Analyze Seven EPA Methods on One GC Column Pair!

Pesticides, PCBs, Herbicides, and More on Rtx®-CL Pesticides & Rtx®-CL Pesticides2 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.
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).

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

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.

www.restek.com
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.

**Columns:** Rtx®-CLPesticides 30 m, 0.32 mm ID, 0.32 µm (cat.# 11141) and Rtx®-CLPesticides2 30 m, 0.32 mm ID, 0.25 µm (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 µL splitless (hold 0.3 min), Liner: Splitless taper (4 mm) (cat.# 20799), Inj. Temp.: 250 °C, **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:** He, **Detector:** Micro-ECD @ 330 °C;

**Notes:** Instrument was operated in constant flow mode. Linear velocity: 60 cm/sec @ 120 °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.

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** 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
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.

**Peaks**
1. Dalapon methyl ester
2. 3,5-Dichlorobenzoic acid methyl ester (SS)
3. 2-Nitroanisole
4. DCAA methyl ester (SS)
5. Dichlorprop methyl ester
6. MCPP methyl ester
7. 2,4-D methyl ester
8. Bentazon methyl ester
9. 2,4,5-T methyl ester
10. 2,4-D methyl ester
11. Pentachlorophenol
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. Dicamba 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)
- 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′-dibromoocatfluorobiphenyl (cat.# 32053)
- 4,000 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**
- Agilent/HP6890 GC

**Notes**
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 Rtx®CLPesticides column.

Rtx®-CLPesticides
30 m, 0.32 mm ID, 0.32 µm (cat.# 11141)

<table>
<thead>
<tr>
<th>Peaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Decachlorobiphenyl (DCB)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rtx®-CLPesticides</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 m, 0.32 mm ID, 0.32 µm (cat.# 11141)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Column</th>
<th>Rtx®-CLPesticides, 30 m, 0.32 mm ID, 0.32 µm (cat.# 11141)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>PCB kit #1 diluted to 1,000 ppb in hexane (cat.# 32089) Decachlorobiphenyl (BD #209) diluted to 100 ppb in acetone (cat.# 32029)</td>
</tr>
<tr>
<td>Injection</td>
<td>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)</td>
</tr>
<tr>
<td>Oven</td>
<td>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)</td>
</tr>
<tr>
<td>Carrier Gas</td>
<td>He, constant flow</td>
</tr>
<tr>
<td>Linear Velocity</td>
<td>60 cm/sec</td>
</tr>
<tr>
<td>Detector</td>
<td>Micro-ECD @ 330 °C</td>
</tr>
<tr>
<td>Notes</td>
<td>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.</td>
</tr>
</tbody>
</table>
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 Rtx®-CLPesticides2 column.

Rtx®-CLPesticides2

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

---

Peaks
1. Decachlorobiphenyl (DCB)

---

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

### Peaks CLP tr (min) CLP2 tr (min)

1. Bromodichloromethane 2.504 2.866
2. Chlorodibromomethane 3.239 3.740
3. 1,2-Dibromomethane (EDB) 3.311 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

**Columns**: Rtx®-CLPesticides2 30 m, 0.32 mm ID, 0.25 µm (cat.# 11124) and Rtx®-CLPesticides 30 m, 0.32 mm ID, 0.32 µm (cat.# 11141) using Restek® guard column 5 m, 0.32 mm ID (cat.# 10039) with universal "Y" Press-Tight® connector (cat.# 204-05); **Sample**: Dibromochloromethane (chlorodibromochloromethane) (cat.# 30271) Bromodichloromethane (cat.# 30251) 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: 50 °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.
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

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)
Diluent: Methyl tert-butyl ether (MTBE)
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 He, constant flow
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.
Figure 8: Organohalide pesticide analysis (Method 505) on Rtx®-CLPesticides and Rtx®-CLPesticides2 columns.

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

<table>
<thead>
<tr>
<th>Test/Requirement</th>
<th>Analyte Concentration (ppb)</th>
<th>Rtx®-CLPesticides2</th>
<th>Rtx®-CLPesticides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inertness (breakdown &lt;20%)</td>
<td>endrin</td>
<td>50</td>
<td>0.9%</td>
</tr>
<tr>
<td>Inertness (breakdown &lt;20%)</td>
<td>4,4’-DDT</td>
<td>100</td>
<td>1.0%</td>
</tr>
<tr>
<td>Sensitivity (S/N&gt;3)</td>
<td>chlorpyrifos</td>
<td>2</td>
<td>12.0</td>
</tr>
<tr>
<td>Chromatographic performance (0.8&lt;PGF&lt;1.15)</td>
<td>DCPA</td>
<td>50</td>
<td>1.03</td>
</tr>
<tr>
<td>Column performance (resolution&gt;0.50)</td>
<td>delta-BHC/ chlorothalonil</td>
<td>40/50</td>
<td>9.9</td>
</tr>
</tbody>
</table>

*For information regarding the nomenclature used for cis-chlordane and trans-chlordane, visit www.restek.com/chlordane-notice*
**Figure 9:** 24-minute analysis of Method 508.1 chlorinated pesticides, herbicides, and organohalides using Rtx®-CLPesticides columns and a micro-ECD.

**Rtx®-CLPesticides**

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

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

**Rtx®-CLPesticides2**

**Columns**

| 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 Rtx® 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) |

**Diluent:** Ethyl acetate

**Injection**

| Inj. Vol.: 2 µL splitless (hold 0.75 min) |

**Liner:** Cyclo double taper (4 mm) (cat.# 20896)

**Inj. Temp.: 250 °C**

**Carrier Gas:** He, constant flow

**Linear Velocity:** 26 cm/sec

**Detector:** Micro-ECD @ 325 °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® phases)

<table>
<thead>
<tr>
<th>ID</th>
<th>df</th>
<th>temp. limits</th>
<th>15-Meter</th>
<th>20-Meter</th>
<th>30-Meter</th>
<th>60-Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.18 mm</td>
<td>0.18 µm</td>
<td>-60 to 320/340 °C</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>0.25 mm</td>
<td>0.25 µm</td>
<td>-60 to 320/340 °C</td>
<td>11120</td>
<td>—</td>
<td>11123</td>
<td>11126</td>
</tr>
<tr>
<td>0.32 mm</td>
<td>0.32 µm</td>
<td>-60 to 320/340 °C</td>
<td>—</td>
<td>—</td>
<td>11141</td>
<td>—</td>
</tr>
<tr>
<td>0.50 µm</td>
<td>-60 to 320/340 °C</td>
<td>11139</td>
<td>11139</td>
<td>11140</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

#### Rtx®-CLPesticides2 Columns (fused silica) (proprietary Crossbond® phases)

<table>
<thead>
<tr>
<th>ID</th>
<th>df</th>
<th>temp. limits</th>
<th>10-Meter</th>
<th>15-Meter</th>
<th>20-Meter</th>
<th>30-Meter</th>
<th>60-Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.18 mm</td>
<td>0.14 µm</td>
<td>-60 to 320/330 °C</td>
<td>42301</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>0.25 mm</td>
<td>0.20 µm</td>
<td>-60 to 320/340 °C</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>11323</td>
<td></td>
</tr>
<tr>
<td>0.32 mm</td>
<td>0.25 µm</td>
<td>-60 to 320/340 °C</td>
<td>—</td>
<td>11321</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>0.50 µm</td>
<td>-60 to 320/340 °C</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>11325</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>0.53 mm</td>
<td>0.42 µm</td>
<td>-60 to 300/320 °C</td>
<td>—</td>
<td>11337</td>
<td>—</td>
<td>11340</td>
<td>—</td>
</tr>
</tbody>
</table>

### Rtx®-CLPesticides Column Kit (0.32 mm ID)
(Note: Columns are not preconnected in this kit.)

<table>
<thead>
<tr>
<th>Rtx-CLPesticides Kit (0.32 mm ID)</th>
<th>cat. # 11196 (kit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes (each product also available separately)</td>
<td>cat. #</td>
</tr>
<tr>
<td>30m, 0.32mm ID, 0.32µm Rtx-CLPesticides Column Column</td>
<td>11141</td>
</tr>
<tr>
<td>30m, 0.32mm ID, 0.25µm Rtx-CLPesticides2 Column Column</td>
<td>11324</td>
</tr>
<tr>
<td>Universal Angled &quot;Y&quot; Press-Tight Connector, Deactivated</td>
<td>20403-261</td>
</tr>
<tr>
<td>5m, 0.32 mm ID Siltek Guard Column</td>
<td>10027</td>
</tr>
</tbody>
</table>

### Rtx®-CLPesticides Column Kit (0.53 mm ID)
(Note: Columns are not preconnected in this kit.)

<table>
<thead>
<tr>
<th>Rtx-CLPesticides Kit (0.53 mm ID)</th>
<th>cat. # 11197 (kit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes (each product also available separately)</td>
<td>cat. #</td>
</tr>
<tr>
<td>30m, 0.53mm ID, 0.50µm Rtx-CLPesticides Column Column</td>
<td>11140</td>
</tr>
<tr>
<td>30m, 0.53mm ID, 0.42µm Rtx-CLPesticides2 Column Column</td>
<td>11340</td>
</tr>
<tr>
<td>Universal Angled &quot;Y&quot; Press-Tight Connector, Deactivated</td>
<td>20403-261</td>
</tr>
<tr>
<td>5m, 0.53mm ID IP Deactivated Guard Column</td>
<td>10045</td>
</tr>
</tbody>
</table>

0.25 mm ID columns are also available at [www.restek.com](http://www.restek.com)
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!

<table>
<thead>
<tr>
<th>Description</th>
<th>ea.</th>
<th>3-pk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal “Y” Press-Tight, Deactivated</td>
<td>20405-261</td>
<td>20406-261</td>
</tr>
</tbody>
</table>

SeCure® “Y” Connector Kits
Kits include: SeCure® “Y” connector body, three knurled nuts, universal “Y” Press-Tight® union, and three ferrules.

<table>
<thead>
<tr>
<th>Description</th>
<th>Ferrules Fit Column ID</th>
<th>qty.</th>
<th>cat.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>SeCure “Y” Connector Kit</td>
<td>0.18/0.25/0.28 mm</td>
<td>kit</td>
<td>20276</td>
</tr>
<tr>
<td>SeCure “Y” Connector Kit</td>
<td>0.32 mm</td>
<td>kit</td>
<td>20277</td>
</tr>
<tr>
<td>SeCure “Y” Connector Kit</td>
<td>0.45/0.53 mm</td>
<td>kit</td>
<td>20278</td>
</tr>
<tr>
<td>Knurled Nut</td>
<td>3-pk.</td>
<td></td>
<td>20279</td>
</tr>
</tbody>
</table>

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

Graphite Ferrules for SeCure® “Y” Connectors
Buy extra to keep spares on hand.

<table>
<thead>
<tr>
<th>Ferrule ID</th>
<th>Fits Column ID</th>
<th>Graphite 10-pk.</th>
<th>Graphite 50-pk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4 mm</td>
<td>0.10/0.15/0.18/0.25/0.28 mm</td>
<td>20200</td>
<td>20227</td>
</tr>
<tr>
<td>0.5 mm</td>
<td>0.32 mm</td>
<td>20201</td>
<td>20228</td>
</tr>
<tr>
<td>0.8 mm</td>
<td>0.45/0.53 mm</td>
<td>20202</td>
<td>20224</td>
</tr>
</tbody>
</table>

MXT® “Y”-Union Connector Kits for Connecting Metal and/or Fused Silica GC Columns
Each kit contains the MXT* union; three ⅛-inch nuts; and three, one-piece, fused silica adaptors.

<table>
<thead>
<tr>
<th>Description</th>
<th>qty.</th>
<th>cat.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>For 0.25 mm ID Columns</td>
<td>kit</td>
<td>21389</td>
</tr>
<tr>
<td>For 0.32 mm ID Columns</td>
<td>kit</td>
<td>21388</td>
</tr>
<tr>
<td>For 0.53 mm ID Columns</td>
<td>kit</td>
<td>21387</td>
</tr>
</tbody>
</table>
### 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 Splitless Injection with Agilent GCs:

#### Restek Premium 4.0 mm ID Single Taper Inlet Liner

<table>
<thead>
<tr>
<th>ID x OD x Length</th>
<th>qty.</th>
<th>cat.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Taper, Restek Premium Technology, Borosilicate Glass</td>
<td>ea.</td>
<td>23302.1</td>
</tr>
<tr>
<td>4.0 mm x 6.5 mm x 78.5 mm</td>
<td>5-pk.</td>
<td>23302.5</td>
</tr>
<tr>
<td>4.0 mm x 6.5 mm x 78.5 mm</td>
<td>25-pk.</td>
<td>23302.25</td>
</tr>
</tbody>
</table>

#### Restek Premium 4.0 mm ID Single Taper Inlet Liner w/ Wool

<table>
<thead>
<tr>
<th>ID x OD x Length</th>
<th>qty.</th>
<th>cat.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Taper, Restek Premium Technology, Borosilicate Glass with Quartz Wool</td>
<td>ea.</td>
<td>23303.1</td>
</tr>
<tr>
<td>4.0 mm x 6.5 mm x 78.5 mm</td>
<td>5-pk.</td>
<td>23303.5</td>
</tr>
<tr>
<td>4.0 mm x 6.5 mm x 78.5 mm</td>
<td>25-pk.</td>
<td>23303.25</td>
</tr>
</tbody>
</table>

#### Restek Premium 4.0 mm ID Double Taper Inlet Liner

<table>
<thead>
<tr>
<th>ID x OD x Length</th>
<th>qty.</th>
<th>cat.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Taper, Restek Premium Technology, Borosilicate Glass</td>
<td>ea.</td>
<td>23308.1</td>
</tr>
<tr>
<td>4.0 mm x 6.5 mm x 78.5 mm</td>
<td>5-pk.</td>
<td>23308.5</td>
</tr>
<tr>
<td>4.0 mm x 6.5 mm x 78.5 mm</td>
<td>25-pk.</td>
<td>23308.25</td>
</tr>
</tbody>
</table>

#### Liners for Splitless Injection with Agilent GCs:

#### Restek Premium 4.0 mm ID Drilled Uniliner® Inlet Liner with Hole near Top

<table>
<thead>
<tr>
<th>ID x OD x Length</th>
<th>qty.</th>
<th>cat.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilled Uniliner (hole near top), Restek Premium Technology, Borosilicate Glass</td>
<td>ea.</td>
<td>23310.1</td>
</tr>
<tr>
<td>4.0 mm x 6.3 mm x 78.5 mm</td>
<td>5-pk.</td>
<td>23310.5</td>
</tr>
<tr>
<td>4.0 mm x 6.3 mm x 78.5 mm</td>
<td>25-pk.</td>
<td>23310.25</td>
</tr>
</tbody>
</table>

#### Dual Vespel® Ring Inlet Seals

Washerless, Leak-Tight Seals for Agilent GCs

<table>
<thead>
<tr>
<th>ID x OD x Length</th>
<th>qty.</th>
<th>cat.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8 mm ID Dual Vespel Ring Inlet Seal</td>
<td>2-pk.</td>
<td>21240</td>
</tr>
<tr>
<td>Gold-Plated</td>
<td>21240</td>
<td>21241</td>
</tr>
<tr>
<td>Siltek-Treated</td>
<td>21242</td>
<td>21243</td>
</tr>
<tr>
<td>1.2 mm ID Dual Vespel Ring Inlet Seal</td>
<td>2-pk.</td>
<td>21246</td>
</tr>
<tr>
<td>Gold-Plated</td>
<td>21246</td>
<td>21247</td>
</tr>
<tr>
<td>Siltek-Treated</td>
<td>21248</td>
<td>21249</td>
</tr>
</tbody>
</table>

Patented.
**Sample Preparation**

**Resprep® SPE Cartridges** (Normal Phase)

Hydrophilic (polar) adsorbents used to extract hydrophilic analytes from nonpolar matrices, such as organic solvents (e.g., polar contaminants from sample extracts).

<table>
<thead>
<tr>
<th>Tubing Type</th>
<th>Column Volume</th>
<th>Bed Weight</th>
<th>Qty.</th>
<th>Cat. #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florisil (EPA SW 846 methods and CLP protocols)</td>
<td>3 mL (500 mg)</td>
<td>24031</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>6 mL (500 mg)</td>
<td>24032</td>
<td>26086</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>6 mL (1,000 mg)</td>
<td>24034</td>
<td>26085</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>15 mL (2 g)</td>
<td>24035</td>
<td>26228</td>
<td>—</td>
</tr>
</tbody>
</table>

**Silica (EPA SW 846 methods)**

<table>
<thead>
<tr>
<th>Tubing Type</th>
<th>Column Volume</th>
<th>Bed Weight</th>
<th>Qty.</th>
<th>Cat. #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 mL (500 mg)</td>
<td>24036</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*PTFE frits **Glass tubes with PTFE frits

**Resprep® CarboPrep® SPE Cartridges**

<table>
<thead>
<tr>
<th>SPE Cartridge</th>
<th>Tube Volume, Bed Weight</th>
<th>Qty.</th>
<th>Cat. #</th>
</tr>
</thead>
<tbody>
<tr>
<td>CarboPrep 90</td>
<td>3 mL, 250 mg</td>
<td>50-pk.</td>
<td>26091</td>
</tr>
<tr>
<td>CarboPrep 90</td>
<td>6 mL, 500 mg</td>
<td>30-pk.</td>
<td>26092</td>
</tr>
</tbody>
</table>

**Reference Standards**

**Organochlorine Pesticide Mix AB #1**

(20 components)

- Aldrin
- α-BHC
- β-BHC
- γ-BHC
- ε-BHC
- cis-chlordane
- trans-chlordane
- 4,4' DDD
- 4,4' DDE
- 4,4' DDT

200 µg/mL each in hexane/toluene (1:1), 1 mL/ampul

<table>
<thead>
<tr>
<th>Compound</th>
<th>Conc.</th>
<th>Cat. #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldrin</td>
<td>8 µg/mL</td>
<td>—</td>
</tr>
<tr>
<td>α-BHC</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>β-BHC</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>γ-BHC</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>ε-BHC</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>cis-chlordane</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>trans-chlordane</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>4,4' DDD</td>
<td>16</td>
<td>—</td>
</tr>
<tr>
<td>4,4' DDE</td>
<td>16</td>
<td>—</td>
</tr>
<tr>
<td>4,4' DDT</td>
<td>16</td>
<td>—</td>
</tr>
</tbody>
</table>

In hexane/toluene (1:1), 1 mL/ampul

cat.# 32291 (ea.)

**Organochlorine Pesticide Mix AB #2**

(20 components)

- Aldrin
- α-BHC
- β-BHC
- γ-BHC
- ε-BHC
- Endosulfan I
- Endosulfan II
- Endosulfan sulfate
- Endrin
- Endrin aldehyde
- Endrin ketone
- Heptachlor
- Heptachlor epoxide (isomer B)
- Dieldrin
- Methoxychlor

200 µg/mL each in hexane/toluene (1:1), 1 mL/ampul

<table>
<thead>
<tr>
<th>Compound</th>
<th>Conc.</th>
<th>Cat. #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldrin</td>
<td>8 µg/mL</td>
<td>—</td>
</tr>
<tr>
<td>α-BHC</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>β-BHC</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>γ-BHC</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>ε-BHC</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Endosulfan I</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Endosulfan II</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Endosulfan sulfate</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Endrin</td>
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<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Heptachlor</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Heptachlor epoxide (isomer B)</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Methoxychlor</td>
<td>8</td>
<td>—</td>
</tr>
</tbody>
</table>

In hexane/toluene (1:1), 1 mL/ampul

cat.# 32292 (ea.)

**Organochlorine Pesticide System Evaluation Mix**

(2 components)

4,4' DDT (50-29-3), 200 µg/mL

Endrin (72-20-8), 100 µg/mL

In methyl tert-butyl ether, 1 mL/ampul

cat.# 32427 (ea.)

**Pesticide Surrogate Mix**

(2 components)

Decachlorobiphenyl (2051-24-3)

2,4,5,6-Tetrachloro-m-xylene (877-09-8)

200 µg/mL each in acetone, 1 mL/ampul

cat.# 32000 (ea.)

200 µg/mL each in acetone, 5 mL/ampul

cat.# 32457 (ea.)

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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 helps you avoid costly problems later.

Restek's New 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 lithium ion internal battery pack (12 hours normal operation)
- Operating Temperature Range: 32–120 °F (0–48 °C)
- Humidity Range: –97%
- Warranty: One year
- Certifications: CE, Ex, Japan
- Compliance: WEEE, RoHS

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 x 10^{-5}, red LED
  - Hydrogen*, 1.0 x 10^{-5}, red LED
  - Nitrogen, 1.4 x 10^{-3}, yellow LED
  - Argon, 1.0 x 10^{-4}, yellow LED
  - Carbon dioxide, 1.0 x 10^{-4}, yellow LED

Gas detection limits measured in atm cc/sec.

*Caution: The Restek® electronic leak detector is designed 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
- Certifications: CE, Ex
- Compliance: WEEE, RoHS
- Patented

Optional Accessories

- Soft-Side Carry/Storage Case
- Small Probe Adaptor for Leak Detector

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