



Restek GC Columns

Analyze Seven EPA Methods on One GC Column Pair!

Pesticides, PCBs, Herbicides, and More on Rtx-CLPesticides & Rtx-CLPesticides2 Columns

- Reduce downtime by running multiple methods on a single column set.
- Speed up analysis time without sacrificing resolution.
- Restek's unique column selectivity assures optimal separations.

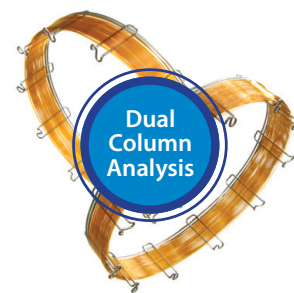


RESTEK

Pure Chromatography

www.restek.com

Save Time and Money—Use One Column Pair for Seven EPA Methods



Analyze Pesticides, PCBs, Herbicides, and More on Rtx-CLPesticides & Rtx-CLPesticides2 Columns

Get fast separations without sacrificing resolution by using Restek's proprietary Rtx-CLPesticides and Rtx-CLPesticides2 columns for multiple environmental methods. Instead of changing columns between GC-ECD methods, you can save time by analyzing chlorinated pesticides, PCBs, herbicides, and other halogenated compounds on a single column set using an Agilent micro-ECD. As shown in the applications in this brochure, Rtx-CLPesticides and Rtx-CLPesticides2 columns have a unique selectivity and are ideal for multiple GC-ECD methods. Compare them to your current column set (Table I) and you'll see the Restek advantage!

Table I: Rtx-CLPesticides columns offer the best overall performance for organochlorine pesticide analysis, as well as many other GC-ECD methods (0.32 mm ID columns).

Method Compound List	Column Pair	Analysis Time (min)	Coelutions	Restek Advantage
8081B (Organochlorine pesticides)	Rtx-CLPesticides / Rtx-CLPesticides2	7 / 7	0 / 0	• Increase sample throughput with 7 min analyses and baseline resolution.
	Competitor A set	7 / 8	0 / 1	
	Competitor B set	10 / 9	0 / 0	
8081B (extended) (Organochlorine pesticides)	Rtx-CLPesticides / Rtx-CLPesticides2	24 / 23	1 / 2	• Best balance of speed and selectivity. • All compounds are resolved on at least one column.
	Competitor A set	27 / 29	0 / 3	
	Competitor B set	NDP / 16	NDP / 3	
8082A (Polychlorinated biphenyls [PCBs], Aroclors)	Rtx-CLPesticides / Rtx-CLPesticides2	7 / 7	n/a	• Fast PCB analysis times.
	Competitor A set	6 / 7	n/a	
	Competitor B set	24 / 21	n/a	
8151A (Chlorinated herbicides)	Rtx-CLPesticides / Rtx-CLPesticides2	13 / 13	1 / 0	• More elution order changes improve confidence in confirmational results.
	Competitor A set	13 / 13	0 / 0	
	Competitor B set	16 / 15	1 / 1	
504.1 (EDB, DBCP, TCP)	Rtx-CLPesticides / Rtx-CLPesticides2	6 / 6	0 / 0	• Reliably separate analytes from trihalomethane interferences.
	Competitor A set	6 / 6	0 / 0	
	Competitor B set	NDP	NDP	
505 (Organohalide pesticides)	Rtx-CLPesticides / Rtx-CLPesticides2	18 / 18.5	1 / 1	• All compounds resolved on at least one column.
	Competitor A set	14 / 14	0 / 1	
	Competitor B set	35 / 36	1 / 2	
508.1 (Chlorinated pesticides, herbicides, organohalides)	Rtx-CLPesticides / Rtx-CLPesticides2	23.5 / 24	2 / 2	• Good balance of speed and resolution.
	Competitor A set	21 / 23	0 / 3	
	Competitor B set	18 / 17	2 / 4	
552.2 (Haloacetic acids, dalapon)	Rtx-CLPesticides / Rtx-CLPesticides2	12 / 12	0 / 0	• No coelutions—get accurate results for compounds that coelute on other columns.
	Competitor A set	8 / 9	1 / 1	
	Competitor B set	NDP / 10	NDP / 1	

Comparison based on published competitor data. All columns tested were 0.32 mm ID. NDP = no data published

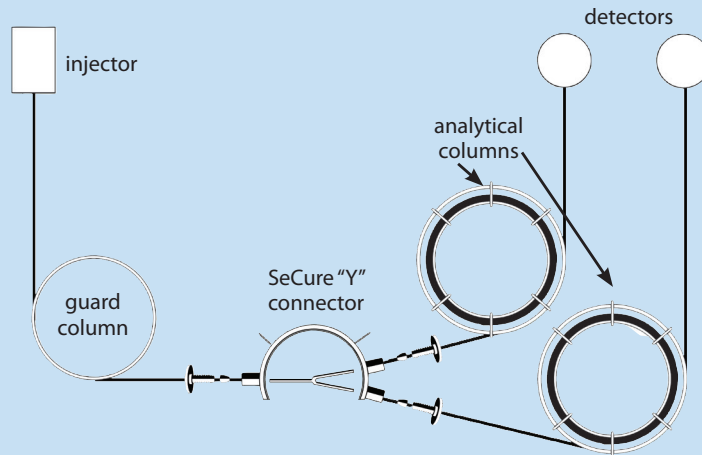
NOTE: Analyzing dirty or derivatized samples can contaminate your column. Restek does not recommend analyzing trace-level pesticide samples following derivatized samples (e.g., Methods 8151A and 552.2) without first performing inlet maintenance. Standard steps include trimming the guard column and changing the inlet liner, O-ring, seal, and septum.

Achieve Optimal Results with Our Parallel Dual-Column Setup

Rtx-CLPesticides and Rtx-CLPesticides2 columns are designed for organochlorine pesticide analysis using a parallel dual-column setup that provides both fast analyses and reduced downtime. The stationary phase film thicknesses and optimized run conditions allow rapid analysis without sacrificing column capacity, meaning faster sample throughput for your laboratory. Parallel dual-column analysis saves time because data for primary and confirmation analyses are obtained from a single injection. In addition, injection port maintenance is reduced because only one injector is used. Once the sample passes through a single guard column, it is split on to two analytical columns, which are attached using a "Y" connector (Figure 1). Parallel dual-column analysis using Rtx-CLPesticides and Rtx-CLPesticides2 columns offers many advantages including:

- **Method-compliant results in half the time**
Parallel dual-column analysis provides simultaneous acquisition of primary and confirmation data using columns with different selectivities.
- **Reduced contamination**
Guard column traps nonvolatile residue, protecting the analytical columns.
- **Consistent performance**
Resolution and relative retention times are unaffected by maintenance because the guard column can be trimmed instead of the analytical columns.
- **Enhanced reproducibility**
Using a single inlet and "Y" connector results in consistent vaporization and on-column amounts.

Figure 1: Perform parallel dual-column analysis using a single injector and guard column with split flow onto two analytical columns.



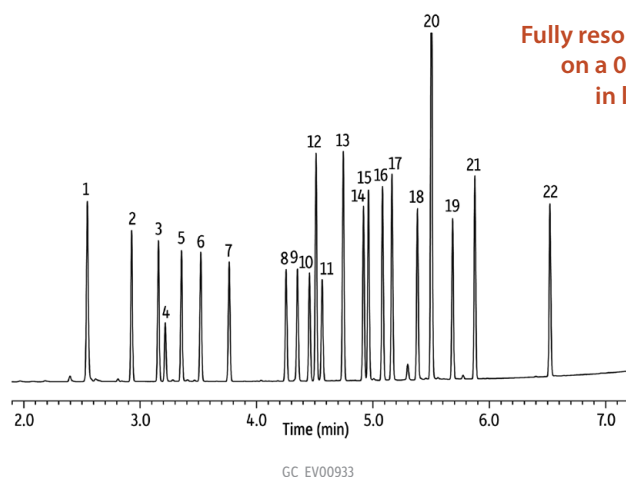
In addition to organochlorine pesticide analysis, parallel dual-column analysis using the Rtx-CLPesticides and Rtx-CLPesticides2 columns is an effective approach for several other environmental ECD methods. As detailed on the following pages, this column pair provides excellent results for analysis time and resolution of critical compounds for seven EPA methods: 8081B (organochlorine pesticides); 8082A (PCBs/Aroclors); 8151A (chlorinated herbicides); 504.1 (EDB, DBCP, and TCP); 505 (organohalide pesticides); 508.1 (chlorinated pesticides, herbicides, and organohalides); and 552.2 (haloacetic acids and dalapon).

EPA Method 8081B: Organochlorine Pesticide Analysis

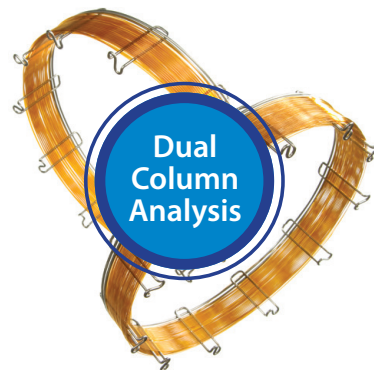
Organochlorine pesticides emerged in the 1940s, but are no longer used today due to their persistence in the environment. However, they still are monitored in water, soil, and other samples. EPA Method 8081B is widely used for organochlorine pesticide analysis in a variety of difficult sample matrices. The selectivity of the Rtx-CLPesticides column set was originally tuned for Method 8081 and Method 8081B, which provide an excellent example of the performance of the column pair (Figure 2). All compounds are fully resolved in just seven minutes using standard 0.32 mm columns and an Agilent micro-ECD for analysis. (Analysis times reflect simultaneous parallel dual-column analysis.) Fast analysis times translate into high sample throughput, which is an important consideration for environmental labs. In addition, several elution order changes are observed, filling the confirmational requirements of the method.

Figure 2: Cut analysis time in half for organochlorine pesticide analysis (Method 8081B) using Rtx-CLPesticides columns and a micro-ECD.

Rtx-CLPesticides



Fully resolve target compounds on a 0.32 mm ID column in less than 7 min.

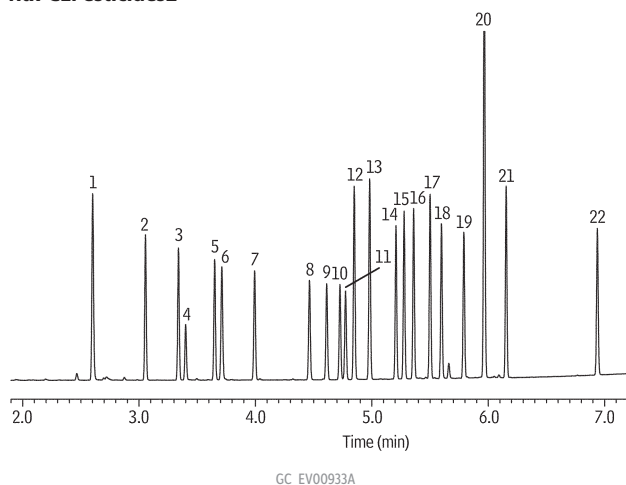


Peaks

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. *trans*-Chlordane*
10. *cis*-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)

* For information regarding the nomenclature used for *cis*-chlordane and *trans*-chlordane, visit www.restek.com/chlordane-notice

Rtx-CLPesticides2



Columns: Rtx-CLPesticides 30 m, 0.32 mm ID, 0.32 μ m (cat.# 11141) and Rtx-CLPesticides2 30 m, 0.32 mm ID, 0.25 μ m (cat.# 11324) using Rxi guard column 5 m, 0.32 mm ID (cat.# 10039) with deactivated universal "Y" Press-Tight connector (cat.# 20405-261); **Sample:** Organochlorine pesticide mix AB #2 (cat.# 32292) Pesticide surrogate mix, EPA 8080, 8081 (cat.# 32000); **Injection:** Inj. Vol.: 1 μ L splitless (hold 0.3 min), Liner: Splitless taper (4 mm) (cat.# 20799), Inj. Temp.: 250 $^{\circ}$ C, **Oven:** Oven Temp.: 120 $^{\circ}$ C to 200 $^{\circ}$ C at 45 $^{\circ}$ C/min to 230 $^{\circ}$ C at 15 $^{\circ}$ C/min to 330 $^{\circ}$ C at 30 $^{\circ}$ C/min (hold 2 min); **Carrier Gas:** He, **Detector:** Micro-ECD @ 330 $^{\circ}$ C;

Notes: Instrument was operated in constant flow mode. Linear velocity: 60 cm/sec @ 120 $^{\circ}$ C.

This chromatogram was obtained using an Agilent micro-ECD. To obtain comparable results, you will need to employ a micro-ECD in addition to dual columns connected to a 5-meter guard column using a "Y" Press-Tight connector.

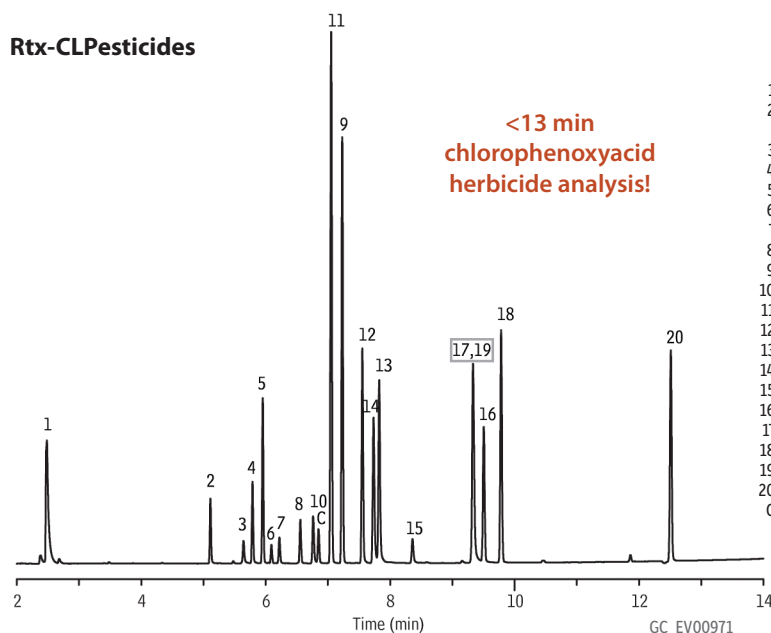
EPA Method 8151A: Chlorinated Herbicide Analysis

Today, many modern herbicides are designed to selectively kill specific types of vegetation. Even though these herbicides are not environmentally persistent and degrade in less than one year, EPA Method 8151A was developed for chlorinated herbicide analysis in wastewater and soil matrices. The most commonly used compounds targeted in this method are the chlorophenoxy herbicides. Of these herbicides, (2,4-dichlorophenoxy) acetic acid, also known as 2,4-D, is the most widely used and widely monitored herbicide worldwide.

According to Method 8151A, samples containing the target herbicides are analyzed using a parallel dual-column confirmation setup and an ECD, the recommended method of detection. Because of this, many laboratories acquire chlorinated herbicides on the same instrument setup used for chlorinated pesticide and PCB analyses. The Rtx-CLPesticides and Rtx-CLPesticides2 column pair also perform exceptionally well for chlorinated herbicide analysis; in fact, all 17 target compounds in EPA Method 8151A can be determined in just 13 minutes using these columns. One pair of compounds (bentazon and picloram methyl esters) coelutes on the Rtx-CLPesticides column, but these compounds are fully resolved on the Rtx-CLPesticides2 column. And, due to the difference in selectivity of the columns, several elution order changes occur filling the confirmational requirement of the method (Figure 3).

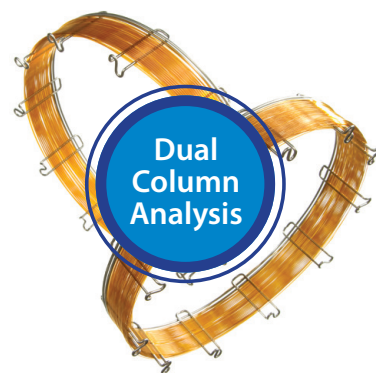
Figure 3: Excellent resolution of chlorinated herbicides on the Rtx-CLPesticides/Rtx-CLPesticides2 column pair.

Rtx-CLPesticides



Peaks

1. Dalapon methyl ester
2. 3,5-Dichlorobenzoic acid methyl ester (SS)
3. 4-Nitroanisole
4. DCAA methyl ester (SS)
5. Dicamba methyl ester
6. MCPP methyl ester
7. MCPA Methyl ester
8. Dichlorprop, methyl ester
9. 4,4'-DBOB (IS)
10. 2,4-D methyl ester
11. Pentachloroanisole
12. 2,4,5-TP, methyl ester
13. 2,4,5-T methyl ester
14. Chloramben, methyl ester
15. 2,4-DB methyl ester
16. Dinoseb methyl ester
17. Bentazon methyl ester
18. DCPA methyl ester (Chlorthal-dimethyl)
19. Picloram methyl ester
20. Acifluorfen methyl ester
- C. contaminant



Columns Rtx-CLPesticides2 30 m, 0.32 mm ID, 0.25 μm (cat.# 11324) and Rtx-CLPesticides 30 m, 0.32 mm ID, 0.32 μm (cat.# 11141) using Rxi deactivated guard column 5 m, 0.32 mm ID (cat.# 10039) with universal "Y" Press-Tight connector (cat.# 20405-261)

Sample 200 ng/mL herbicide mix #1 (cat.# 32055)
1,000 ng/mL dalapon methyl ester (cat.# 32057)
20,000 ng/mL herbicide mix #3 (cat.# 32059)
200 ng/mL herbicide mix #4 (cat.# 32062)
250 ng/mL 4,4'-dibromooctafluorobiphenyl (cat.# 32053)
400 ng/mL 2,4-dichlorophenyl acetic acid methyl ester (cat.# 32050)

Diluent: Hexane

Injection

Inj. Vol.: 1.0 μL splitless (hold 0.75 min)
Liner: Cyclo double taper (4 mm) (cat.# 20895)
Inj. Temp.: 250 °C

Oven

Oven Temp: 70 °C (hold 0.5 min) to 190 °C at 25 °C/min (hold 1 min) to 300 °C at 11 °C/min (hold 5 min)

Carrier Gas

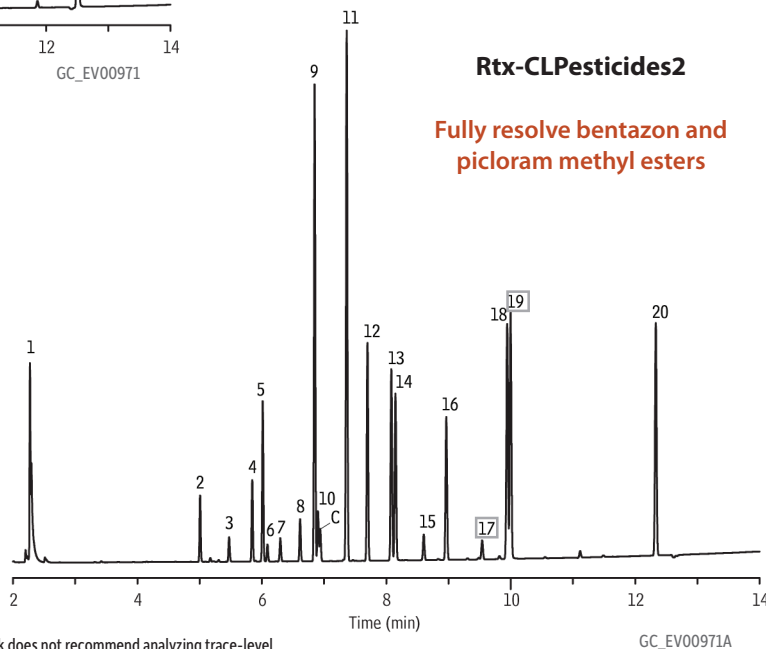
Linear Velocity: 36 cm/sec @ 70 °C

Detector μ-ECD @ 325 °C

Instrument

Notes

This chromatogram was obtained using an Agilent μ-ECD. To obtain comparable results, you will need to employ a μ-ECD in addition to confirmational dual columns connected to a 5-meter guard column using a "Y" Press-Tight connector.



Analyzing dirty or derivatized samples can contaminate your column. Restek does not recommend analyzing trace-level pesticide samples following derivatized samples (e.g., Methods 8151A and 552.2) without first performing inlet maintenance. Standard steps include trimming the guard column and changing the inlet liner, O-ring, seal, and septum.

EPA Method 8082A: PCB Analysis

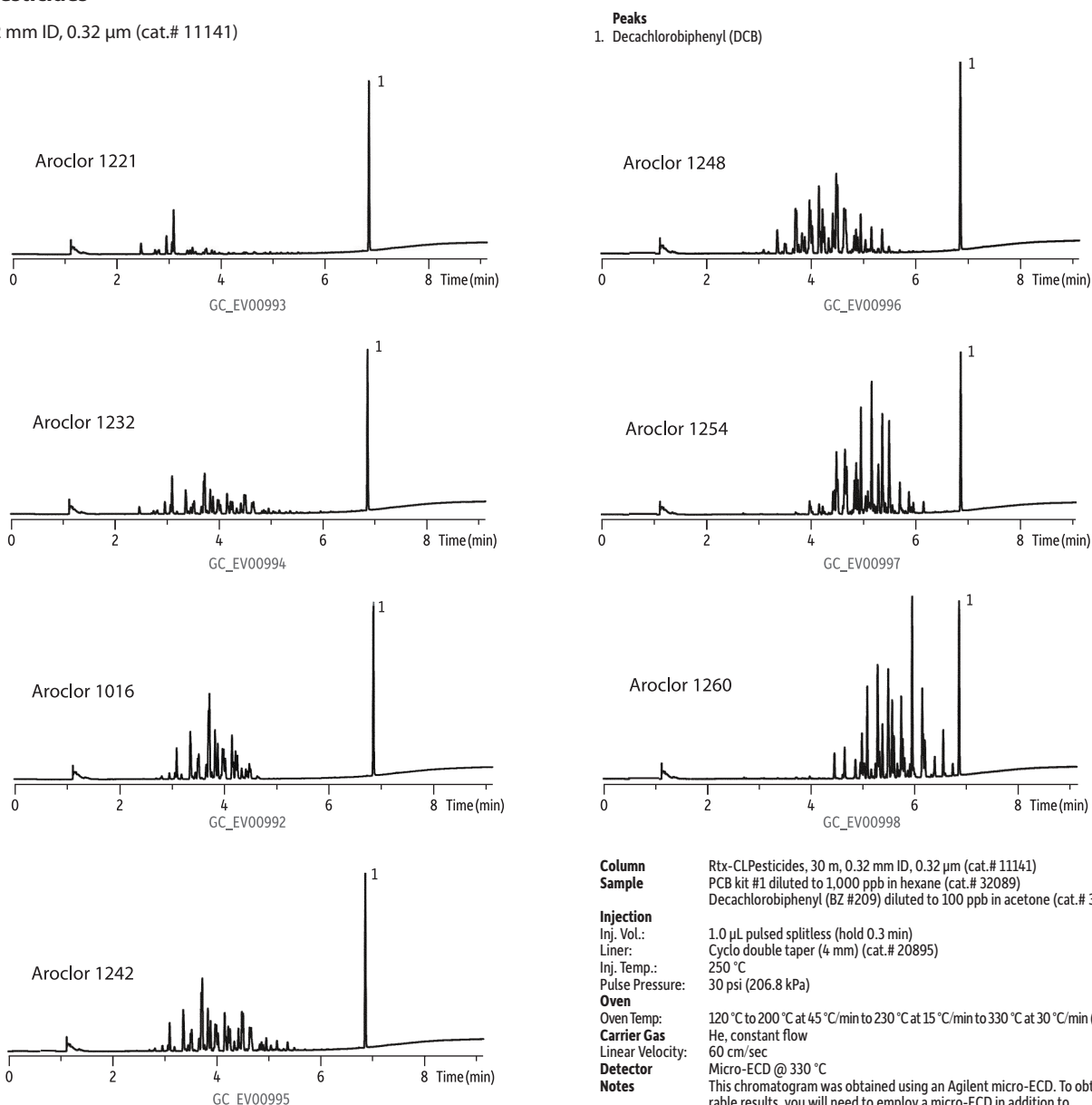
Polychlorinated biphenyls (PCBs) are a group of industrial organochlorine chemicals that were used extensively as coolant fluids in transformers and capacitors. Later they were used as plasticizers, de-inking solvents, heat transfer fluids in machinery, and also as waterproofing agents, among other uses. PCBs are chemically inert liquids that are difficult to burn. Because they are very persistent in the environment, bioaccumulate in living systems, and some are toxic (i.e., coplanar PCBs), they are a major environmental concern.

EPA Method 8082A details how Aroclor mixtures and PCB congeners are to be analyzed in a parallel dual-column confirmation setup. When choosing columns, it is important to select stationary phases that have low bleed and high thermal stability. This allows the columns to be held at high temperature at the end of each analysis to prevent carryover from one injection to the next. Because many instruments used for PCB analysis also may be used for pesticide and herbicide analyses, the column pair of choice is the Rtx-CLPesticides and Rtx-CLPesticides2 columns. This column set provides low bleed, high thermal stability, and is designed for primary column analysis and secondary column confirmation.

Figure 4: Aroclor analysis on the RtxCLPesticides column.

Rtx-CLPesticides

30 m, 0.32 mm ID, 0.32 μ m (cat.# 11141)



For Aroclor mixture analysis under EPA 8082A, individual Aroclor mixes are required to be analyzed as standards, then the sample extract chromatograms are compared to the standards to qualitatively identify the Aroclor mixtures. Once identification has been made, quantification can be performed by selecting five of the largest peaks, treating them as individual compounds, and then reporting the average concentration. Figures 4 and 5 show the individual Aroclor mixes and the differences among them.

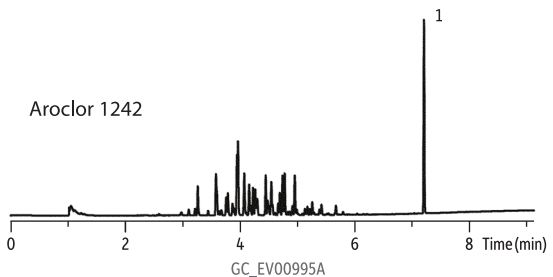
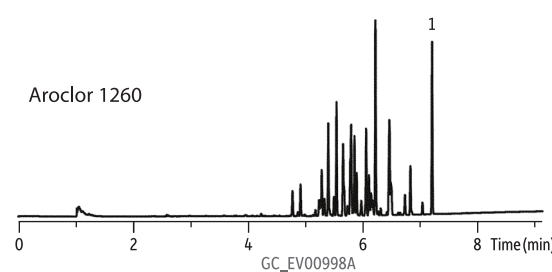
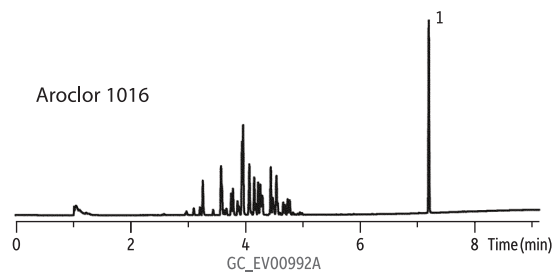
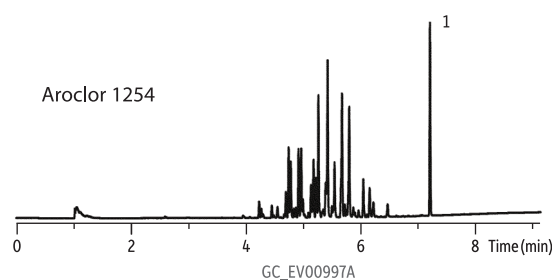
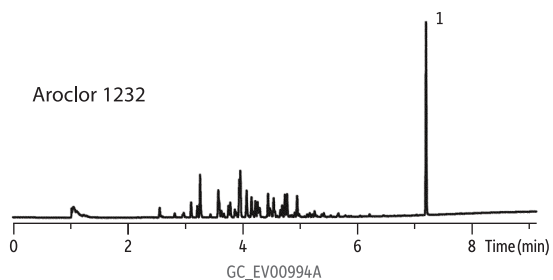
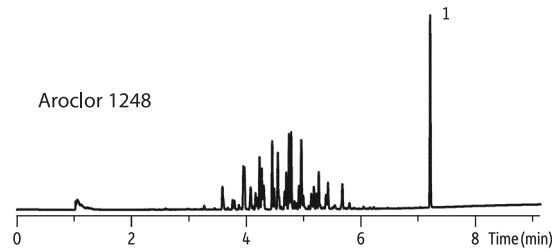
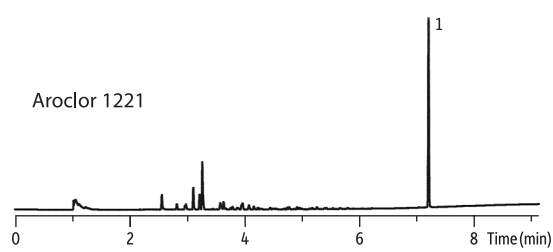
When analyzing for PCB congeners using Method 8082A, each peak is to be treated as an individual component and a standard curve is made for each of the congeners of interest. Note that while many laboratories are interested in the analysis of PCBs by congener, most do not need, or desire, to analyze all 209.

Figure 5: Aroclor analysis on the RtxCLPesticides2 column.

Rtx-CLPesticides2

30 m, 0.32 mm ID, 0.25 µm (cat.# 11324)

Peaks
1. Decachlorobiphenyl (DCB)



Column Rtx-CLPesticides2, 30 m, 0.32 mm ID, 0.25 µm (cat.# 11324)
Sample PCB kit #1 diluted to 1,000 ppb in hexane (cat.# 32089)
 Decachlorobiphenyl (BZ #209) diluted to 100 ppb in acetone (cat.# 32029)
Injection
 Inj. Vol.: 1.0 µL pulsed splitless (hold 0.3 min)
 Liner: Cyclo double taper (4 mm) (cat.# 20895)
 Inj. Temp.: 250 °C
 Pulse Pressure: 30 psi (206.8 kPa)
Oven
 Oven Temp: 120 °C to 200 °C at 45 °C/min to 230 °C at 15 °C/min to 330 °C at 30 °C/min (hold 2 min)
Carrier Gas
 Linear Velocity: He, constant flow
 60 cm/sec
Detector
 Micro-ECD @ 330 °C
Notes
 This chromatogram was obtained using an Agilent micro-ECD. To obtain comparable results, you will need to employ a micro-ECD in addition to confirmational dual columns connected to a 5-meter guard column using a "Y" Press-Tight connector.

EPA Method 504.1: EDB, DBCP, TCP Analysis

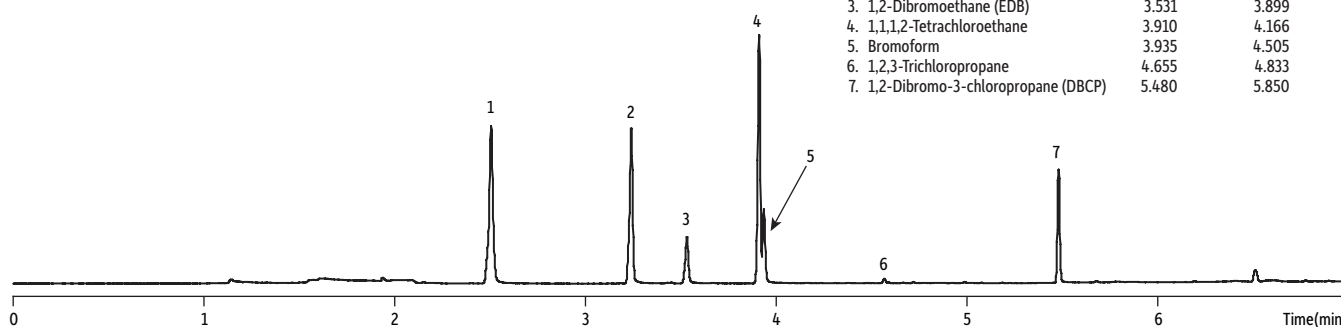
EPA Method 504.1 is a common test performed by environmental laboratories for the analysis of 1,2-dibromoethane (EDB), 1,2-dibromo-3-chloropropane (DBCP), and 1,2,3-trichloropropane (TCP) in drinking water. This method uses parallel dual-column gas chromatography with electron capture detection (GC-ECD), the same instrument setup that is used for the analysis of chlorinated pesticides and herbicides. Thus, when selecting a set of capillary columns for EDB, DBCP, TCP analysis, it is advantageous that they work well for a number of different methods.

The Rtx-CLPesticides and the Rtx-CLPesticides2 columns provide excellent separation for the compounds listed in Method 504.1, as well as for analytes in several other drinking water methods. Figure 6 shows the analysis of the Method 504.1 target compounds on these columns connected in parallel using a glass "Y" Press-Tight connector. This configuration is important to ensure that both the primary and confirmation column analyses are performed simultaneously under the same conditions and using the same injection port. Method 504.1 requires that EDB, DBCP, and TCP be fully resolved from the common interference compounds (e.g., chloroform, bromodichloromethane, chlorodibromomethane, 1,1,1,2-tetrachloroethane, and bromoform). The Rtx-CLPesticides2 columns fully resolved these compounds. Note that the coelution of 1,1,1,2-tetrachloroethane and bromoform is between two interference compounds; it does not affect the identification or quantification of EDB, DBCP, or TCP.

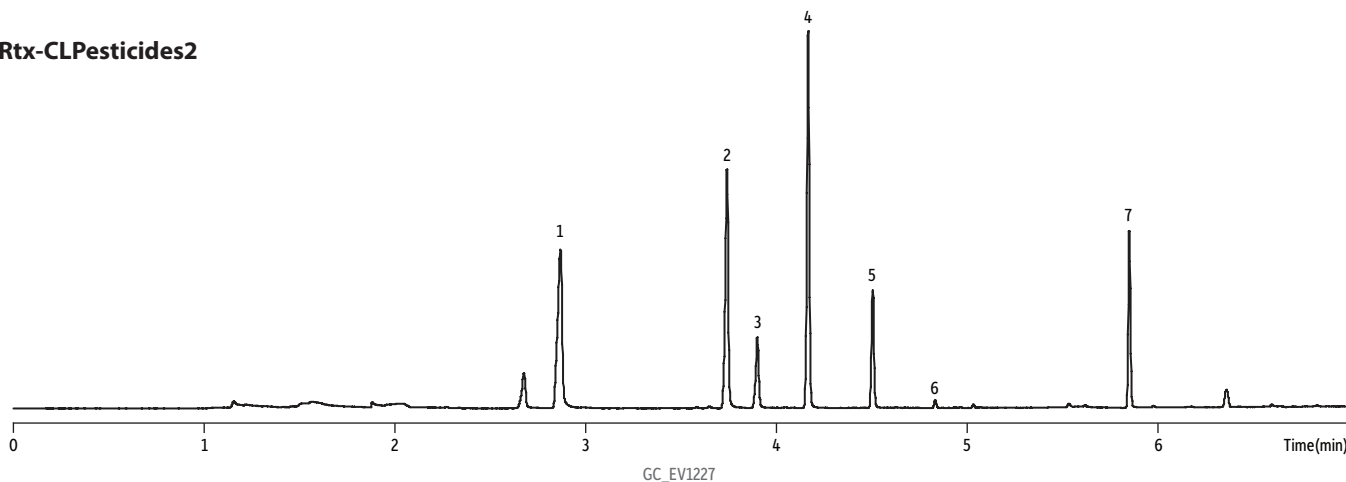
Figure 6: EDB, DBCP, and TCP analysis on Rtx-CLPesticides and Rtx-CLPesticides2 columns according to EPA Method 504.1

Rtx-CLPesticides

Peaks	CLP1 t_r (min)	CLP2 t_r (min)
1. Bromodichloromethane	2.504	2.866
2. Chlorodibromomethane	3.239	3.740
3. 1,2-Dibromoethane (EDB)	3.531	3.899
4. 1,1,1,2-Tetrachloroethane	3.910	4.166
5. Bromoform	3.935	4.505
6. 1,2,3-Trichloropropane	4.655	4.833
7. 1,2-Dibromo-3-chloropropane (DBCP)	5.480	5.850



Rtx-CLPesticides2



Columns: Rtx-CLPesticides2 30 m, 0.32 mm ID, 0.25 μm (cat.# 11324) and Rtx-CLPesticides 30 m, 0.32 mm ID, 0.32 μm (cat.# 11141) using Rxi guard column 5 m, 0.32 mm ID (cat.# 10039 with universal "Y" Press-Tight connector (cat.# 20405); **Sample:** Dibromochloromethane (chlorodibromochloromethane) (cat.# 30271) Bromodichloromethane (cat.# 30251); 504.1 calibration mix (cat.#30239); 1,1,1,2-tetrachloroethane (cat.# 30411); Bromoform (cat.# 30252); Diluent: n-Hexane; Conc.: 10 ng/mL; **Injection:** Inj. Vol.: 2 μL splitless (hold 0.50 min.); Liner: Restek Premium 4 mm single taper inlet liner w/wool (cat.# 23303.1); Inj. Temp.: 200 °C; Purge Flow: 50 mL/min; **Oven:** Oven Temp: 30 °C (hold 2.0 min) to 220 °C at 30 °C/min; **Carrier Gas:** He, constant flow; Linear Velocity: 60 cm/sec; **Detector:** Micro-ECD @ 220 °C; Make-up Gas Flow Rate: 50 mL/min; Make-up Gas Type: He; Data Rate: 50 Hz; **Instrument:** Agilent/HP6890 GC; **Notes:** This chromatogram was obtained using an Agilent micro-ECD. To obtain comparable results, you will need to employ a micro-ECD in addition to confirmational dual-columns connected to a 5-meter guard column using a "Y" Press-Tight connector.

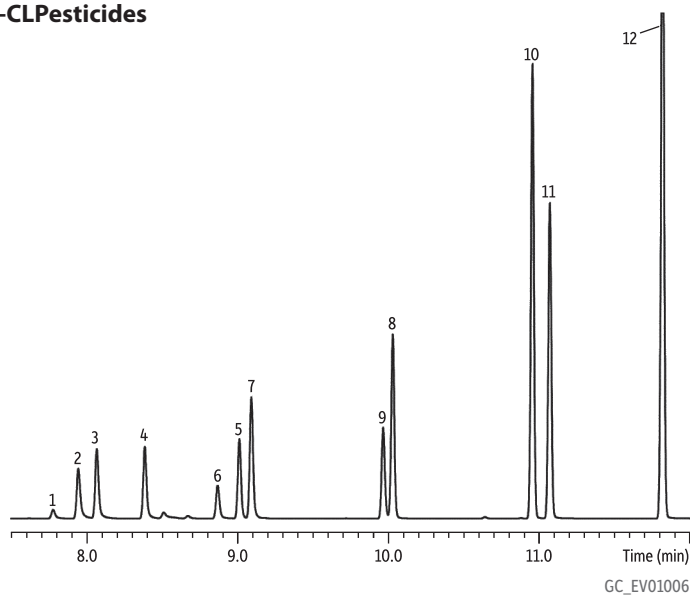
EPA Method 504.1: EDB, DBCP, TCP Analysis

Haloacetic acids are a byproduct of chlorinated disinfection of drinking water. Historically, there has been some concern that these analytes may represent a chronic risk to human health, and toxicological evidence suggests that some of them are possible human carcinogens. Elevated levels of haloacetic acids in drinking water could pose acute human risk because of their corrosive nature. Using Method 552.2 and an appropriate GC column set, such as the Rtx-CLPesticides and the Rtx-CLPesticides2 columns, environmental chemists can achieve accurate analysis of haloacetic acids and dalapon.

Haloacetic acid analysis can be performed on a variety of GC column phases. However, an important criterion for column selection is the degree of resolution between the methylated haloacetic acid compounds and known interference compounds like bromoform. Bromoform may be present due to the partial decarboxylation of tribromoacetic acid that can occur during a methylation step that uses acidic methanol. As shown in Figure 7, the Rtx-CLPesticides and Rtx-CLPesticides2 columns provide the necessary resolution for this GC-ECD analysis in less than 12 minutes, using the same instrument setup as several other EPA methods.

Figure 7: Dalapon and haloacetic acid analysis by Method 552.2 on an Rtx-CLPesticides column set.

Rtx-CLPesticides



Peaks

Peaks	Conc. (µg/mL)
1. Methyl monochloroacetate	1.2
2. Methyl monobromoacetate	0.8
3. Methyl dichloroacetate	1.2
4. Dalapon methyl ester	2
5. Methyl trichloroacetate	0.4
6. 1,2,3-Trichloropropane (IS)	4
7. Methyl bromo(chloro)acetate	0.8
8. Methyl bromodichloroacetate	0.8
9. Methyl dibromoacetate	0.4
10. Methyl chlorodibromoacetate	2
11. Methyl 2,3-dibromopropionate (SS)	2
12. Methyl tribromoacetate	4

Rtx-CLPesticides2

Columns Rtx-CLPesticides2 30 m, 0.32 mm ID, 0.25 µm (cat.# 11324) and Rtx-CLPesticides 30 m, 0.32 mm ID, 0.32 µm (cat.# 11141) using Rxi guard column 5 m, 0.32 mm ID (cat.# 10039) with deactivated universal "Y" Press-Tight connector (cat.# 20405-261)

Sample Haloacetic acid methyl ester mix #2 (cat.# 31647)
Dalapon methyl ester (cat.# 32057)
Methyl-2,3-dibromopropionate (cat.# 31656)
1,2,3-Trichloropropane (cat.# 31648)
Methyl *tert*-butyl ether (MTBE)

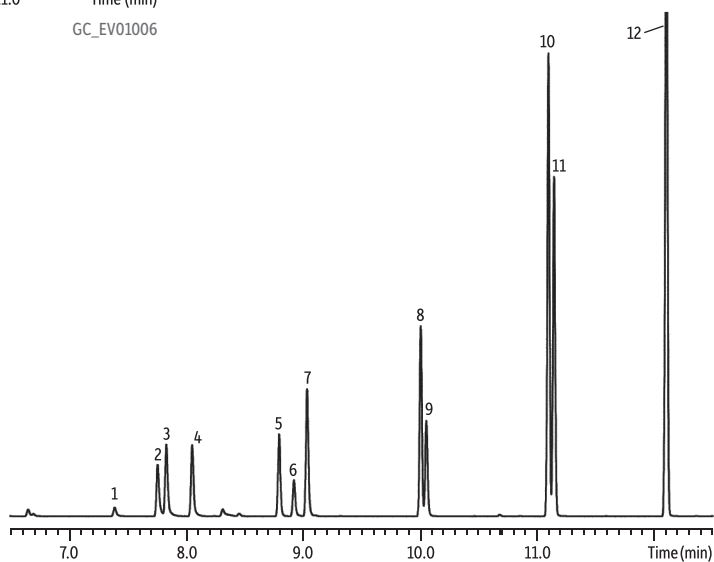
Diluent:
Injection
Inj. Vol.: 1.0 µL splitless (hold 0.75 min)
Liner: Cyclo double taper (4 mm) (cat.# 20896)
Inj. Temp.: 250 °C

Oven
Oven Temp.: 35 °C (hold 4 min) to 250 °C at 15 °C/min (hold 5 min)

Carrier Gas
Linear Velocity: 25 cm/sec

Detector
Micro-ECD @ 300 °C

Notes
This chromatogram was obtained using an Agilent micro-ECD. To obtain comparable results, you will need to employ a micro-ECD in addition to confirmational dual columns connected to a 5-meter guard column using a "Y" Press-Tight connector.



Analyzing dirty or derivatized samples can contaminate your column. Restek does not recommend analyzing trace-level pesticide samples following derivatized samples (e.g., Methods 8151A and 552.2) without first performing inlet maintenance. Standard steps include trimming the guard column and changing the inlet liner, O-ring, seal, and septum.

EPA Method 505: Organohalide Pesticide Analysis and EPA Method 508.1: Chlorinated Pesticide, Chlorinated Herbicide, and Organohalide Analysis

With the advent of modern agriculture and its vast selection of chemical pest control measures, the farming community has made significant increases in productivity and efficiency. Crop yield per acre is extremely high, due in part to the role of pesticides and herbicides in mitigating the devastating effects of many plant and insect pests. However, the use of these chemicals can have drawbacks, including surface and ground water contamination. EPA Methods 505 and 508.1 are used for chlorinated pesticide, chlorinated herbicide, and organohalide analysis in drinking and ground water. The Rtx-CLPesticides and Rtx-CLPesticides2 column set also works well for the analysis of compounds in these methods because the columns are highly selective for analytes that contain electronegative substituents. The optimized parallel dual-column method shown here satisfies method requirements in very fast analysis times, which improves sample throughput (Table II, Figures 8 and 9).

Table II: Rtx-CLPesticides and Rtx-CLPesticides2 columns easily pass Method 508.1 performance criteria.

Test/Requirement	Analyte	Concentration (ppb)	Rtx-CLPesticides2	Rtx-CLPesticides
Inertness (breakdown <20%)	endrin	50	0.9%	1.4%
Inertness (breakdown <20%)	4,4'-DDT	100	1.0%	1.1%
Sensitivity (S/N>3)	chlorpyrifos	2	12.0	6.2
Chromatographic performance (0.8<PGF<1.15)	DCPA	50	1.03	1.06
Column performance (resolution>0.50)	delta-BHC/ chlorothalonil	40/50	9.9	26.8

Figure 8: Organohalide pesticide analysis (Method 505) on Rtx-CLPesticides and Rtx-CLPesticides2 columns.

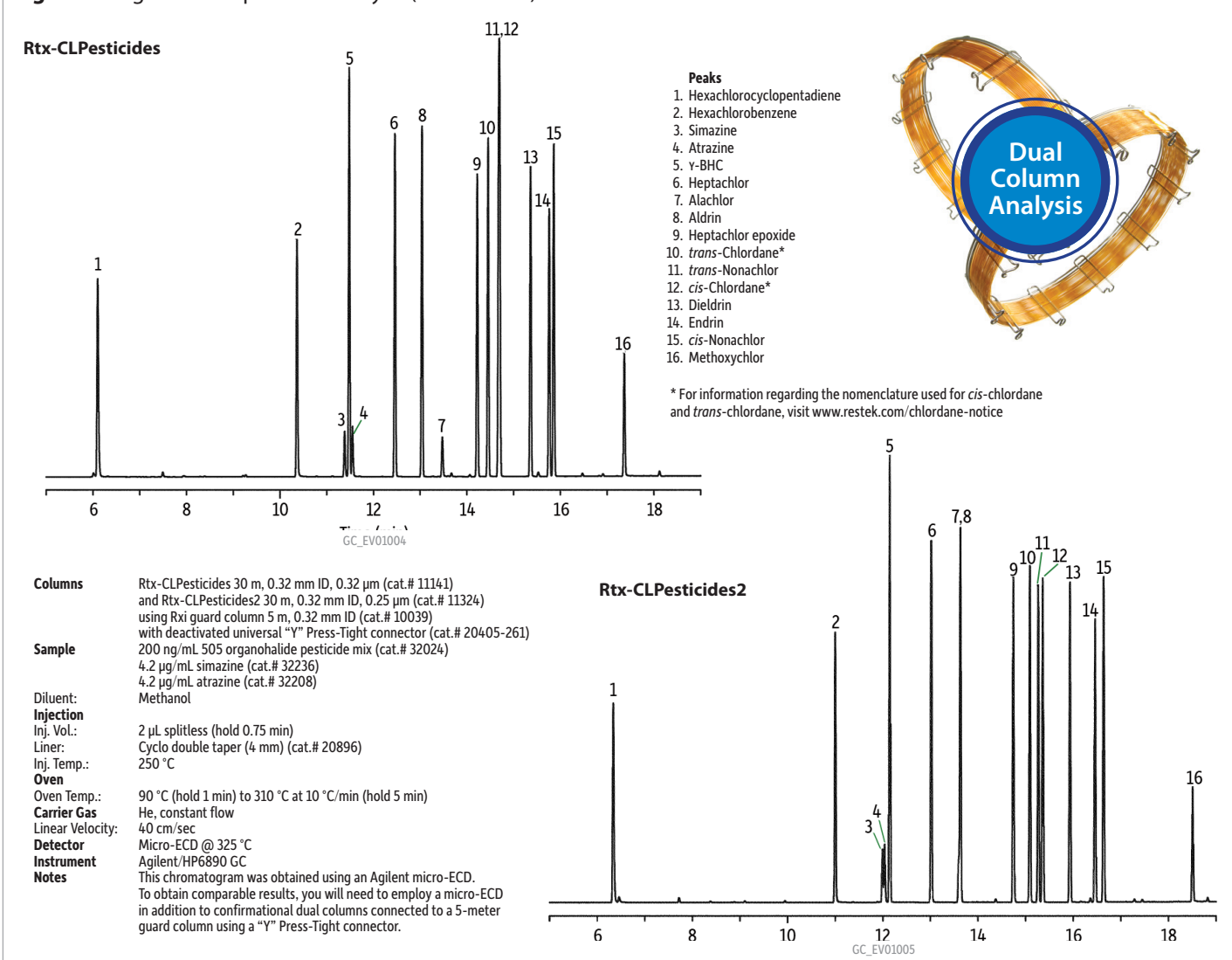
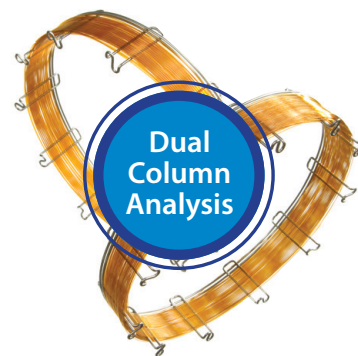
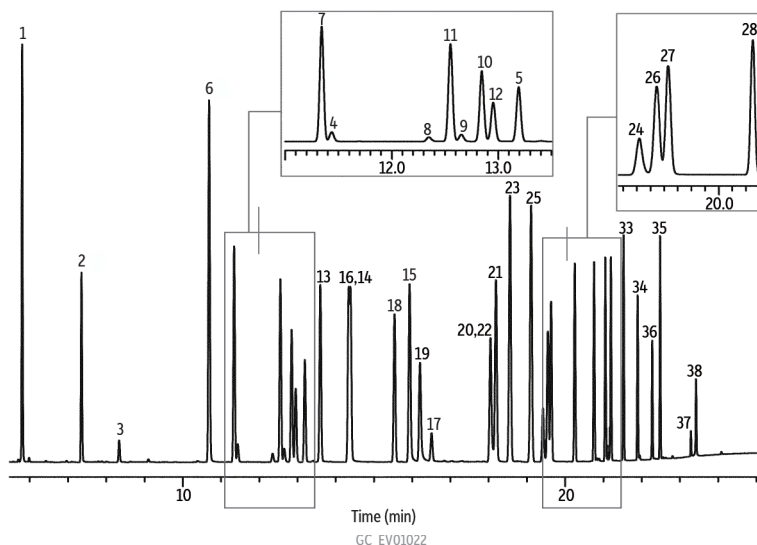


Figure 9: 24-minute analysis of Method 508.1 chlorinated pesticides, herbicides, and organohalides using Rtx-CLPesticides columns and a micro-ECD.

Rtx-CLPesticides

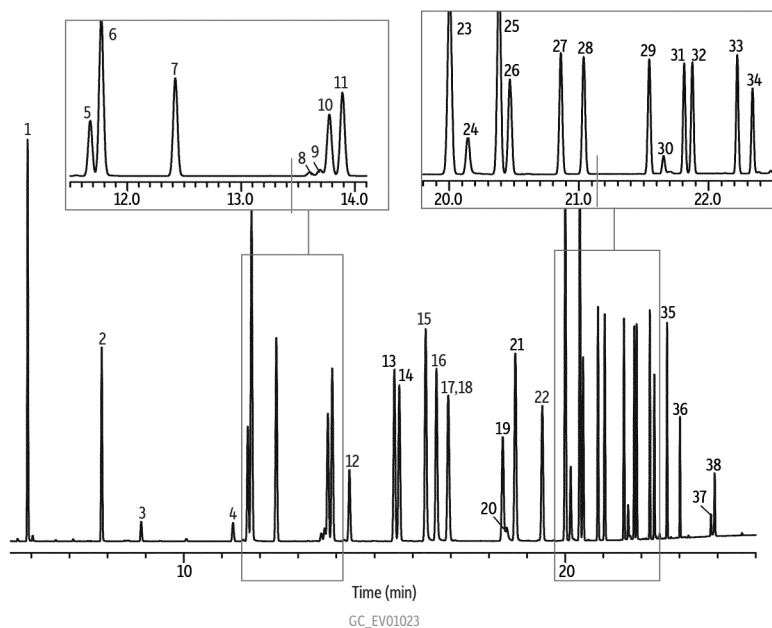


Peaks

- | | |
|----------------------------------|------------------------------|
| 1. Hexachlorocyclopentadiene | 20. Metachlor |
| 2. Etridiazole | 21. DCPA |
| 3. Chlorneb | 22. Heptachlor epoxide |
| 4. Propachlor | 23. <i>trans</i> -Chlordane* |
| 5. Trifluralin | 24. Cyanazine |
| 6. Hexachlorobenzene | 25. <i>cis</i> -Chlordane* |
| 7. α -BHC | 26. Endosulfan I |
| 8. Simazine | 27. 4,4'-DDE |
| 9. Atrazine | 28. Dieldrin |
| 10. Pentachloronitrobenzene (IS) | 29. Endrin |
| 11. γ -BHC | 30. Chlorobenzilate |
| 12. β -BHC | 31. 4,4'-DDD |
| 13. δ -BHC | 32. Endosulfan II |
| 14. Heptachlor | 33. 4,4'-DDT |
| 15. Chlorothalonil | 34. Endrin aldehyde |
| 16. Metribuzin | 35. Endosulfan sulfate |
| 17. Alachlor | 36. Methoxychlor |
| 18. Aldrin | 37. <i>cis</i> -Permethrin |
| 19. 4,4'-Dibromobiphenyl (SS) | 38. <i>trans</i> -Permethrin |

* For information regarding the nomenclature used for *cis*-chlordane and *trans*-chlordane, visit www.restek.com/chlordane-notice

Rtx-CLPesticides2



Columns

Rtx-CLPesticides2 30 m, 0.32 mm ID, 0.25 μ m (cat.# 11324) and Rtx-CLPesticides 30 m, 0.32 mm ID, 0.32 μ m (cat.# 11141) using Rxi guard column 5 m, 0.32 mm ID (cat.# 10039) with deactivated universal "Y" Press-Tight connector (cat.# 20405-261)

Sample

50 ng/mL 508.1 calibration mix #1 (cat.# 32094)
100 ng/mL 508.1 calibration mix #2 (cat.# 32095)
100 ng/mL 508.1 calibration mix #3 (cat.# 32096)
50 ng/mL pentachloronitrobenzene (cat.# 32091)
250 ng/mL 4,4'-dibromobiphenyl (cat.# 32092)
500 ng/mL atrazine (cat.# 32208)
500 ng/mL simazine (cat.# 32236)
Ethyl acetate

Diluent:

Injection

Inj. Vol.: 2 μ L splitless (hold 0.75 min)
Liner: Cyclo double taper (4 mm) (cat.# 20896)
Inj. Temp.: 250 $^{\circ}$ C

Oven

Oven Temp.: 80 $^{\circ}$ C (hold 0.5 min) to 155 $^{\circ}$ C at 19 $^{\circ}$ C/min (hold 1 min) to 210 $^{\circ}$ C at 4 $^{\circ}$ C/min to 310 $^{\circ}$ C at 25 $^{\circ}$ C/min (hold 0.5 min)

Carrier Gas

Linear Velocity: 26 cm/sec

Detector

Micro-ECD @ 325 $^{\circ}$ C

Notes

This chromatogram was obtained using an Agilent micro-ECD. To obtain comparable results, you will need to employ a micro-ECD in addition to confirmational dual columns connected to a 5-meter guard column using a "Y" Press-Tight connector.

Get Set for Parallel Dual-Column Analysis!

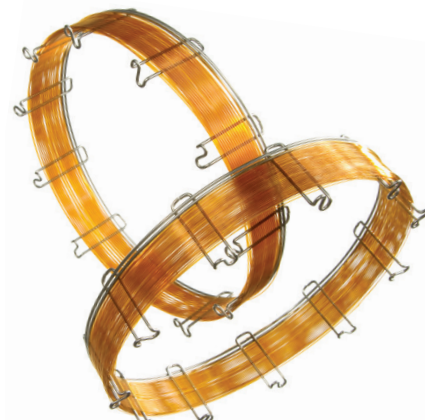
Analytical Columns

Improved resolution and faster analysis times, compared to 1701 or phenyl phases, make the Rtx-CLPesticides/Rtx-CLPesticides2 column pair ideal for analyzing chlorinated pesticides, PCBs as Aroclors, and chlorinated herbicides. These columns offer alternate selectivity, meeting method requirements for elution order changes and relative retention time shifts. Column bleed is low, allowing high boiling point contaminants to be heated off of the column, which extends column lifetime.

Rtx-CLPesticides Columns (fused silica)

proprietary Crossbond phase

ID	df	Length	Temp. Limits	qty.	cat.#
Rtx-CLPesticides Column					
0.18 mm	0.18 µm	20 m	-60 to 320/340 °C	ea.	42102
	0.25 µm	15 m	-60 to 320/340 °C	ea.	11120
0.25 mm	0.25 µm	30 m	-60 to 320/340 °C	ea.	11123
	0.25 µm	30 m	-60 to 320/340 °C	6-pk.	11123-600
	0.25 µm	60 m	-60 to 320/340 °C	ea.	11126
0.32 mm	0.32 µm	30 m	-60 to 320/340 °C	ea.	11141
	0.50 µm	15 m	-60 to 320/340 °C	ea.	11136
	0.50 µm	30 m	-60 to 320/340 °C	ea.	11139
0.53 mm	0.50 µm	30 m	-60 to 320/340 °C	6-pk.	11139-600
	0.50 µm	30 m	-60 to 300/320 °C	ea.	11140



Rtx-CLPesticides2 Columns (fused silica)

proprietary Crossbond phase

ID	df	Length	Temp. Limits	qty.	cat.#
Rtx-CLPesticides2 Column					
0.18 mm	0.14 µm	10 m	-60 to 320/330 °C	ea.	42301
	0.14 µm	20 m	-60 to 310/330 °C	ea.	42302
0.25 mm	0.20 µm	30 m	-60 to 320/340 °C	ea.	11323
	0.20 µm	60 m	-60 to 320/340 °C	ea.	11326
0.32 mm	0.25 µm	15 m	-60 to 320/340 °C	ea.	11321
	0.25 µm	30 m	-60 to 320/340 °C	ea.	11324
	0.25 µm	30 m	-60 to 320/340 °C	6-pk.	11324-600
0.53 mm	0.50 µm	30 m	-60 to 320/340 °C	ea.	11325
	0.42 µm	30 m	-60 to 300/320 °C	ea.	11340



ordering notes

Custom lengths and film thicknesses available. Call Technical Service at 800-356-1688 or 814-353-1300, ext. 4, or contact your Restek representative.

Save Money, Buy a Kit!

Purchase one of these recommended combinations of guard and analytical columns and save money.

Rtx-CLPesticides Column Kits (proprietary Crossbond phases)

Note: Columns are not preconnected in these kits.

ID	Includes	qty.	cat.#
Rtx-CLPesticides Kit (0.32 mm ID, 0.32 µm)			
	Rtx-CLPesticides Column (cat.# 11141); Rtx-CLPesticides2 Column (cat.# 11324); Deactivated Universal Angled "Y" Press-Tight Connector (cat.# 20403-261); and Siltek Guard Column (cat.# 10027)	kit	11196
Rtx-CLPesticides Kit (0.53 mm ID)			
	Rtx-CLPesticides Column (cat.# 11140); Rtx-CLPesticides2 Column (cat.# 11340); Deactivated Universal Angled "Y" Press-Tight Connector (cat.# 20403-261); and IP Deactivated Guard Column (cat.# 10045)	kit	11197
Rtx-CLPesticides Kit (0.25 mm ID)			
	Rtx-CLPesticides Column (cat.# 11123); Rtx-CLPesticides2 Column (cat.# 11323); Deactivated Universal Angled "Y" Press-Tight Connector (cat.# 20403-261); and Siltek Guard Column (cat.# 10026)	kit	11199



Connectors

The best chromatography for parallel dual-column analysis is obtained using the universal “Y” Press-Tight connector. The internal design of the taper allows the column to seal to the glass surface and minimizes dead volume. To strengthen this connection, Restek developed the SeCure “Y” connector, which uses a C-clamp to hold the columns in place, assuring a reliable connection.

The MXT-Union connectors are an alternative connector system that uses special ferrules designed to eliminate dead volume. The MXT-Union is made of stainless steel and is deactivated with Siltek treatment, making an inert sample pathway. The special ferrules used to make the connection are designed to eliminate the dead volume when installing the columns.

Universal “Y” Press-Tight Connectors

An alternative method of performing dual-column confirmational analyses!

Description	Deactivation	qty.	cat.#
Universal “Y” Press-Tight Connector	Deactivated	ea.	20405-261
	Deactivated	3-pk	20406-261



SeCure “Y” Connector Kits

Description	Fits Column ID	qty.	cat.#
SeCure “Y” Connector Kit	0.18/0.25/0.28 mm (fused silica)	kit	20276
Includes: SeCure “Y” connector body; knurled nuts (3); universal “Y” Press-Tight union; and ferrules (3)	0.32 mm (fused silica)	kit	20277
	0.45/0.53 mm (fused silica)	kit	20278



The SeCure “Y” connector’s open design allows visual confirmation of the seal.

Graphite Capillary Ferrules for 1/16-Inch Compression-Type Fittings

Buy extra to keep spares on hand.

Ferrule ID	Fits Column ID	qty.	cat.#
0.4 mm	0.025/0.05/0.075/0.10/0.15/0.18/0.20/0.25 mm (fused silica); 0.18 mm (MXT)	10-pk.	20200
		50-pk.	20227
0.5 mm	0.32 mm (fused silica); 0.25/0.32 mm (MXT)	10-pk.	20201
		50-pk.	20228
0.8 mm	0.45/0.53 mm (fused silica); 0.53 mm (MXT)	10-pk.	20202
		50-pk.	20224



21060

MXT “Y”-Union Connector Kits for Connecting Metal and/or Fused Silica GC Columns

Description	Fits Column ID	qty.	cat.#
MXT “Y”-Union Connector Kit	0.25 mm (fused silica); 0.25 mm (MXT)	kit	21389
Includes: the MXT union; three 1/32-inch nuts; and three, one-piece, fused silica adaptors	0.32 mm (fused silica); 0.32 mm (MXT)	kit	21388
	0.53 mm (fused silica); 0.53 mm (MXT)	kit	21387



21387

Inlet Liners

The Rtx-CLPesticides and Rtx-CLPesticides2 column pair will work with both split or splitless injection techniques and any liner geometry. Various inlet liners are used for pesticide analysis; the four most common are the single taper, double taper, cyclo double taper, and the drilled Uniliner inlet liner.

The drilled Uniliner inlet liner provides the most inert sample pathway and eliminates injection port discrimination because the sample is funneled directly onto the column without contacting the metal injection port. Using a drilled Uniliner inlet liner eliminates the need to replace the inlet seal at the bottom of the injection port, substantially reducing maintenance time and expense.

The tapered liners are also commonly used for pesticide analysis and work best with pressure pulsing conditions. The best tapered liner to use with pressure pulsing is the cyclo double taper. This liner has a screw-type sample pathway which collects nonvolatile material at the beginning of the screws and offers more surface area to vaporize the sample prior to reaching the entrance of the column.

Liners for Split/Splitless Injection with Agilent GCs:



Topaz 4.0 mm ID Single Taper Inlet Liner

for Agilent GCs equipped with split/splitless inlets

ID x OD x Length	qty	Similar to Part #	cat.#
Single Taper, Premium Deactivation, Borosilicate Glass			
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	Agilent 5181-3316 (ea.), 5183-4695 (5-pk.), 5183-4696 (25-pk.), 5190-2292 (ea.), 5190-3162 (5-pk.), 5190-3166 (25-pk.), 5190-3170 (100-pk.)	23302



Topaz 4.0 mm ID Single Taper Inlet Liner w/ Wool

for Agilent GCs equipped with split/splitless inlets

ID x OD x Length	Packing	qty	Similar to Part #	cat.#
Single Taper, Premium Deactivation, Borosilicate Glass				
4.0 mm x 6.5 mm x 78.5 mm	Quartz Wool	5-pk.	Agilent 5062-3587 (ea.), 5183-4693 (5-pk.), 5183-4694 (25-pk.), 5190-2293 (ea.), 5190-3163 (5-pk.), 5190-3167 (25-pk.), 5190-3171 (100-pk.)	23303



Topaz 4.0 mm ID Double Taper Inlet Liner

for Agilent GCs equipped with split/splitless inlets

ID x OD x Length	qty	Similar to Part #	cat.#
Double Taper, Premium Deactivation, Borosilicate Glass			
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	Agilent 5181-3315 (ea.), 5183-4705 (5-pk.), 5183-4706 (25-pk.), 5190-3983 (ea.), 5190-4007 (5-pk.)	23308



Topaz 4.0 mm ID Cyclo Double Taper Inlet Liner

for Agilent GCs equipped with split/splitless inlets

ID x OD x Length	qty	cat.#
Cyclo Double Taper, Premium Deactivation, Borosilicate Glass		
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	23310

Topaz 4.0 mm ID Drilled Uniliner Inlet Liner with Hole near Top

for Agilent GCs equipped with split/splitless inlets

ID x OD x Length	qty	cat.#
Drilled Uniliner (hole near top), Premium Deactivation, Borosilicate Glass		
4.0 mm x 6.3 mm x 78.5 mm	5-pk.	23311



Topaz 4.0 mm ID Precision Inlet Liner w/ Wool

for Agilent GCs equipped with split/splitless inlets

ID x OD x Length	Packing	qty	Similar to Part #	cat.#
Precision, Premium Deactivation, Borosilicate Glass				
4.0 mm x 6.3 mm x 78.5 mm	Quartz Wool	5-pk.	Agilent 210-4004-5	23305



* 100% SATISFACTION GUARANTEE: If your Topaz inlet liner does not perform to your expectations for any reason, simply contact Restek Technical Service or your local Restek representative and provide a sample chromatogram showing the problem. If our GC experts are not able to quickly and completely resolve the issue to your satisfaction, you will be given an account credit or replacement product (same cat.#) along with instructions for returning any unopened product. (Do not return product prior to receiving authorization.) For additional details about Restek's return policy, visit www.restek.com/warranty

Inlet Supplies

Dual Vespel Ring Inlet Seals

Washerless, Leak-Tight Seals for Agilent GCs

Description	ID	Instrument	Material	qty.	cat.#
Dual Vespel Ring Inlet Seal	0.8 mm	for Agilent GCs	Stainless Steel	2-pk.	21238
	0.8 mm	for Agilent GCs	Stainless Steel	10-pk.	21239
	0.8 mm	for Agilent GCs	Gold-Plated	2-pk.	21240
	0.8 mm	for Agilent GCs	Gold-Plated	10-pk.	21241
	0.8 mm	for Agilent GCs	Siltek-Treated	2-pk.	21242
	0.8 mm	for Agilent GCs	Siltek-Treated	10-pk.	21243
	1.2 mm	for Agilent GCs	Stainless Steel	2-pk.	21244
	1.2 mm	for Agilent GCs	Stainless Steel	10-pk.	21245
	1.2 mm	for Agilent GCs	Gold-Plated	2-pk.	21246
	1.2 mm	for Agilent GCs	Gold-Plated	10-pk.	21247
	1.2 mm	for Agilent GCs	Siltek-Treated	2-pk.	21248
	1.2 mm	for Agilent GCs	Siltek-Treated	10-pk.	21249
	0.8 mm	for Agilent GCs	Gold-Plated	50-pk.	23418
	0.8 mm	for Agilent GCs	Siltek-Treated	50-pk.	23419
	0.8 mm	for Agilent GCs	Stainless Steel	50-pk.	23420

Patented



Sample Preparation



Resprep Florisil SPE Cartridges

- High-quality, silica-based hydrophilic adsorbents.
- Used to extract hydrophilic analytes from nonpolar matrices, such as organic solvents (e.g., polar contaminants from sample extracts).

Material	Packing	Volume	qty.	cat.#
Polypropylene tubes with polyethylene frits	Florisil	3 mL, 500 mg	50-pk.	28990
Polypropylene tubes with polyethylene frits	Florisil	6 mL, 500 mg	30-pk.	28992
Polypropylene tubes with polyethylene frits	Florisil	6 mL, 1000 mg	30-pk.	28993
Polypropylene tubes with polyethylene frits	Florisil	15 mL, 2000 mg	15-pk.	28995

ordering notes

Certificates of analysis for this product are provided electronically. To view and download your certificate, simply visit www.restek.com/documentation



Resprep Silica SPE Cartridges

- High-quality, silica-based hydrophilic adsorbents.
- Used to extract hydrophilic analytes from nonpolar matrices, such as organic solvents (e.g., polar contaminants from sample extracts).

Material	Packing	Volume	qty.	cat.#
Polypropylene tubes with polyethylene frits	Silica	3 mL, 500 mg	50-pk.	28978
Polypropylene tubes with polyethylene frits	Silica	6 mL, 1000 mg	30-pk.	28980

Resprep Alumina SPE Cartridges

- Porous aluminum oxide adsorbent.
- Used for common sample matrices such as food, soil, and petroleum.

Material	Packing	Volume	qty.	cat.#
Polypropylene tubes with polyethylene frits	Alumina A (pH ~4)	3 mL, 500 mg	50-pk.	28940
Polypropylene tubes with polyethylene frits	Alumina B (pH ~10)	6 mL, 1000 mg	30-pk.	28942
Polypropylene tubes with polyethylene frits	Alumina N (pH ~7.5)	3 mL, 500 mg	50-pk.	28943
Polypropylene tubes with polyethylene frits	Alumina N (pH ~7.5)	6 mL, 1000 mg	30-pk.	28944

Cartridges may be processed by any one or all of these techniques: positive pressure, sidearm flask, centrifuge, or vacuum manifold.



25845

Resprep CarboPrep Plus SPE Cartridges

Description	Packing	Volume	qty.	cat.#
Resprep CarboPrep Plus SPE Cartridges	CarboPrep Plus	3 mL, 95 mg	30-pk.	25845



26091

Resprep CarboPrep SPE Cartridges

Description	Packing	Volume	qty.	cat.#
Resprep SPE Cartridge	CarboPrep 90	3 mL, 250 mg	50-pk.	26091
	CarboPrep 90	6 mL, 500 mg	30-pk.	26092

Reference Standards

Organochlorine Pesticide Mix AB # 1

(20 components)

Aldrin (309-00-2)	<i>cis</i> -Chlordane (5103-71-9)	Dieldrin (60-57-1)	Endrin aldehyde (7421-93-4)				
α -BHC (319-84-6)	<i>trans</i> -Chlordane (5103-74-2)	Endosulfan I (959-98-8)	Endrin ketone (53494-70-5)				
β -BHC (319-85-7)	4,4'-DDD (72-54-8)	Endosulfan II (33213-65-9)	Heptachlor (76-44-8)				
γ -BHC (Lindane) (58-89-9)	4,4'-DDE (72-55-9)	Endosulfan sulfate (1031-07-8)	Heptachlor epoxide (isomer B) (1024-57-3)				
δ -BHC (319-86-8)	4,4'-DDT (50-29-3)	Endrin (72-20-8)	Methoxychlor (72-43-5)				
Conc. in Solvent and Volume	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
200 µg/mL each in hexane:toluene (1:1), 1 mL/ampul	Yes	6 months	48 months	Ambient	10 °C or colder	ea.	32291

Organochlorine Pesticide Mix AB # 2

(20 components)

Aldrin (309-00-2), 8 µg/mL	<i>trans</i> -Chlordane (5103-74-2), 8 µg/mL	Endosulfan II (33213-65-9), 16 µg/mL	Heptachlor epoxide (isomer B) (1024-57-3), 8 µg/mL				
α -BHC (319-84-6), 8 µg/mL	4,4'-DDD (72-54-8), 16 µg/mL	Endosulfan sulfate (1031-07-8), 16 µg/mL	Methoxychlor (72-43-5), 80 µg/mL				
β -BHC (319-85-7), 8 µg/mL	4,4'-DDE (72-55-9), 16 µg/mL	Endrin (72-20-8), 16 µg/mL					
γ -BHC (Lindane) (58-89-9), 8 µg/mL	4,4'-DDT (50-29-3), 16 µg/mL	Endrin aldehyde (7421-93-4), 16 µg/mL					
δ -BHC (319-86-8), 8 µg/mL	Dieldrin (60-57-1), 16 µg/mL	Endrin ketone (53494-70-5), 16 µg/mL					
<i>cis</i> -Chlordane (5103-71-9), 8 µg/mL	Endosulfan I (959-98-8), 8 µg/mL	Heptachlor (76-44-8), 8 µg/mL					
Conc. in Solvent and Volume	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
In hexane:toluene (1:1), 1 mL/ampul	Yes	6 months	48 months	Ambient	10 °C or colder	ea.	32292

Organochlorine Pesticide Mix AB # 3

(20 components)

Aldrin (309-00-2)	<i>cis</i> -Chlordane (5103-71-9)	Dieldrin (60-57-1)	Endrin aldehyde (7421-93-4)	Methoxychlor (72-43-5)			
α -BHC (319-84-6)	<i>trans</i> -Chlordane (5103-74-2)	Endosulfan I (959-98-8)	Endrin ketone (53494-70-5)				
β -BHC (319-85-7)	4,4'-DDD (72-54-8)	Endosulfan II (33213-65-9)	Heptachlor (76-44-8)				
γ -BHC (Lindane) (58-89-9)	4,4'-DDE (72-55-9)	Endosulfan sulfate (1031-07-8)	Heptachlor epoxide (isomer B) (1024-57-3)				
δ -BHC (319-86-8)	4,4'-DDT (50-29-3)	Endrin (72-20-8)					
Conc. in Solvent and Volume	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
2000 µg/mL each in hexane:toluene (1:1); 1 mL/ampul	Yes	6 months	52 months	Ambient	10 °C or colder	ea.	32415

Organochlorine Pesticide System Evaluation Mix

(2 components)

4,4'-DDT (50-29-3), 200 µg/mL Endrin (72-20-8), 100 µg/mL

Conc. in Solvent and Volume	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
In methyl tert-butyl ether, 1 mL/ampul	Yes	6 months	44 months	Ambient	10 °C or colder	ea.	32417

Pesticide Surrogate Mix

(2 components)

Decachlorobiphenyl (2051-24-3) 2,4,5,6-Tetrachloro-m-xylene (877-09-8)

Conc. in Solvent and Volume	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
200 µg/mL each in acetone, 1 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	32000
200 µg/mL each in acetone, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	32457

Organochlorine Pesticide Resolution Check Mix (with surrogates)

(22 components)

Aldrin (309-00-2), 10 µg/mL	<i>trans</i> -Chlordane (5103-74-2), 10 µg/mL	Endosulfan I (959-98-8), 10 µg/mL	Heptachlor (76-44-8), 10 µg/mL
α-BHC (319-84-6), 10 µg/mL	Decachlorobiphenyl (SS) (2051-24-3), 20 µg/mL	Endosulfan II (33213-65-9), 20 µg/mL	Heptachlor epoxide (isomer B) (1024-57-3), 10 µg/mL
β-BHC (319-85-7), 10 µg/mL	Dieldrin (60-57-1), 20 µg/mL	Endosulfan sulfate (1031-07-8), 20 µg/mL	Methoxychlor (72-43-5), 100 µg/mL
γ-BHC (Lindane) (58-89-9), 10 µg/mL	4,4'-DDD (72-54-8), 20 µg/mL	Endrin (72-20-8), 20 µg/mL	2,4,5,6-Tetrachloro- <i>m</i> -xylene (SS) (877-09-8), 10 µg/mL
δ-BHC (319-86-8), 10 µg/mL	4,4'-DDE (72-55-9), 20 µg/mL	Endrin aldehyde (7421-93-4), 20 µg/mL	
<i>cis</i> -Chlordane (5103-71-9), 10 µg/mL	4,4'-DDT (50-29-3), 20 µg/mL	Endrin ketone (53494-70-5), 20 µg/mL	

Conc. in Solvent and Volume	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
In hexane:toluene (90:10), 1 mL/ampul	Yes	6 months	48 months	Ambient	10 °C or colder	ea.	32454

Aroclor Solutions

Product Name	CAS #	Conc. in Solvent and Volume	cat.#
Aroclor 1016	12674-11-2	1000 µg/mL in hexane, 1 mL/ampul	32006
Aroclor 1221	11104-28-2	1000 µg/mL in hexane, 1 mL/ampul	32007
Aroclor 1232	11141-16-5	1000 µg/mL in hexane, 1 mL/ampul	32008
Aroclor 1242	53469-21-9	1000 µg/mL in hexane, 1 mL/ampul	32009
Aroclor 1248	12672-29-6	1000 µg/mL in hexane, 1 mL/ampul	32010
Aroclor 1254	11097-69-1	1000 µg/mL in hexane, 1 mL/ampul	32011
Aroclor 1260	11096-82-5	1000 µg/mL in hexane, 1 mL/ampul	32012
Aroclor 1016/1260	—	1000 µg/mL in hexane, 1 mL/ampul	32039
Aroclor 1262	37324-23-5	1000 µg/mL in hexane, 1 mL/ampul	32409
Aroclor 1268	11100-14-4	1000 µg/mL in hexane, 1 mL/ampul	32410



Be Certain with Restek Reference Standards

Precision data can only be delivered by high-purity, rigorously controlled reference standards. With decades of chemical expertise, Restek standards ensure accuracy and reliability.

- Fully characterized starting materials blended for maximum stability and convenience.
- Professionally formulated mixes reduce time, expense, and uncertainty compared to in-house preparation.
- Single and multicomponent standards covering a wide range of compounds and classes.



Source Your Standards with Confidence
www.restek.com/standards

Dynamic Duo (Restek Leak Detector and ProFLOW 6000 Flowmeter)

Dynamic Duo (Restek Leak Detector and ProFLOW 6000 Flowmeter)

Protect your instrument and improve data quality with this powerful pair from Restek. Checking for leaks and verifying flows before you start running help you avoid costly problems later.

Description	Certification/Compliance	Includes	qty.	cat.#
Dynamic Duo Combo Pack (Restek Leak Detector and ProFLOW 6000 Flowmeter)		Restek Electronic Leak Detector (cat.# 28500) & ProFLOW 6000 Flowmeter (cat.# 22656)	kit	22654
Restek Electronic Leak Detector	CE (EU, Korea, Japan, Australia), CSA/UL tested, not listed., WEEE, CEC, China RoHS 2, UKCA	carrying case, universal AC power adaptor [U.S., UK, Europe, Australia, Japan], 6-ft USB charging cable	ea.	28500
Small Probe Adaptor for Leak Detector			ea.	22658
Restek ProFLOW 6000 Electronic Flowmeter with Hard-Sided Carrying Case	CE, Ex, Canadian ICES-003, WEEE, RoHS 2, China RoHS 2, UKCA		ea.	22656
Soft-Sided Storage Case for Restek Leak Detector or ProFLOW 6000 Flowmeter			ea.	22657
Charging Kit		6-ft USB charging cable and universal AC power adaptor [U.S., UK, Europe, Australia, Japan]	kit	28502
6-ft USB charging cable			ea.	28501



Restek's Electronic Leak Detector

Redesigned and better than ever, our new leak detector is an essential tool for troubleshooting and routine maintenance of your gas chromatograph. Don't risk damaging your system or losing sensitivity; check for leaks often and protect your GC column and instrument with a Restek leak detector!

Leak Detector Specifications

Detectable Gases: Helium, nitrogen, argon, carbon dioxide, hydrogen*
 Battery: Rechargeable nickel-metal hydride (NiMH) internal battery pack (12 hours normal operation)
 Ambient Temperature: 50–98.6 °F (10–37 °C)
 Humidity Range: 0–97%
 Warranty: One year
 Certification/Compliance: CE (EU, Korea, Japan, Australia); CSA/UL tested, not listed; WEEE; CEC; China RoHS 2; UKCA
 Indoor Use Only

Limits of Detection

These gases can be detected with the Restek electronic leak detector at the following leak rates:
 Minimum Detectable Gas Limits and Indicating LED Color:
 Helium, 1.0×10^{-5} , red LED
 Hydrogen*, 1.0×10^{-5} , red LED
 Nitrogen, 1.4×10^{-3} , yellow LED
 Argon, 1.0×10^{-4} , yellow LED
 Carbon dioxide, 1.0×10^{-4} , yellow LED
 Gas detection limits measured in atm cc/sec.

Avoid using liquid leak detectors on a GC! Liquids can be drawn into the system and/or into the leak detector.

*Caution: The Restek electronic leak detector should only be used to detect trace amounts of hydrogen in a noncombustible environment. It is NOT designed for determining leaks in a combustible environment. A combustible gas detector should be used for determining combustible gas leaks under any condition. When using it to detect hydrogen, the Restek electronic leak detector may only be used for determining trace amounts in a GC environment.

ProFLOW 6000 Flowmeter

With its wide range of capabilities, the ProFLOW 6000 flowmeter simplifies gas flow measurement in the lab. Real-time measurements can be made for various types of flow paths, including continually changing gas types.

Flowmeter Specifications

Type of Flowmeter: Volumetric
 Battery: 2-AA
 Operating Temp. Range: 32–120 °F (0–48 °C)
 Warranty: One-year warranty (excludes recalibration)
 Certification/Compliance: CE; Ex; Canadian ICES-003; WEEE; RoHS 2; China RoHS 2; UKCA
 Patented

Optional Accessories

Soft-Sided Storage Case

Ideal for storing your leak detector or flowmeter in smaller spaces, such as your toolbox.



Small Probe Adaptor for Restek Electronic Leak Detector

Verify hard-to-reach leaks using the small probe adaptor.





Questions? Contact us or your local Restek representative (www.restek.com/contact-us).

Restek patents and trademarks are the property of Restek Corporation. (See www.restek.com/Patents-Trademarks for full list.) Other trademarks in Restek literature or on its website are the property of their respective owners. Restek registered trademarks are registered in the U.S. and may also be registered in other countries. To unsubscribe from future Restek communications or to update your preferences, visit www.restek.com/subscribe. To update your status with an authorized Restek distributor or instrument channel partner, please contact them directly.

© 2023 Restek Corporation. All rights reserved. Printed in the U.S.A.

www.restek.com



Lit. Cat.# EVSS1013F-UNV