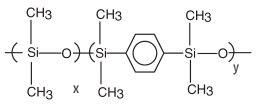
Semivolatiles Analysis

new!

Rxi®-5Sil MS Structure



Rxi®-5Sil MS (low polarity Crossbond® silarylene phase; similar to 5% diphenyl/95% dimethyl polysiloxane)

- Engineered to be a low bleed GC/MS column.
- Excellent inertness for active compounds.
- General purpose columns—ideal for GC/MS analysis of chlorinated hydrocarbons, phthalates, phenols, amines, organochlorine pesticides, organophosphorus pesticides, drugs, solvent impurities, hydrocarbons.
- Temperature range: -60°C to 350°C.

The Rxi®-5Sil MS stationary phase incorporates phenyl rings in the polymer backbone. This improves thermal stability, reduces bleed, and makes the phase less prone to oxidation. Rxi®-5Sil MS columns are ideal for GC/MS applications requiring high sensitivity, including use in ion trap systems.

Rxi®-5Sil MS column is recommended for US EPA Method 8270.

similar phases

DB-5MS, VF-5ms, CP-Sil 8 Low-Bleed/MS

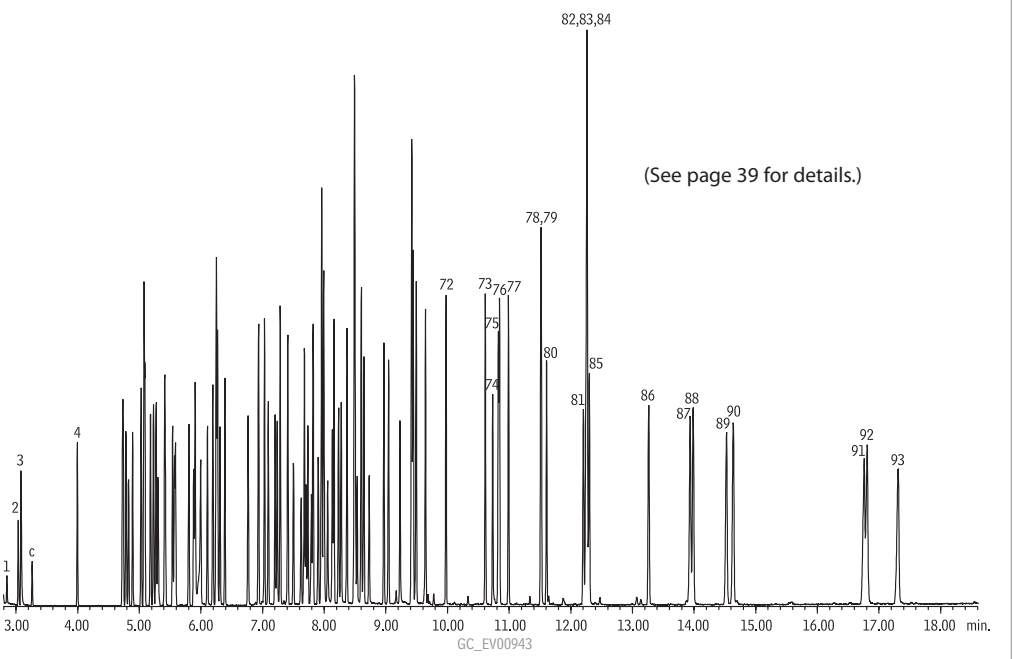
Rxi®-5Sil MS Columns (fused silica)

(Crossbond®, selectivity similar to 5% diphenyl/95% dimethyl polysiloxane)

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10	-60 to 330/350°C	13605	13608	
	0.25	-60 to 330/350°C	13620	13623	13626
	0.50	-60 to 330/350°C	13635	13638	
	1.00	-60 to 325/350°C	13650	13653	13697
0.32mm	0.25	-60 to 330/350°C	13621	13624	
	0.50	-60 to 330/350°C		13639	
	1.00	-60 to 325/350°C		13654	
0.53mm	1.50	-60 to 310/330°C		13670	

ID	df (µm)	temp. limits	10-Meter	20-Meter
0.10mm	0.10	-60 to 330/350°C	43601	
0.18mm	0.18	-60 to 330/350°C		43602
	0.36	-60 to 330/350°C		43604

Semivolatile organics by US EPA Method 8270 on an Rxi®-5Sil MS column.



(See page 39 for details.)

Cindy Ross
Southeast Sales Representative
21+ years of service!

Organophosphorus Pesticides Analysis

Rtx®-OPPesticides/Rtx®-OPPesticides2 (proprietary Crossbond® phases)

- Application-specific columns for organophosphorus pesticides; best column combination for US EPA Method 8141A.
- Low bleed—ideal for GC/FPD, GC/NPD, or GC/MS analyses.
- Stable to 330°C.

restek **innovation**!

- Better separations
- Faster analysis

Using sophisticated computer modeling software, we created two stationary phases for separating the 55 organophosphorus pesticides (OPP) listed in EPA Method 8141A. Separation is improved, and analysis time is significantly reduced, compared to other columns. The extended upper temperature limit of these phases (330°C) allows analysts to bake out high molecular weight contamination typically associated with pesticide samples. The low bleed columns are a perfect match for sensitive detection systems.

Rtx®-OPPesticides Columns (fused silica)

ID	df (µm)	temp. limits	30-Meter
0.32mm	0.50	-20 to 310/330°C	11239
0.53mm	0.83	-20 to 310/330°C	11240

Rtx®-OPPesticides2 Columns (fused silica)

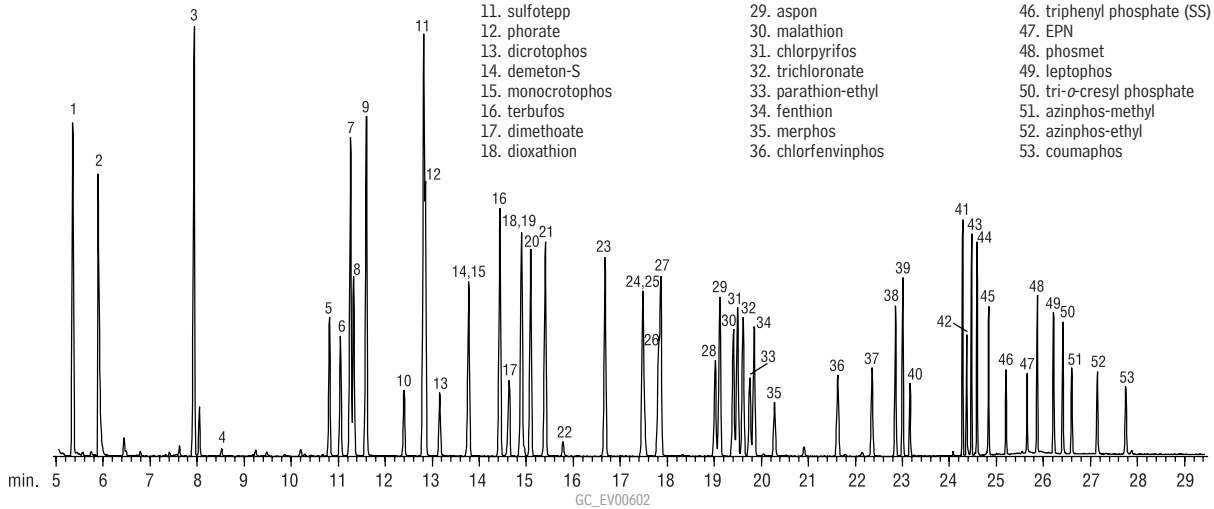
ID	df (µm)	temp. limits	20-Meter	30-Meter
0.18mm	0.20	-20 to 310/330°C	11244	
0.25mm	0.25	-20 to 310/330°C		11243
0.32mm	0.32	-20 to 310/330°C		11241
0.53mm	0.50	-20 to 310/330°C		11242

did you **know**?

These application-specific Restek columns give fast, efficient analysis of the OPPs listed in EPA Method 8141A

Organophosphorus pesticides by US EPA Method 8141A on an Rtx®-OPPesticides2 column.

1. dichlorvos
2. hexamethylphosphoramide
3. mevinphos
4. trichlorfon
5. TEPP
6. demeton-O
7. thionazin
8. tributyl phosphate (IS)
9. ethoprop
10. naled
11. sulfotepp
12. phorate
13. dicrotophos
14. demeton-S
15. monocrotophos
16. terbufos
17. dimethoate
18. dioxathion
19. fonophos
20. diazinon
21. disulfoton
22. phosphamidon isomer
23. dichlorofenthion
24. chlorpyrifos methyl
25. phosphamidon
26. parathion-methyl
27. ronnel
28. fenitrothion
29. aspon
30. malathion
31. chlorpyrifos
32. trichloronate
33. parathion-ethyl
34. fenthion
35. merphos
36. chlorfenvinphos
37. crotoxyphos
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



GC_EV00602

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. to 210°C @ 4°C/min. (hold 1 min.) to 280°C @ 30°C (hold 5 min.)
	8140/8141 OP Pesticides Calibration Mix A (cat.# 32277)		
	8141 OP Pesticides Calibration Mix B (cat.# 32278)	Det:	MS
	Custom Mixes: Call Restek for Information	Transfer line temp.:	280°C
Inj.:	1.0µL splitless (hold 0.4 min.), 4mm double gooseneck inlet liner (cat.# 20785)	Scan range:	35-400amu
		Ionization:	EI

Chlorinated Pesticides Analysis

restek innovation!

- Very low bleed
- Faster analysis

Rtx®-CLPesticides/Rtx®-CLPesticides2 (proprietary Crossbond® phases)

- Application-specific columns for organochlorine pesticides and herbicides.
- Low bleed—ideal for GC/ECD or GC/MS analyses.
- Baseline separations in less than 10 minutes.
- Stable to 340°C.

Improved resolution and faster analyses, compared to 1701 or phenyl phases, make these the pesticide columns of choice. Rtx®-CLPesticides columns are specially designed to overcome the coelutions and analyte breakdown typically encountered in chlorinated pesticide analyses for EPA Methods 8081, 608, and CLP. By achieving baseline resolution of the 20 target analytes, more accurate qualitative data can be obtained, providing reliable identification without GC/MS.

Column bleed, measured by ECD, is extremely low at temperatures up to 330°C, which is critical for baking-out the column to remove high-boiling compounds commonly found in pesticide/PCB extracts. An analysis time of less than 10 minutes improves throughput compared to other stationary phases.

free literature

Fast GC Analysis of Chlorinated Pesticides

Download your free copy from www.restek.com

Flyer
lit. cat.# 59547A

Rtx®-CLPesticides Columns (fused silica)

ID	df (µm)	temp. limits	10-Meter	15-Meter	20-Meter	30-Meter	60-Meter
0.10mm	0.10	-60 to 310/330°C	43101				
0.18mm	0.18	-60 to 310/330°C	42101		42102		
0.25mm	0.25	-60 to 320/340°C		11120		11123	11126
0.32mm	0.32	-60 to 320/340°C			new!	11141	
	0.50	-60 to 320/340°C		11136		11139	
0.53mm	0.50	-60 to 300/320°C		11137		11140	

Rtx®-CLPesticides2 Columns (fused silica)

ID	df (µm)	temp. limits	10-Meter	15-Meter	20-Meter	30-Meter	60-Meter
0.10mm	0.10	-60 to 310/330°C	43301		43302		
0.18mm	0.14	-60 to 310/330°C	42301		42302		
0.25mm	0.20	-60 to 320/340°C		11320		11323	11326
0.32mm	0.25	-60 to 320/340°C		11321		11324	
	0.50	-60 to 320/340°C				11325	
0.53mm	0.42	-60 to 300/320°C		11337		11340	

ordering note

Add "-530" or "-535" to the catalog number for the kit, to save on the cost of the reference mix.

Rtx®-CLPesticides Column Kits

(Note: Columns are not preconnected in these kits.)

0.25mm ID Rtx®-CLPesticides Kit cat.# 11199 (kit), **kit**

Includes:	cat.#
30m, 0.25mm ID, 0.25µm Rtx®-CLPesticides Column	11123
30m, 0.25mm ID, 0.20µm Rtx®-CLPesticides2 Column	11323
Universal Angled "Y" Press-Tight® Connector	20403
5m, 0.25mm ID Siltek® Guard Column	10026

new!

New column dimensions now available.

0.32mm ID Rtx®-CLPesticides Kit cat.# 11196 (kit), **kit**

Includes:	cat.#
30m, 0.32mm ID, 0.32µm Rtx®-CLPesticides Column	11141
30m, 0.32mm ID, 0.25µm Rtx®-CLPesticides2 Column	11324
Universal Angled "Y" Press-Tight® Connector	20403
5m, 0.32mm ID Siltek® Guard Column	10027

0.53mm ID Rtx®-CLPesticides Kit cat.# 11197 (kit), **kit**

Includes:	cat.#
30m, 0.53mm ID, 0.50µm Rtx®-CLPesticides Column	11140
30m, 0.53mm ID, 0.42µm Rtx®-CLPesticides2 Column	11340
Universal Angled "Y" Press-Tight® Connector	20403
5m, 0.53mm ID IP Deactivated Guard Column	10045

also available

For column connectors, see **pages 220-227**.

Add a reference mix to your kit order and save!

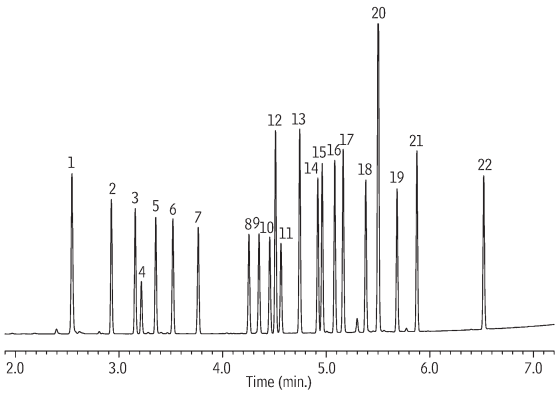
Description	suffix #
Organochlorine Pesticide Mix AB #1 (cat.# 32291)	-530
Organochlorine Pesticide Mix AB #2 (cat.# 32292)	-535

Chlorinated Pesticides Analysis

Fast GC analyses of chlorinated pesticides on Rtx®-CLPesticides and Rtx®-CLPesticides2 columns.

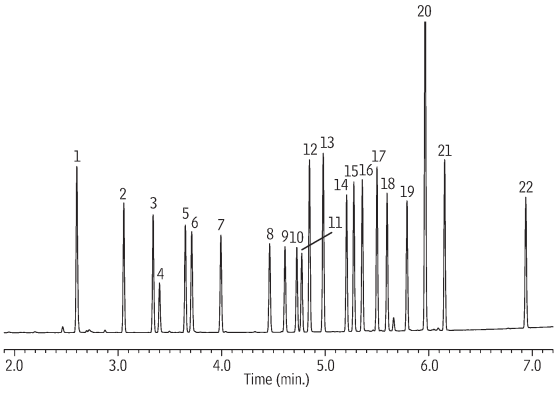
Rtx®-CLPesticides & Rtx®-CLPesticides2 columns (0.32mm ID)

Rtx®-CLPesticides



GC_EV00933

Rtx®-CLPesticides2



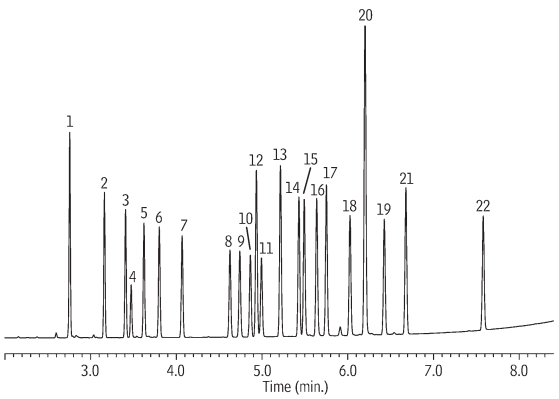
GC_EV00933A

Columns:	Rtx®-CLPesticides, 30m, 0.32mm ID, 0.32μm (cat.# 11141) and Rtx®-CLPesticides2, 30m, 0.32mm ID, 0.25μm (cat.# 11324) with 5m x 0.32mm ID Rxi® deactivated guard tubing (cat.# 10039), connected using Deactivated Universal "Y" Press-Tight® connector (cat.# 20405-261)
Sample:	Organochlorine Pesticide Mix AB #2, 8-80μg/mL each component in hexane/toluene (cat.# 32292), Pesticide Surrogate Mix, 200μg/mL each component in acetone (cat.# 32000)
Inj.:	1.0μL splitless (hold 0.3 min.), 4mm single gooseneck inlet liner (cat.# 20799)
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Linear velocity:	60cm/sec. @ 120°C
Oven temp.:	120°C to 200°C @ 45°C/min. to 230°C @ 15°C/min. to 330°C (hold 2 min.) @ 30°C/min.
Det.:	ECD @ 330°C

1. 2,4,5,6-tetrachloro-*m*-xylene (SS)
2. α-BHC
3. γ-BHC
4. β-BHC
5. δ-BHC
6. heptachlor
7. aldrin
8. heptachlor epoxide (isomer B)
9. γ-chlordane
10. α-chlordane
11. endosulfan I
12. 4,4'-DDE
13. dieldrin
14. endrin
15. 4,4'-DDD
16. endosulfan II
17. 4,4'-DDT
18. endrin aldehyde
19. endosulfan sulfate
20. methoxychlor
21. endrin ketone
22. decachlorobiphenyl (SS)

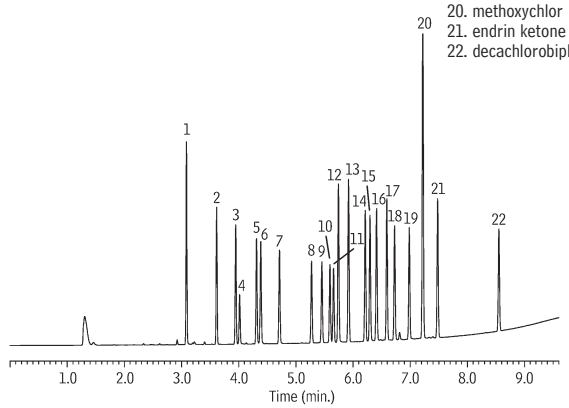
Rtx®-CLPesticides & Rtx®-CLPesticides2 columns (0.53mm ID)

Rtx®-CLPesticides



GC_EV00936

Rtx®-CLPesticides2



GC_EV00937

Columns:	Rtx®-CLPesticides, 30m, 0.53mm ID, 0.50μm (cat.# 11140) and Rtx®-CLPesticides2, 30m, 0.53mm ID, 0.42μm (cat.# 11340) with 5m x 0.53mm ID Rxi® deactivated guard tubing (cat.# 10054), connected using Universal Siltek® "Y" Press-Tight® connector (cat.# 20486)
Sample:	Organochlorine Pesticide Mix AB #2, 8-80μg/mL each component in hexane/toluene (cat.# 32292), Pesticide Surrogate Mix, 200μg/mL each component in acetone (cat.# 32000)
Inj.:	1.0μL splitless (hold 0.3 min.), 4mm single gooseneck inlet liner (cat.# 20799)
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Linear velocity:	45cm/sec. @ 120°C
Oven temp.:	120°C to 200°C @ 45°C/min. to 230°C @ 12.5°C/min. to 325°C (hold 2 min.) @ 30°C/min.
Det.:	ECD @ 330°C

Chlorinated Pesticides Analysis

restek **innovation**!

Stx™-CLPesticides/Stx™-CLPesticides2 (proprietary Crossbond® phases)
- Application-specific columns for organochlorine pesticides and herbicides.
- Baseline separations in less than 10 minutes.
- Siltek® surface deactivation enhances responses for endrin, DDT, methoxychlor.
- Stable to 330°C.

Many laboratories analyzing organochlorine pesticides struggle with breakdown and adsorption of endrin, DDT, and methoxychlor caused by active sites throughout the analytical system. Siltek® passivation technology enables these columns to offer unsurpassed inertness and the highest responses for active pesticides.

it's a **fact**

These columns are treated with Siltek® deactivation, which provides better responses for endrin, DDT, and methoxychlor.

Stx™-CLPesticides Columns (fused silica with Siltek® deactivation)

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.25mm	0.25	-60 to 310/330°C	11540	11543
0.32mm	0.32	-60 to 310/330°C		new! 11546
	0.50	-60 to 310/330°C	11541	11544

Stx™-CLPesticides2 Columns (fused silica with Siltek® deactivation)

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.25mm	0.20	-60 to 310/330°C	11440	11443
0.32mm	0.25	-60 to 310/330°C	11441	11444

ordering **note**

Kits include Siltek® deactivated guard column.

Stx™-CLPesticides Kits
(Note: Columns are not preconnected in these kits.)

0.25mm ID Stx™-CLPesticides Kit cat.# 11190 (kit) — **kit**

Includes:	cat.#
30m, 0.25mm ID, 0.25µm Stx™-CLPesticides Column	11543
30m, 0.25mm ID, 0.20µm Stx™-CLPesticides2 Column	11443
Universal Angled "Y" Press-Tight® Connector	20403
5m, 0.25mm ID Siltek® Guard Column	10026

new! →

New column dimensions now available.

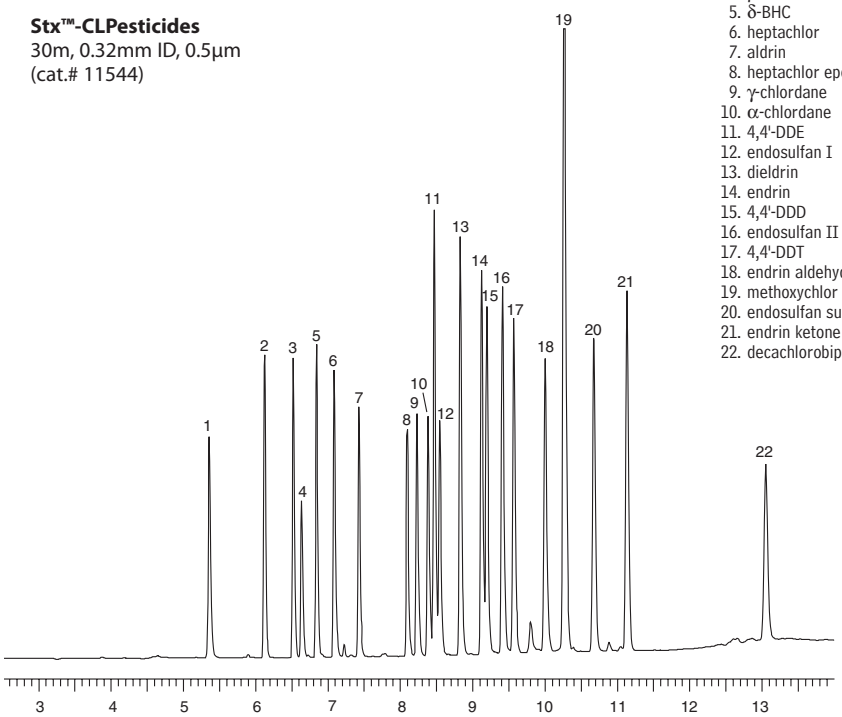
0.32mm ID Stx™-CLPesticides Kit cat.# 11193 (kit) — **kit**

Includes:	cat.#
30m, 0.32mm ID, 0.32µm Stx™-CLPesticides Column	11546
30m, 0.32mm ID, 0.25µm Stx™-CLPesticides2 Column	11444
Universal Angled "Y" Press-Tight® Connector	20403
5m, 0.32mm ID Siltek® Guard Column	10027

Chlorinated Pesticides Analysis

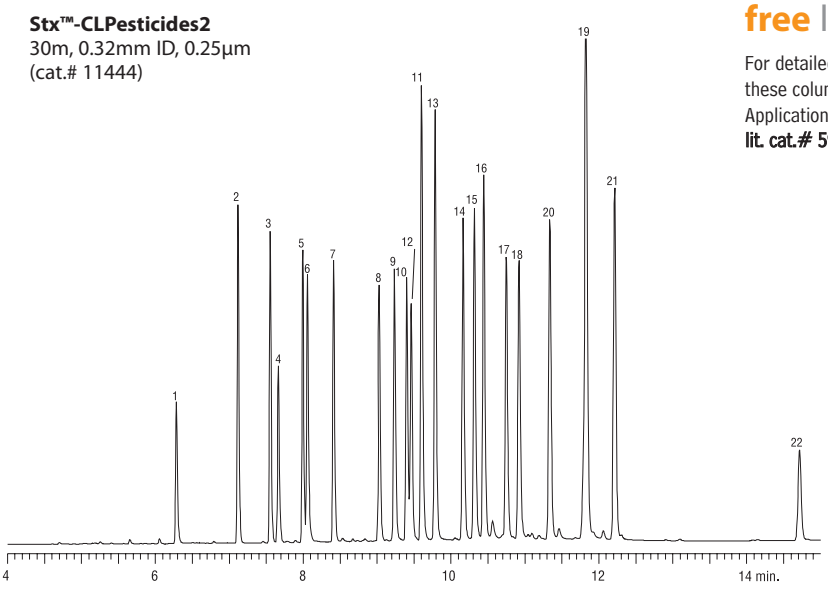
Excellent responses for all US EPA Method 8081 chlorinated pesticides: Stx™-CLPesticides columns.

Stx™-CLPesticides
30m, 0.32mm ID, 0.5µm
(cat.# 11544)



1. 2,4,5,6 tetrachloro-*m*-xylene (SS)
2. α-BHC
3. γ-BHC
4. β-BHC
5. δ-BHC
6. heptachlor
7. aldrin
8. heptachlor epoxide
9. γ-chlordane
10. α-chlordane
11. 4,4'-DDE
12. endosulfan I
13. dieldrin
14. endrin
15. 4,4'-DDD
16. endosulfan II
17. 4,4'-DDT
18. endrin aldehyde
19. methoxychlor
20. endosulfan sulfate
21. endrin ketone
22. decachlorobiphenyl (SS)

Stx™-CLPesticides2
30m, 0.32mm ID, 0.25µm
(cat.# 11444)



GC_EV00512

Inj.:	1µL direct injection of 20/40/200ng/mL std. concentration in hexane
Oven temp.:	110°C (hold 1 min.) to 245°C @ 20°C/min. to 300°C @ 6°C/min.
Inj./det. temp.:	210°C/310°C
Carrier gas:	helium
Dead time:	0.8min. @ 120°C
Inlet liner:	Siltek® deactivated Drilled Uniliner® inlet liner (cat.# 21055-214.1)
Make-up gas:	nitrogen

free literature

For detailed information about these columns, request Applications Note
lit. cat.# 59351B

Table of Contents for
Applications
see **pages 518-519**

Jason Thomas
Innovations Chemist
6+ years of service!

it's a fact

The Stx™-CLPesticides and Stx™-CLPesticides2 column pair will provide <10 minute analysis times if you use the same conditions used for the Rtx®-CLPesticides and Rtx®-CLPesticides2 column pair listed on **page 79**!

PCB Congeners Analysis

restek
innovation!

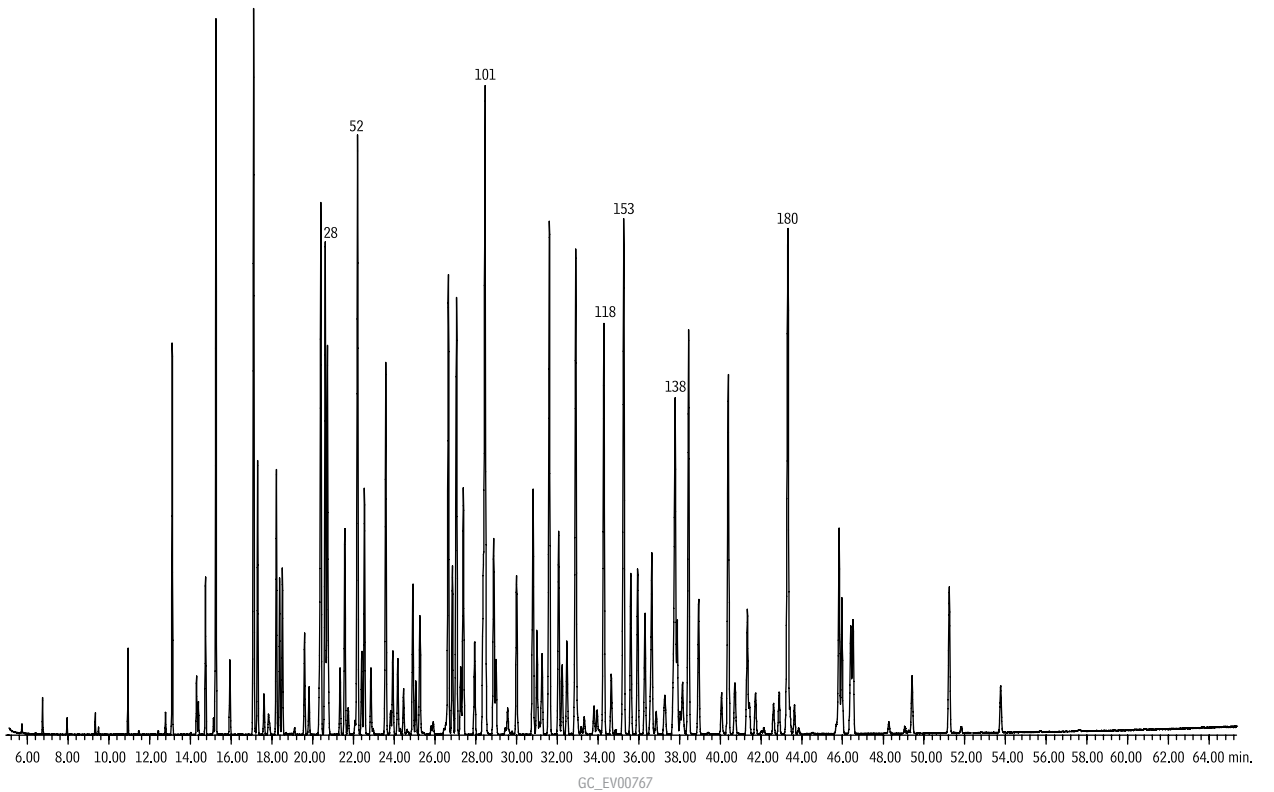
Rtx®-PCB (proprietary Crossbond® phase)
- Unique polymer for PCBs analysis by GC/ECD or GC/MS.
- Good results for other semivolatiles.
- Low polarity; inert to active compounds.
- Stable to 340°C.

Rtx®-PCB Columns (fused silica)

ID	df (µm)	temp. limits*	20-Meter	30-Meter	40-Meter	60-Meter
0.18mm	0.18	30°C to 320/340°C	41302		41303	41304
0.25mm	0.25	30°C to 320/340°C		13223		13226
0.32mm	0.50	30°C to 320/340°C		13239		

*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

Aroclor 1242/1254/1262 PCBs on Rtx®-PCB:
best available resolution of individual congeners.



Column:	Rtx®-PCB, 60m, 0.25mm ID, 0.25µm (cat.# 13226)
Sample:	Aroclor 1242 (cat.# 32009), 1254 (cat.# 32011), 1262 (cat.# 32409), 333ppm each
Inj.:	1.0µL 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

PCB Congeners Analysis

Stx™-500 (Crossbond® carborane/dimethyl polysiloxane)

- Application-specific columns for brominated flame retardants, coplanar PCB congeners, and other analytes with high boiling temperatures.
- Low bleed—ideal for GC/FPD, GC/NPD, or GC/MS analyses.
- Stable to 380°C.
- Stx™ is used for columns that have been deactivated using Restek's Siltek® deactivation.

The Stx™-500 column gives excellent results for neutral or slightly acidic compounds. It is not recommended for analyses of basic compounds.

similar **phase**

HT-8

Stx™-500 Columns (fused silica)
(Crossbond® carborane/dimethyl polysiloxane)

ID	df (µm)	temp. limits*	30-Meter	60-Meter
0.25mm	0.15	-60°C to 380°C	10750	10751
0.53mm	0.15	-60°C to 380°C	10752	

*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

Dioxin & Furan Congeners Analysis

Rtx®-Dioxin (proprietary Crossbond® phase)

- Replacement column for 5% diphenyl phases.
- Improved separations of dioxin or furan congeners.
- Greater thermal stability than 5% diphenyl phases or high-cyano confirmation columns.

restek **innovation**!

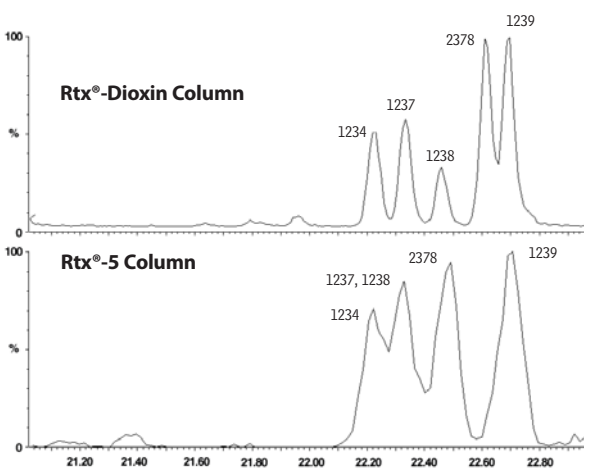
Rtx®-Dioxin Columns (fused silica)

ID	df (µm)	temp. limits	60-Meter
0.25mm	0.15	-60°C to 380°C	10755

also **available**

Rtx®-Dioxin2 columns.
See page 84.

Rtx®-Dioxin column separates all five components in the TCDD resolution check mixture.



Temperature program:

	Time (min.)	Rate (°C/min.)	Temp. (°C)
	0	52	200
	10.2	2.9	235
	10	6.9	300
	24		

Injector temp.: 270°C
Flow: 1.2mL/min. (constant pressure)

Column: Rtx®-Dioxin, 40m, 0.18mm ID, 0.11µm
Initial temp.: 130°C
Instrument: Micromass Altima high resolution GC/MS

Chromatography courtesy of Karen MacPherson and Eric Reiner, Ontario Ministry of the Environment, Etobicoke, ON, Canada.

Dioxin & Furan Congeners Analysis

restek
innovation!
Excellent for dioxins or furans.

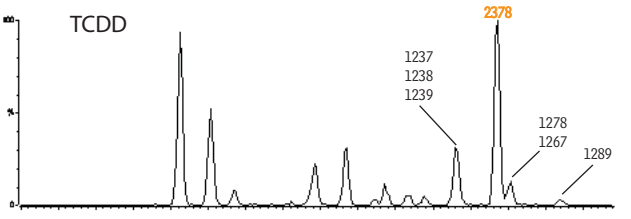
Rtx®-Dioxin2 (proprietary Crossbond® phase)
- Isomer specificity for 2,3,7,8-TCDD and 2,3,7,8-TCDF achieved with one GC column.
- Thermally stable to 340°C for longer lifetime.
- Unique selectivity for toxic dioxin and furan congeners allow use as a primary or confirmation GC column.

Rtx®-Dioxin2 Columns (fused silica)

ID	df (µm)	temp. limits	40-Meter	60-Meter
0.18mm	0.18	20°C to 340°C	10759	—
0.25mm	0.25	20°C to 340°C	—	10758

Jack Cochran
Director of New Business & Technology

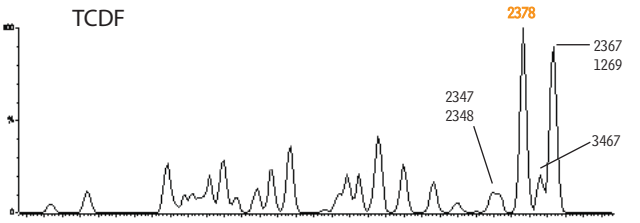
2,3,7,8-Tetrachlorodibenzodioxin resolved from other TCDD congeners, using an Rtx®-Dioxin2 column.



Other peak identifications available upon request. GC_EV00948

Column: Rtx®-Dioxin2, 60m, 0.25mm ID, 0.25µm (cat.# 10758)
Sample: WMS-01 Reference Material, Wellington Laboratories
Inj.: Splitless
Inj. temp.: 250°C
Carrier gas: helium, constant flow
Flow rate: 1.5mL/min.
Oven temp.: 130°C (hold 1.0 min.) to 200°C @ 40°C/min. to 235°C @ 3.0°C/min. to 300°C @ 5°C/min. (hold 10 min.)
Det.: Micromass Ultima high-resolution mass spectrometer
Ionization: EI
Mode: SIR

Tetrachlorodibenzofuran congeners on an Rtx®-Dioxin2 column.



Other peak identifications available upon request. GC_EV00949

Column: Rtx®-Dioxin2, 60m, 0.25mm ID, 0.25µm (cat.# 10758)
Sample: WMS-01 Reference Material, Wellington Laboratories
Inj.: Splitless
Inj. temp.: 250°C
Carrier gas: helium, constant flow
Flow rate: 1.5mL/min.
Oven temp.: 130°C (hold 1.0 min.) to 200°C @ 40°C/min. to 235°C @ 3.0°C/min. to 300°C @ 5°C/min. (hold 10 min.)
Det.: Micromass Ultima high-resolution mass spectrometer
Ionization: EI
Mode: SIR

Chromatograms courtesy of Terry Kolic, Karen MacPherson, Eric Reiner, Ontario Ministry of the Environment, Toronto, Ontario, Canada

free literature

Rtx®-Dioxin2 Column: 2,3,7,8-TCDD and 2,3,7,8-TCDF Specificity in One GC Column

New data available—all 128 dioxin and furan tetra thru octa congeners aquired on the Rtx®-Dioxin2 column.

Download your free copy from www.restek.com

Flyer
lit. cat.# 580119A

Polycyclic Aromatic Hydrocarbon (PAH) Analysis

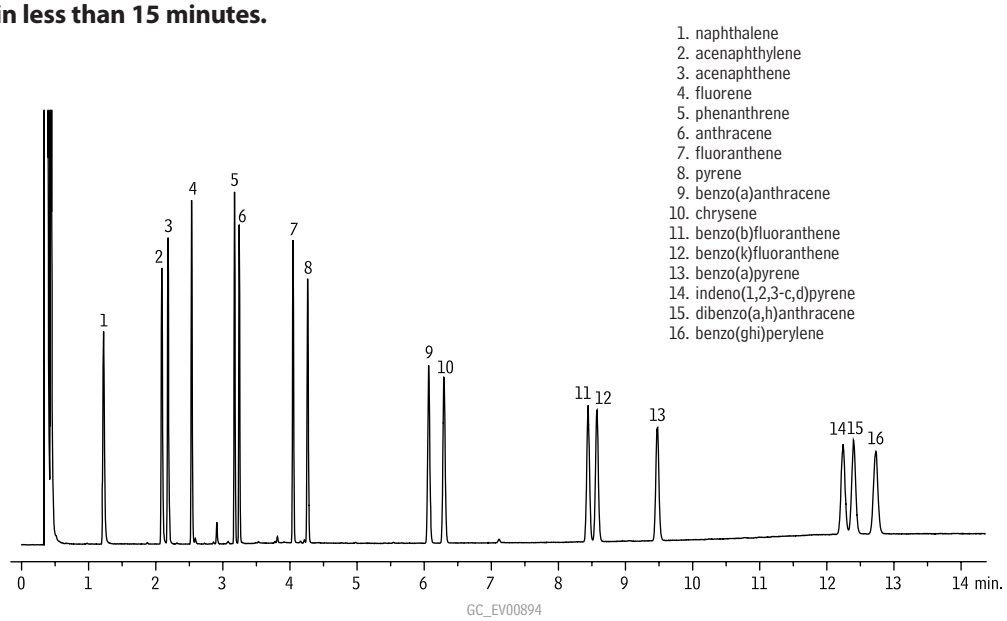
Rt™-PAH (polar, proprietary liquid crystalline phase)

- Specially designed for the analysis of polycyclic aromatic hydrocarbons (PAHs) listed in US EPA methods 610 and 8100.
- Low bleed at 285°C.
- Temperature range: 80°C to 285°C.

Rt™-PAH Columns (fused silica)

ID	df (µm)	temp. limits	12-Meter
0.25mm	0.15	80°C to 285°C	19733

Separation of 16 regulated polycyclic aromatic hydrocarbons (PAHs) in less than 15 minutes.



Column:	Rt™-PAH, 12m, 0.25mm ID, 0.15µm (cat.# 19733)
Sample:	16 component EPA Method 610 PAH standard (20ng/µl of each component in dichloromethane)
Inj.:	1.0µL split (split ratio 10:1)
Inj. temp.:	225°C
Carrier gas:	helium, 110kPa column head pressure
Oven temp.:	80°C to 220°C @ 40°C/min., 220°C to 285°C @ 8°C/min. (hold 5 min.)
Detector:	FID @ 290°C

Chromatogram courtesy of J&K Scientific.

Rt™-LC50 (polar, dimethyl (50% liquid crystal) polysiloxane)

- General purpose column with selectivity for dioxin or furan congeners, or PCB congeners.
- Low bleed at 270°C.
- Temperature range: 100°C to 270°C.

The unique liquid crystalline Rt™-LC50 stationary phase resolves compounds of similar structure and boiling point. It has proven effective for resolving many polycyclic aromatic hydrocarbons; other potential applications include dioxin, furan, or PCB congeners.

Rt™-LC50 Columns (fused silica)

ID	df (µm)	temp. limits	10-Meter	20-Meter
0.10mm	0.10	100°C to 270°C	19736	—
0.18mm	0.10	100°C to 270°C	19735	—
0.25mm	0.10	100°C to 270°C	—	19734

Explosives Analysis

restek **innovation**!

Rtx®-TNT/Rtx®-TNT2 (proprietary Crossbond® phase)

- Application-specific columns for explosives in US EPA Method 8095.
- Low bleed—ideal for ECD analysis.
- Complete analysis in less than 20 minutes.
- Rtx®-TNT2 confirmation column provides 8 elution order changes under same conditions.
- Economical 3-packs.
- Stable to 310°C.

please **note**

Polymer specially designed for explosives analysis.

We designed Rtx®-TNT and Rtx®-TNT2 columns specifically for analyses of nitroaromatic compounds by GC/ECD, such as the 16 analytes listed in US EPA Method 8095. They provide better resolution and higher thermal stability than any other currently recommended columns. Operate the Rtx®-TNT primary column and Rtx®-TNT2 confirmation column under identical GC oven temperature programs.

Rtx®-TNT Columns (fused silica)

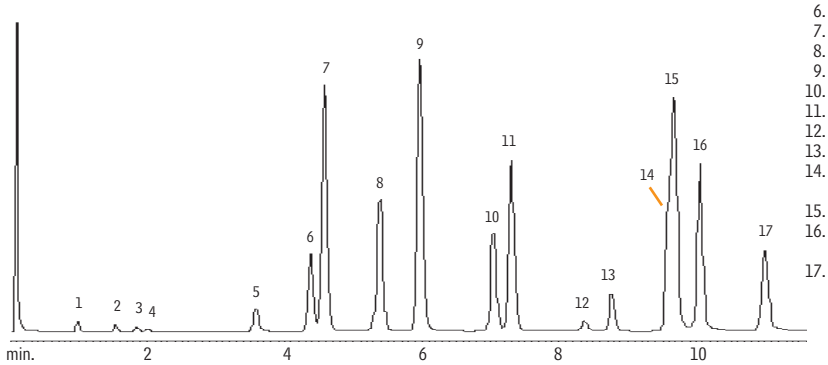
ID	df (µm)	temp. limits	6-Meter/3-pk.
0.53mm	1.50	-20 to 300/310°C	12998

Rtx®-TNT2 Columns (fused silica)

ID	df (µm)	temp. limits	6-Meter/3-pk.
0.53mm	1.50	-20 to 300/310°C	12999

US EPA Method 8095 explosives on Rtx®-TNT and Rtx®-TNT columns.

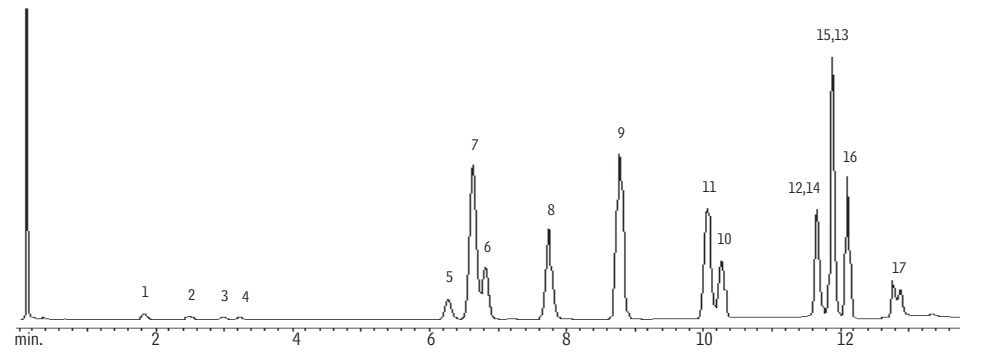
Rtx®-TNT
6m, 0.53mm ID, 1.50µm (cat.# 12998)



GC_EV00406

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

Rtx®-TNT2
6m, 0.53mm ID, 1.50µm (cat.# 12999)



GC_EV00407

Inj.:	Direct injection using a 1mm Siltek® Uniliner® (cat.# 21052-214.1)
On-column conc.:	est. 200-1000pg/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

Jarl Snider
R&D Chemist
12+ years of service!

Volatile Organics Analysis

Rtx®-VMS (proprietary Crossbond® phase)

- Application-specific columns for volatile organic pollutants by GC/MS.
- Complete separation of US EPA Method 8260 compounds in less than 18 minutes.
- Stable to 260°C.
- No known equivalent phases.

Rtx®-VMS columns offer lower bleed, better selectivity, and overall faster analysis for separating volatile organic compounds, such as those listed in US EPA Method 8260. The Rtx®-VMS stationary phase is a highly stable polymer that provides outstanding analysis of volatile compounds, in combination with sensitive ion traps and Agilent 5973 mass spectrometers. 0.18 and 0.25mm ID columns allow sample splitting at the injection port, eliminating the added expense and maintenance of a jet separator. A 0.45mm or 0.53mm ID column can be directly connected to the purge & trap transfer line in a system equipped with a jet separator.

restek **innovation!**

- First choice for use with dual purge & traps[1]
- EPA recommended surrogate used.

[1]A.L. Hilling and G. Smith, Environmental Testing & Analysis, 10(3), 15-19, 2001.

Rtx®-VMS Columns (fused silica)

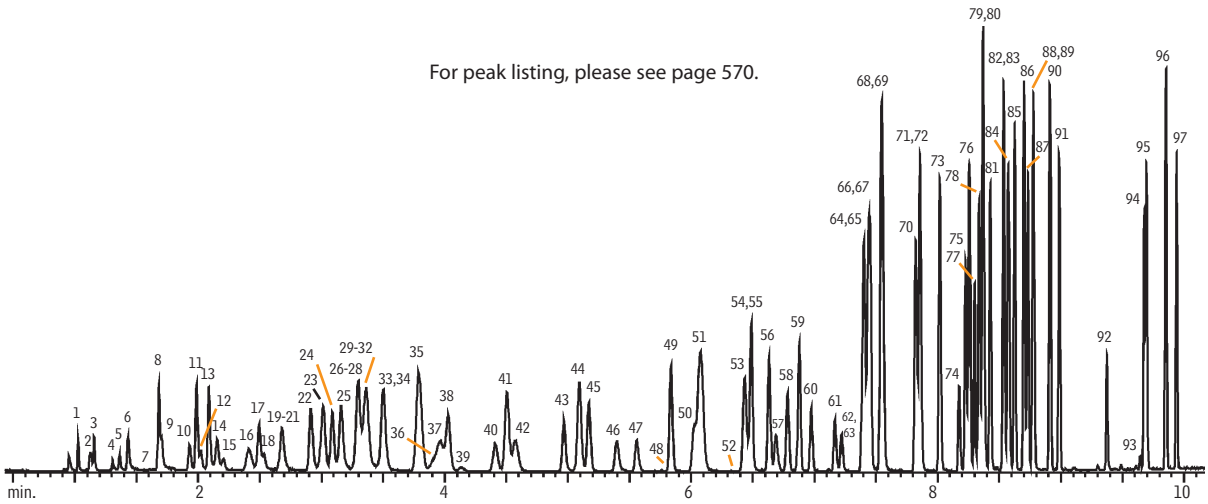
ID	df (µm)	temp. limits	30-Meter	60-Meter	75-Meter
0.25mm	1.40	-40 to 240/260°C	19915	19916	
0.32mm	1.80	-40 to 240/260°C	19919	19920	
0.45mm	2.55	-40 to 240/260°C	19908	19909	
0.53mm	3.00	-40 to 240/260°C	19985	19988	19974

ID	df (µm)	temp. limits	20-Meter	40-Meter
0.18mm	1.00	-40 to 240/260°C	49914	49915

Need a column for a volatiles analysis?
see **page 563**

Rapid analysis of volatile organics in US EPA Method 8260B, on an Rtx®-VMS column.

For peak listing, please see page 570.



GC_EV00428

Column:	Rtx®-VMS, 20m, 0.18mm ID, 1.00µm (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® 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

Volatile Organics Analysis

restek **innovation**!

Polymer specially designed for volatiles analysis by PID/ELCD.

Rtx®-VGC (proprietary Crossbond® phase)

- Application-specific columns for volatile organic pollutants by GC/PID/ELCD. Excellent separation of trihalomethanes.
- Complete US EPA Method 8021A analysis in less than 28 minutes.
- Stable to 260°C.
- No known equivalent phases.

Using computer modeling techniques, we optimized the Rtx®-VGC column for analysis of volatile organic compounds on GC systems equipped with photoionization (PID) and electrolytic conductivity detectors (ELCD). It performs the most difficult separations of volatile organic compounds, such as those listed in US EPA Methods 502.2 and 8021, providing unsurpassed separation in the fastest analysis time, thereby increasing sample throughput. The Rtx®-VGC column provides ≥85% resolution of trihalomethanes (THMs) from other volatile compounds. This unique column also achieves excellent separation of gases and early eluting compounds.

Need a column for a volatiles analysis?

see page 563

Rtx®-VGC Columns (fused silica)

ID	df (µm)	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40	-40 to 240/260°C	19415	19416		
0.32mm	1.80	-40 to 240/260°C	19419	19420		
0.45mm	2.55	-40 to 240/260°C	19408		19409	
0.53mm	3.00	-40 to 240/260°C	19485	19488	19474	19489

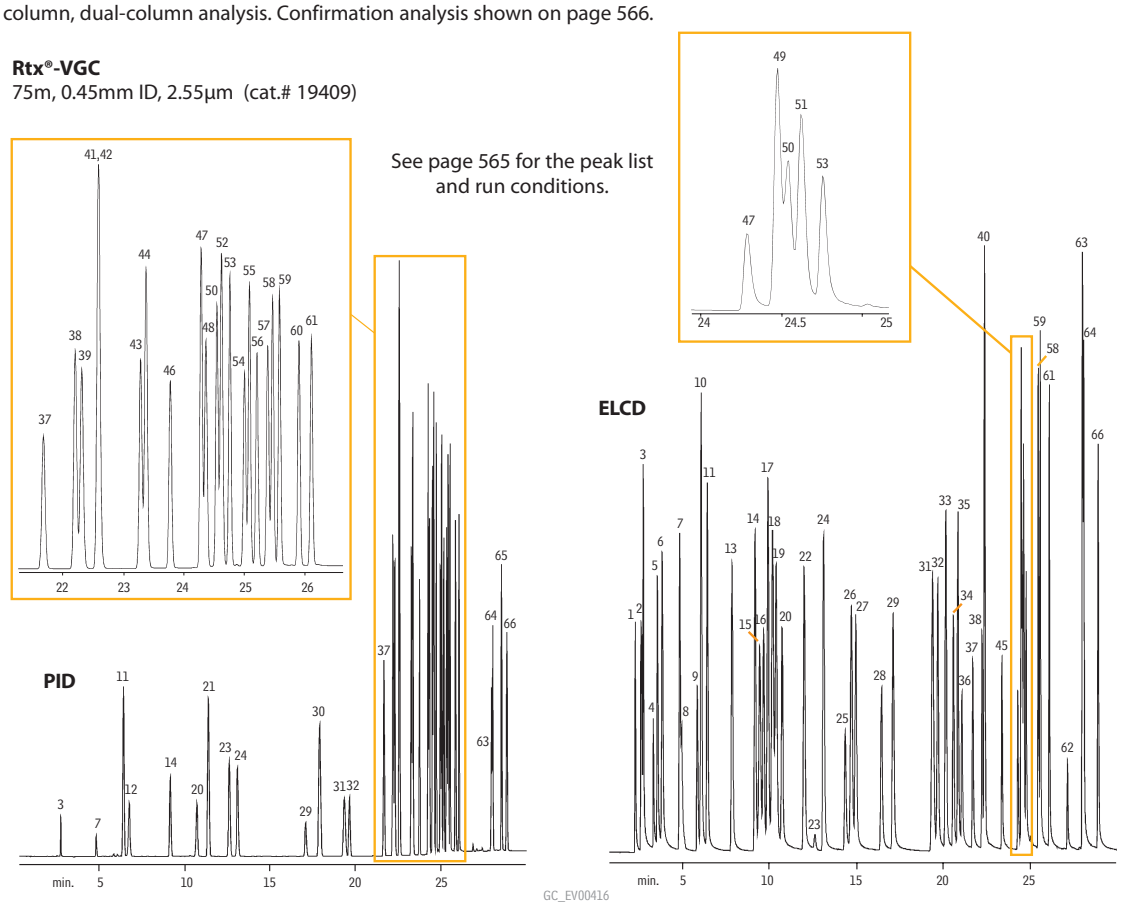
ID	df (µm)	temp. limits	20-Meter	40-Meter
0.18mm	1.00	-40 to 240/260°C	49414	49415

Fast separation of US EPA Method 8021 volatile organics: Rtx®-VGC column.

Primary column, dual-column analysis. Confirmation analysis shown on page 566.

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

See page 565 for the peak list and run conditions.



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

Volatile Organics Analysis

Rtx®-VRX (proprietary Crossbond® phase)

- Application-specific columns for volatile organic pollutants.
- Excellent for US EPA Method 8021 compounds.
- Stable to 260°C.

The Rtx®-VRX stationary phase and optimized column dimensions provide low bleed, excellent resolution, and fast analysis times for volatile compounds.

similar **phase**

DB-VRX

Rtx®-VRX Columns (fused silica)

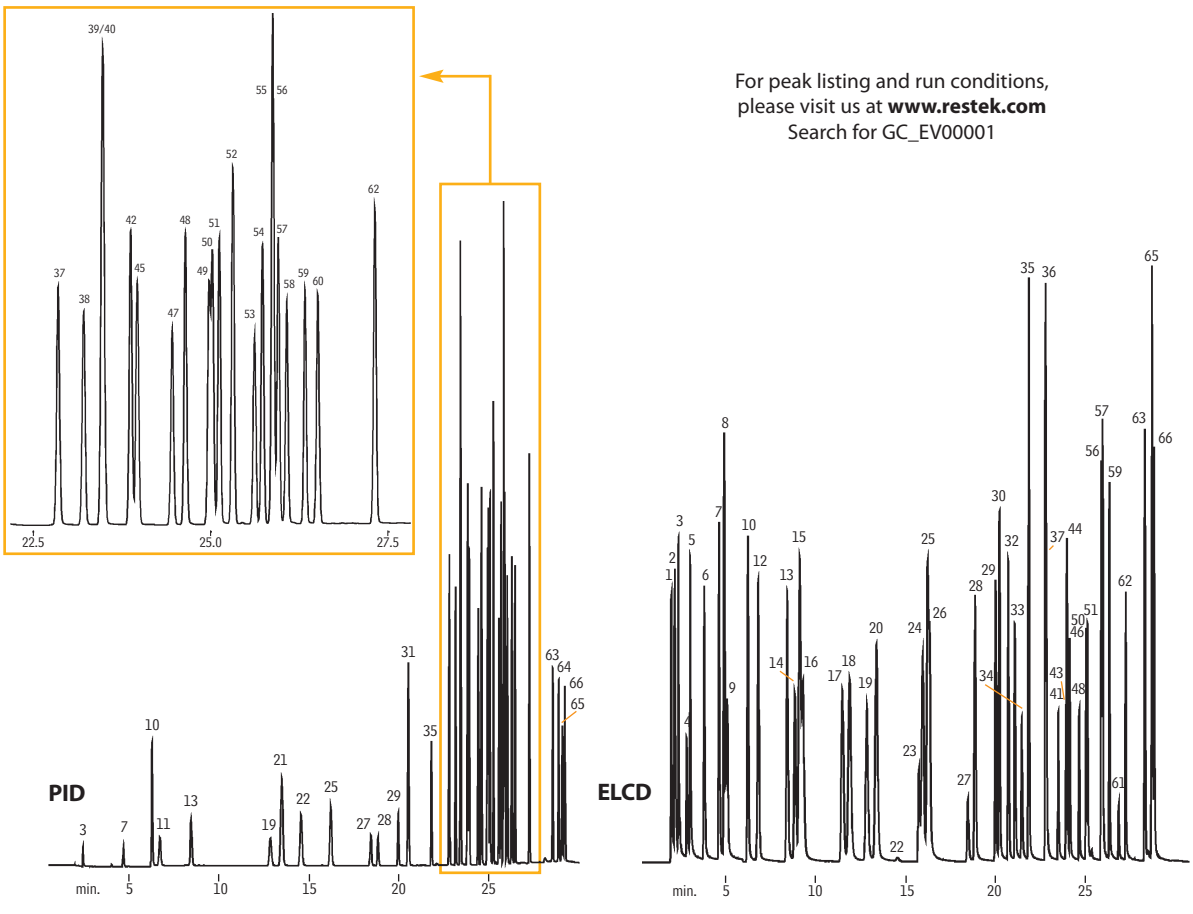
ID	df (µm)	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40	-40 to 240/260°C	19315	19316		
0.32mm	1.80	-40 to 240/260°C	19319	19320		
0.45mm	2.55	-40 to 240/260°C	19308		19309	
0.53mm	3.00	-40 to 240/260°C	19385	19388	19374	19389

ID	df (µm)	temp. limits	20-Meter	40-Meter
0.18mm	1.00	-40 to 240/260°C	49314	49315

Need a column for a volatiles analysis?

see **page 563**

Excellent resolution of EPA Method 8021 volatile organics on an Rtx®-VRX column.



Volatile Organics Analysis

Rtx®-502.2 (proprietary Crossbond® diphenyl/dimethyl polysiloxane phase)

- Application-specific columns with unique selectivity for volatile organic pollutants. The Rtx®-502.2 column is cited in US EPA Method 502.2 and in many gasoline range organics (GRO) methods for monitoring underground storage tanks.
- Excellent separation of trihalomethanes; ideal polarity for light hydrocarbons and aromatics.
- Stable to 270°C.

similar phase

DB-502.2

An Rtx®-502.2 column will enable you to quantify all compounds listed in US EPA methods 502.2 or 524.2, whether you use a mass spectrometer or a PID in tandem with an ELCD. The diphenyl/dimethyl polysiloxane based Rtx®-502.2 stationary phase provides low bleed and thermal stability to 270°C. A 105-meter column can separate the light gases specified in EPA methods without subambient cooling. Narrow bore columns can interface directly in GC/MS systems.

Rtx®-502.2 Columns (fused silica)
(proprietary Crossbond® diphenyl/dimethyl polysiloxane phase)

ID	df (µm)	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40	-20 to 250/270°C	10915	10916		
0.32mm	1.80	-20 to 250/270°C	10919	10920		10921
0.45mm	2.55	-20 to 250/270°C			10986	
0.53mm	3.00	-20 to 250/270°C	10908	10909		10910

ID	df (µm)	temp. limits	20-Meter	40-Meter
0.18mm	1.00	-20 to 250/270°C	40914	40915

also available

MXT® Columns
Rugged, flexible, Siltek® treated stainless steel tubing; inertness comparable to fused silica tubing. See **pages 106 and 107** for our MXT®-502.2 and MXT®- Volatiles columns.

Rtx®-Volatiles (proprietary Crossbond® diphenyl/dimethyl polysiloxane phase)

- Application-specific columns for volatile organic pollutants.
- Stable to 280°C.

similar phase

VOCOL®

Rtx®-Volatiles columns were the first columns designed specifically for analyses of the 34 volatile organic pollutants listed in US EPA methods 601, 602, and 624. With these columns, you can quantify all compounds listed in these methods, whether you use a mass spectrometer or a PID in tandem with an ELCD. The diphenyl/dimethyl polysiloxane based Rtx®-Volatiles stationary phase provides low bleed and thermal stability to 280°C. Narrow bore columns can interface directly in GC/MS systems.

Rtx®-Volatiles Columns (fused silica)
(proprietary Crossbond® diphenyl/dimethyl polysiloxane phase)

ID	df (µm)	temp. limits*	30-Meter	60-Meter	105-Meter
0.25mm	1.00	-20 to 270/280°C	10900	10903	
0.32mm	1.50	-20 to 270/280°C	10901	10904	
0.53mm	2.00	-20 to 270/280°C	10902	10905	10906

ordering note

Rtx®-Volatiles columns are available with Integra-Guard™ built-in guard columns. Get the protection without the connection! See **page 30** for descriptions and ordering information.

it's a fact

Quantify all compounds in US EPA method 601, 602, or 624, using an Rtx®-Volatiles column.

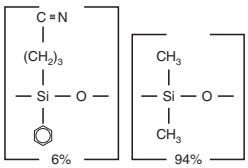
Volatile Organics Analysis

Rtx®-624 (low to midpolarity phase; Crossbond® 6% cyanopropylphenyl/94% dimethyl polysiloxane)

- Application-specific columns for volatile organic pollutants. Recommended in US EPA methods for volatile organic pollutants.
- Temperature range: -20°C to 240°C.
- Equivalent to USP G43 phase.

The unique polarity of the Rtx®-624 column makes it ideal for analyzing volatile organic pollutants. Although the Rtx®-502.2 column is recommended in many methods, the Rtx®-624 column offers better resolution of early eluting compounds. The Rtx®-624 phase produces greater than 90% resolution of the first six gases in EPA Methods 8260 and 524.2. This stationary phase is especially well-suited for EPA Method 524.2 revision IV since it resolves 2-nitropropane from 1,1-dichloropropanone, which share quantification ion m/z 43 and must be separated chromatographically.

Rtx®-624 Structure



Rtx®-624 Columns (fused silica)

(Crossbond® 6% cyanopropylphenyl/94% dimethyl polysiloxane)

ID	df (µm)	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40	-20 to 240°C	10968	10969		
0.32mm	1.80	-20 to 240°C	10970	10972		
0.45mm	2.55	-20 to 240°C			10982	
0.53mm	3.00	-20 to 240°C	10971	10973	10974	10975

ID	df (µm)	temp. limits	10-Meter	20-Meter	40-Meter
0.18mm	1.00	-20 to 240°C		40924	40925

similar phases

DB-1301, DB-624, HP-1301, HP-624, SPB-1301, SPB-624, VF-1301, VF-624ms, CP-1301, CP-Select 624 CB

also available

MXT® Columns
Rugged, flexible, Siltek® treated stainless steel tubing; inertness comparable to fused silica tubing. See **page 107** for our MXT®-624 columns.

Kristi Sellers
Innovations Chemist
20+ years of service!