-43-2)  
Bromobenzene (108-86-1)  
Bromochloromethane (74-97-5)  
Bromodichloromethane (75-27-4)  
Bromoform (75-25-2)  
*n*-Butylbenzene (104-51-8)  
*sec*-Butylbenzene (135-98-8)  
*tert*-Butylbenzene (98-06-6)  
Carbon disulfide (75-15-0)  
Carbon tetrachloride (56-23-5)  
Chlorobenzene (108-90-7)  
2-Chloroethanol (107-07-3)  
Chloroform (67-66-3)  
Chloroprene (2-chloro-1,3-butadiene) (126-99-8)  
2-Chlorotoluene (95-49-8)  
4-Chlorotoluene (106-43-4)  
Dibromochloromethane (124-48-1)  
1,2-Dibromo-3-chloropropane (DBCP) (96-12-8)  
1,2-Dibromoethane (EDB) (106-93-4)  
Dibromomethane (74-95-3)  
1,2-Dichlorobenzene (95-50-1)  
1,3-Dichlorobenzene (541-73-1)  
1,4-Dichlorobenzene (106-46-7)

*cis*-1,4-Dichloro-2-butene (1476-11-5)  
*trans*-1,4-Dichloro-2-butene (110-57-6)  
1,1-Dichloroethane (75-34-3)  
1,2-Dichloroethane (107-06-2)  
1,1-Dichloroethene (75-35-4)  
*cis*-1,2-Dichloroethene (156-59-2)  
*trans*-1,2-Dichloroethene (156-60-5)  
1,2-Dichloropropane (78-87-5)  
1,3-Dichloropropane (142-28-9)  
2,2-Dichloropropane (594-20-7)  
1,1-Dichloropropene (563-58-6)  
*cis*-1,3-Dichloropropene (10061-01-5)  
*trans*-1,3-Dichloropropene (10061-02-6)  
Diethyl ether (ethyl ether) (60-29-7)  
1,4-Dioxane (123-91-1)  
Ethylbenzene (100-41-4)  
Ethyl methacrylate (97-63-2)  
Hexachloro-1,3-butadiene (87-68-3)  
Iodomethane (methyl iodide) (74-88-4)  
Isobutyl alcohol (2-methyl-1-propanol) (78-83-1)  
Isopropylbenzene (cumene) (98-82-8)  
4-Isopropyl toluene (*p*-Cymene) (99-87-6)  
Methacrylonitrile (126-98-7)  
Methyl acrylate (96-33-3)  
Methyl methacrylate (80-62-6)  
Methylene chloride (dichloromethane) (75-09-2)  
Naphthalene (91-20-3)

Nitrobenzene (98-95-3)  
2-Nitropropane (79-46-9)  
Pentachloroethane (76-01-7)  
Propionitrile (107-12-0)  
*n*-Propylbenzene (103-65-1)  
Styrene (100-42-5)  
1,1,1,2-Tetrachloroethane (630-20-6)  
1,1,2,2-Tetrachloroethane (79-34-5)  
Tetrachloroethene (127-18-4)  
Tetrahydrofuran (109-99-9)  
Toluene (108-88-3)  
1,2,3-Trichlorobenzene (87-61-6)  
1,2,4-Trichlorobenzene (120-82-1)  
1,1,1-Trichloroethane (71-55-6)  
1,1,2-Trichloroethane (79-00-5)  
Trichloroethene (79-01-6)  
1,2,3-Trichloropropane (96-18-4)  
1,1,2-Trichlorotrifluoroethane (CFC-113) (76-13-1)  
1,2,4-Trimethylbenzene (95-63-6)  
1,3,5-Trimethylbenzene (108-67-8)  
*m*-Xylene (108-38-3)  
*o*-Xylene (95-47-6)  
*p*-Xylene (106-42-3)

<b>30265: 2-Chloroethyl Vinyl Ether</b>

2-Chloroethyl vinyl ether (110-75-8)

Contains 1 mL each of these mixtures.

cat.# 30475 (kit)

## California Oxygenates Mix (5 components)

*tert*-Amyl methyl ether (TAME) (994-05-8), 2,000 µg/mL  
*tert*-Butanol (TBA) (75-65-0), 10,000 µg/mL  
Diisopropyl ether (DIPE) (108-20-3), 2,000 µg/mL  
Ethyl-*tert*-butyl ether (ETBE) (637-92-3), 2,000 µg/mL  
Methyl *tert*-butyl ether (MTBE) (1634-04-4), 2,000 µg/mL

In P&T methanol, 1 mL/ampul

cat.# 30465 (ea.)

## 8260A Surrogate Mix (4 components)

1-Bromo-4-fluorobenzene (BFB) (460-00-4)  
Dibromofluoromethane (1868-53-7)  
1,2-Dichloroethane-*d*<sub>4</sub> (17060-07-0)  
Toluene-*d*<sub>8</sub> (2037-26-5)

2,500 µg/mL each in P&T methanol, 1 mL/ampul

cat.# 30240 (ea.)

## VOA Calibration Mix #1 (ketones) (4 components)

Acetone (67-64-1)  
2-Butanone (MEK) (78-93-3)  
2-Hexanone (591-78-6)  
4-Methyl-2-pentanone (MIBK) (108-10-1)

5,000 µg/mL each in P&T methanol:water (90:10), 1 mL/ampul

cat.# 30006 (ea.)

## 8260 Internal Standard Mix (4 components)

Chlorobenzene-*d*<sub>5</sub> (3114-55-4)  
1,4-Dichlorobenzene-*d*<sub>4</sub> (3855-82-1)  
1,4-Difluorobenzene (540-36-3)  
Pentafluorobenzene (363-72-4)

2,500 µg/mL each in P&T methanol, 1 mL/ampul

cat.# 30074 (ea.)



## EPA 524.3 Reference Standards (5 separate mixes, including a MegaMix standard)

### 524.3 VOA MegaMix Standard (69 components)

Allyl chloride (3-chloropropene) (107-05-1)  
*tert*-Amyl ethyl ether (TAE) (919-94-8)  
*tert*-Amyl methyl ether (TAME) (994-05-8)  
Benzene (71-43-2)  
Bromobenzene (108-86-1)  
Bromochloromethane (74-97-5)  
Bromodichloromethane (75-27-4)  
Bromoform (75-25-2)  
*tert*-Butanol (TBA) (75-65-0)  
*n*-Butylbenzene (104-51-8)  
*sec*-Butylbenzene (135-98-8)  
*tert*-Butylbenzene (98-06-6)  
Carbon disulfide (75-15-0)  
Carbon tetrachloride (56-23-5)  
Chlorobenzene (108-90-7)  
Chloroform (67-66-3)  
1-Chlorobutane (butyl chloride) (109-69-3)  
2-Chlorotoluene (95-49-8)  
4-Chlorotoluene (106-43-4)  
Dibromochloromethane (124-48-1)  
1,2-Dibromo-3-chloropropane (96-12-8)  
Dibromomethane (74-95-3)  
1,2-Dibromoethane (EDB) (106-93-4)

1,2-Dichlorobenzene (95-50-1)  
1,3-Dichlorobenzene (541-73-1)  
1,4-Dichlorobenzene (106-46-7)  
1,1-Dichloroethane (75-34-3)  
1,2-Dichloroethane (107-06-2)  
1,1-Dichloroethene (75-35-4)  
*cis*-1,2-Dichloroethene (156-59-2)  
*trans*-1,2-Dichloroethene (156-60-5)  
1,2-Dichloropropane (78-87-5)  
1,3-Dichloropropane (142-28-9)  
1,1-Dichloropropene (563-58-6)  
*cis*-1,3-Dichloropropene (10061-01-5)  
*trans*-1,3-Dichloropropene (10061-02-6)  
Diethyl ether (ethyl ether) (60-29-7)  
Diisopropyl ether (DIPE) (108-20-3)  
Ethylbenzene (100-41-4)  
Ethyl-*tert*-butyl ether (ETBE) (637-92-3)  
Ethyl methacrylate (97-63-2)  
Hexachlorobutadiene (87-68-3)  
Hexachloroethane (67-72-1)  
Iodomethane (methyl iodide) (74-88-4)  
Isopropylbenzene (cumene) (98-82-8)  
4-Isopropyltoluene (*p*-cymene) (99-87-6)

Methyl acetate (79-20-9)  
Methyl-*tert*-butyl ether (MTBE) (1634-04-4)  
Methylene chloride (dichloromethane) (75-09-2)  
Naphthalene (91-20-3)  
Pentachloroethane (76-01-7)  
*n*-Propylbenzene (103-65-1)  
Styrene (100-42-5)  
Tetrachloroethene (127-18-4)  
1,1,1,2-Tetrachloroethane (630-20-6)  
1,1,2,2-Tetrachloroethane (79-34-5)  
Tetrahydrofuran (109-99-9)  
Toluene (108-88-3)  
1,2,3-Trichlorobenzene (87-61-6)  
1,2,4-Trichlorobenzene (120-82-1)  
1,1,1-Trichloroethane (71-55-6)  
1,1,2-Trichloroethane (79-00-5)  
Trichloroethene (79-01-6)  
1,2,3-Trichloropropane (96-18-4)  
1,2,4-Trimethylbenzene (95-63-6)  
1,3,5-Trimethylbenzene (108-67-8)  
*m*-Xylene (108-38-3)  
*o*-Xylene (95-47-6)  
*p*-Xylene (106-42-3)

2,000 µg/mL each in P&T methanol, 1 mL/ampul

cat.# 30013 (ea.)

### 524.3 Gas Calibration Mix (7 components)

Bromomethane (methyl bromide) (74-83-9)  
1,3-Butadiene (106-99-0)  
Chlorodifluoromethane (CFC-22) (75-45-6)  
Chloromethane (methyl chloride) (74-87-3)  
Dichlorodifluoromethane (CFC-12) (75-71-8)  
Trichlorofluoromethane (CFC-11) (75-69-4)  
Vinyl chloride (75-01-4)

2,000 µg/mL each in P&T methanol, 1 mL/ampul  
cat.# 30014 (ea.)

### 524.3 Internal Standard Mix (3 components)

Chlorobenzene-*d*5 (3114-55-4)  
1,4-Dichlorobenzene-*d*4 (3855-82-1)  
1,4-Difluorobenzene (540-36-3)

2,000 µg/mL each in P&T methanol, 1 mL/ampul  
cat.# 30015 (ea.)

### 524.3 Surrogate Standard (3 components)

1-Bromo-4-fluorobenzene (BFB) (460-00-4)  
Methyl-*d*3-*tert*-butyl ether (29366-08-3)  
1,2-Dichlorobenzene-*d*4 (2199-69-1)

2,000 µg/mL each in P&T methanol, 1 mL/ampul  
cat.# 30016 (ea.)

### 524.3 Internal Standard/Surrogate Mix (6 components)

1-Bromo-4-fluorobenzene (BFB) (460-00-4)  
Methyl-*d*3-*tert*-butyl ether (29366-08-3)  
Chlorobenzene-*d*5 (3114-55-4)  
1,2-Dichlorobenzene-*d*4 (2199-69-1)  
1,4-Dichlorobenzene-*d*4 (3855-82-1)  
1,4-Difluorobenzene (540-36-3)

2,000 µg/mL each in P&T methanol, 1 mL/ampul  
cat.# 30017 (ea.)





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