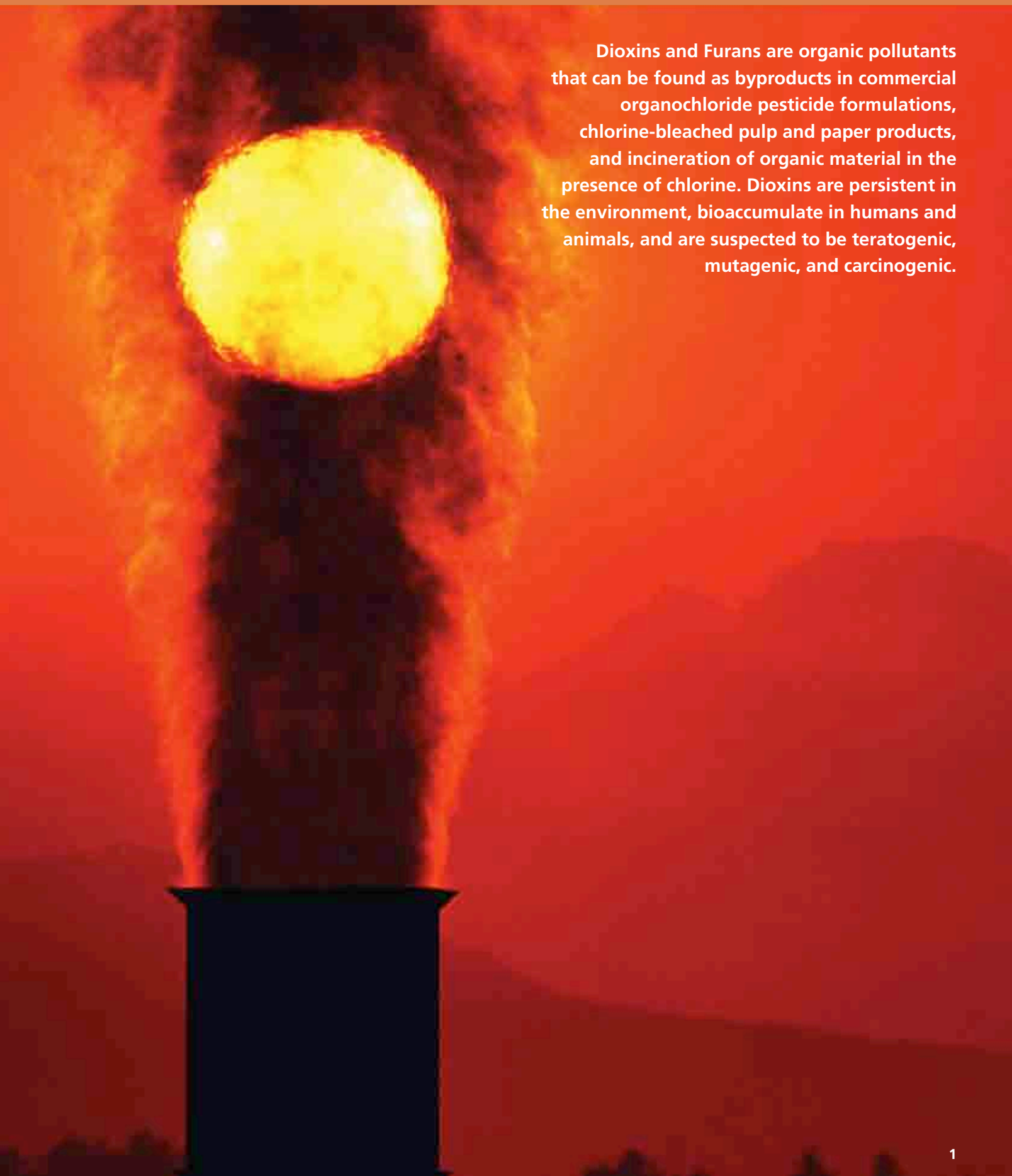


**Dioxins and Furans are organic pollutants that can be found as byproducts in commercial organochloride pesticide formulations, chlorine-bleached pulp and paper products, and incineration of organic material in the presence of chlorine. Dioxins are persistent in the environment, bioaccumulate in humans and animals, and are suspected to be teratogenic, mutagenic, and carcinogenic.**

## Certified Reference Standards

The preparation of polychlorinated dibenzo-*p*-dioxin (PCDD) and dibenzofuran (PCDF) certified solution standards begins with the total synthesis of each isomer from known, well-characterized intermediates. Cerilliant QC protocol specifies that all materials be tested to determine identity (multiple techniques), isomer specificity, and purity (multiple techniques), prior to acceptance as a raw material.
With few exceptions, our specifications require a chemical purity of >98% for native material and chemical purity of >97% for $^{13}C$ material.

Preparation of CIL/Cerilliant certified solution standards is tightly controlled using a validated process to ensure accuracy and consistency. Our gravimetric approach (both analyte and solvent are added by weight) is performed using high precision 5-place, micro and ultra-micro analytical balances and governed by exacting procedures to ensure minimal uncertainty. Balances are fully qualified in their installed state, are calibrated semi-annually with weekly and pre-use verifications performed – all using NIST traceable weights. Various controls are employed during the dispensing process to ensure no evaporation, degradation, or contamination occurs and to ensure homogeneity and consistency of fill volume from ampoule to ampoule.

Fully certified standards are then put through rigorous QC testing to verify concentration accuracy, consistency with previous lots (when available), and comparison to the corresponding native or $^{13}C$ analog. Finally, homogeneity is assured through testing of samples pulled during the dispensing process using a random stratified sampling plan. The analytical results are detailed in a comprehensive Certificate of Analysis (COA) containing complete traceability documentation, which is supplied with each product at no additional charge.

An international round robin study composed of independent government, commercial, and research laboratories analyzed all 17
CIL/Cerilliant 2,3,7,8-containing polychlorinated dibenzo-*p*-dioxin (PCDD) and dibenzofuran (PCDF) individual solution standards in August 1987. The objective of the study was to determine the accuracy of CIL/Cerilliant solution reference standards. The consensus average values for each of these solutions agreed closely with CIL/Cerilliant reported values – in fact, 15 out of the 17 were within 4%.

**Cambridge Isotope Laboratories (CIL) and Cerilliant Corporation would like to thank the following laboratories for their participation in this study:**

Battelle – Columbus Laboratories
Columbus, OH

Centers for Disease Control
Atlanta, GA

Dow Chemical Company
Midland, MI

Ontario Ministry of the Environment
Rexdale, Ontario, Canada

Midwest Research Institute
Kansas City, MO

Monsanto Company
St. Louis, MO

Triangle Labs
Research Triangle Park, NC

Twin City Testing
St. Paul, MN

## Unlabeled Chlorodioxin/Furan Standards for Elution Profiling

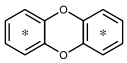
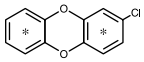
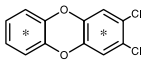
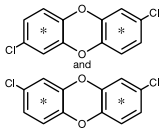
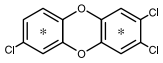
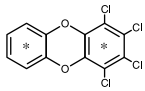
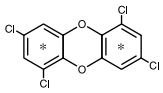
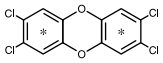
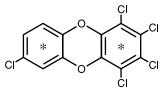
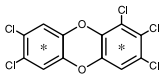
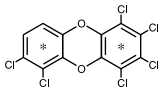
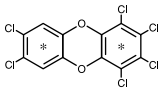
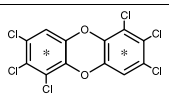
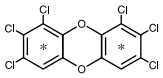
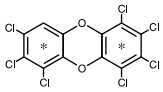
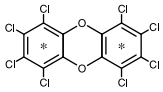
CIL introduces the first commercially available set of all 136 Tetra-Octa chlorinated dioxin and furan congeners. These qualitative standards are available as ~25ng/mL solutions in Nonane and are used primarily for elution profiling and peak identification.
Homolog group kits are available, as is a suite of all 136 congeners. See pages 10-11 for full product listings.

## ISO Accreditation

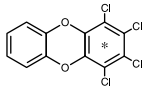
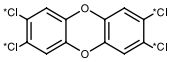
Adding to our list of firsts in the field of dioxin and furan reference standards, CIL is pleased to announce the availability of the first dioxin and furan standards manufactured under **ISO/IEC 17025 and ISO Guide 34 accreditation**.

Cerilliant Corporation, CIL's longtime collaborator for dioxin and furan standards, has received accreditation under ISO Guide 34 for Reference Material Producers, as well as ISO/IEC 17025 for Testing and Calibration Laboratories. These two new accreditations provide
a powerful boost to their already impressive quality credentials, including ISO-9001:2008.

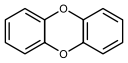
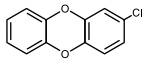
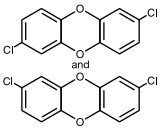
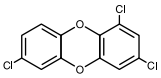
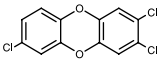
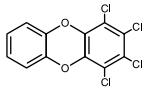
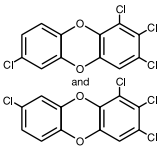
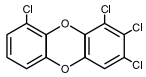
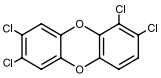
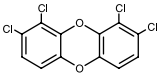
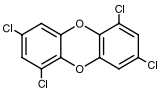
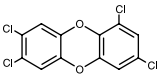
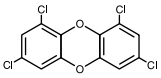
## $^{13}C_{12}$ Labeled Chlorodioxin Standards

| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| CLM-1544-1.2 | **Dibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-4169 | **2-Monochlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-4170 | **2,3-Dichlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-925 | **2,7-Dichlorodibenzo-*p*-dioxin/ 2,8-Dichlorodibenzo-*p*-dioxin isomer pair ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-2531 | **2,3,7-Trichlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-911<br>NEW ED-911-1<br>NEW ED-911-200 | **1,2,3,4-Tetrachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane<br>1 ± 0.05 µg/mL in Nonane<br>200 ± 10 ng/mL in Nonane | 1.2 mL<br>1.2 mL<br>1.2 mL |
| ED-4198 | **1,3,6,8-Tetrachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-900 | **2,3,7,8-Tetrachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-4076 | **1,2,3,4,7-Pentachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 1.2 mL |
| ED-955 | **1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-4077 | **1,2,3,4,6,7-Hexachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 1.2 mL |
| ED-946 | **1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-966 | **1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in 80% Nonane/20% Toluene | 1.2 mL |
| ED-996 | **1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in 80% Nonane/20% Toluene | 1.2 mL |
| ED-972 | **1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-981 | **Octachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 10 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL |

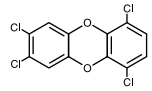
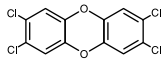
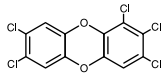
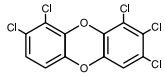
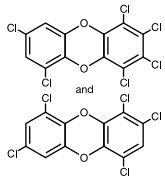
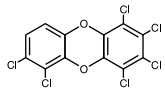
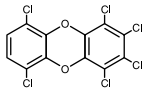
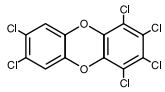
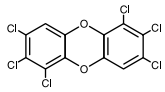
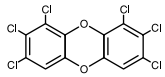
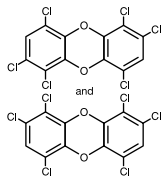
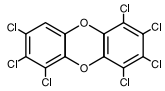
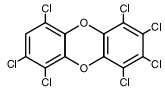
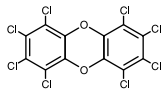
## $^{13}C_6$ and $^{37}Cl_4$ Labeled Chlorodioxin Standards

| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| ED-910 | **1,2,3,4-Tetrachlorodibenzo-*p*-dioxin ($^{13}C_6$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-907 | **2,3,7,8-Tetrachlorodibenzo-*p*-dioxin ($^{37}Cl_4$,96%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |

## Unlabeled Chlorodioxin Standards

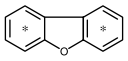
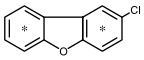
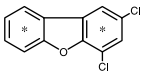
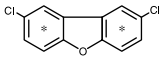
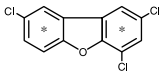
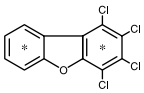
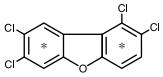
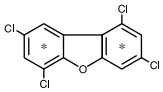
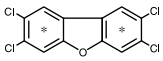
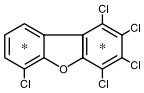
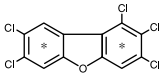
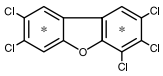
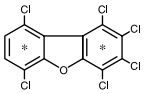
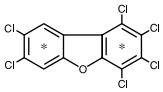
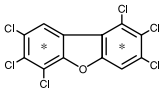
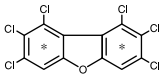
| | | | | |
|---|---|---|---|---|
| ULM-1711-1.2 | **Dibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-1771<br>ED-1771-C | **2-Monochlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane<br>Crystalline solid | 1.2 mL<br>1 mg |
| ED-926 | **2,7-Dichlorodibenzo-*p*-dioxin/ 2,8-Dichlorodibenzo-*p*-dioxin Isomer Pair** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-4090 | **1,3,7-Trichlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-1779<br>ED-1779-C | **2,3,7-Trichlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane<br>Crystalline solid | 1.2 mL<br>1 mg |
| ED-912 | **1,2,3,4-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-905 | **1,2,3,7-Tetrachlorodibenzo-*p*-dioxin/ 1,2,3,8-Tetrachlorodibenzo-*p*-dioxin Isomer Pair** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-948 | **1,2,3,9-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-915 | **1,2,7,8-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-916 | **1,2,8,9-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-2518 | **1,3,6,8-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-917 | **1,3,7,8-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-4061 | **1,3,7,9-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |

## Unlabeled Chlorodioxin Standards

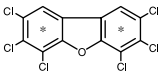
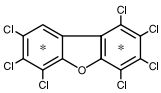
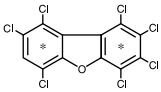
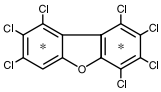
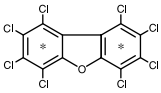
| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| ED-922 | **1,4,7,8-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-901 | **2,3,7,8-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 2.5 µg/mL in Nonane | 4 x 1.2 mL |
| ED-901-A | | | 10 ± 1 µg/mL in Methanol | 1.2 mL |
| ED-901-B | | | 50 ± 5 µg/mL in DMSO | 1.2 mL |
| ED-901-C | | | Crystalline solid | 1 mg |
| ED-901-D | | | 32 ± 4 pg/µL in DMSO (100 nM) | 0.2 mL |
| ED-950 | **1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-950-C | | | Crystalline solid | 1 mg |
| ED-924 | **1,2,3,8,9-Pentachlorodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in Nonane | 1.2 mL |
| ED-927 | **1,2,4,6,8-Pentachlorodibenzo-*p*-dioxin/ 1,2,4,7,9-Pentachlorodibenzo-*p*-dioxin Isomer Pair** |  | 5 ± 0.5 µg/mL in Nonane | 1.2 mL |
| ED-932 | **1,2,3,4,6,7-Hexachlorodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in Nonane | 1.2 mL |
| ED-933 | **1,2,3,4,6,9-Hexachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-933-C | | | Crystalline solid | 1 mg |
| ED-961 | **1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-960 | **1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-960-C | | | Crystalline solid | 1 mg |
| ED-969 | **1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-969-C | | | Crystalline solid | 1 mg |
| ED-929 | **1,2,4,6,7,9-Hexachlorodibenzo-*p*-dioxin/ 1,2,4,6,8,9-Hexachlorodibenzo-*p*-dioxin Isomer Pair** |  | 5 ± 0.5 µg/mL in Nonane | 1.2 mL |
| ED-971 | **1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| ED-971-C | | | Crystalline solid | 1 mg |
| ED-976 | **1,2,3,4,6,7,9-Heptachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-980 | **Octachlorodibenzo-*p*-dioxin** |  | 10 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL |
| ED-980-C | | | Crystalline solid | 10 mg |

Other isomers may be available on a special request basis. Please inquire.

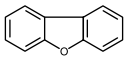
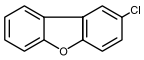
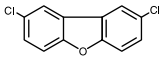
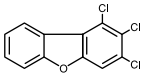
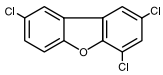
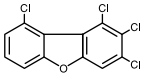
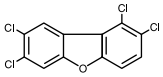
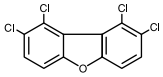
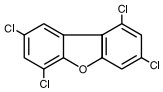
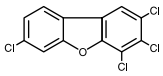
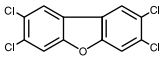
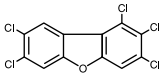
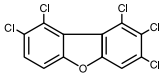
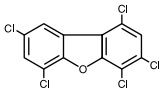
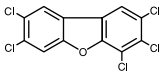
## $^{13}C_{12}$ Labeled Chlorofuran Standards

| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| CLM-1561-1.2 | **Dibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-4168 | **2-Monochlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-4171 | **2,4-Dichlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-4016 | **2,8-Dichlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-4172 | **2,4,8-Trichlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-920 | **1,2,3,4-Tetrachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-1438 | **1,2,7,8-Tetrachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-5009 | **1,3,6,8-Tetrachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-904 | **2,3,7,8-Tetrachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-5050 | **1,2,3,4,6-Pentachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-952 | **1,2,3,7,8-Pentachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-958 | **2,3,4,7,8-Pentachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-5052 | **1,2,3,4,6,9-Hexachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-963 | **1,2,3,4,7,8-Hexachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-985 | **1,2,3,6,7,8-Hexachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-986 | **1,2,3,7,8,9-Hexachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |

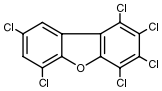
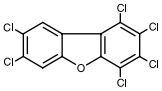
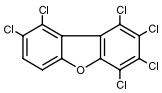
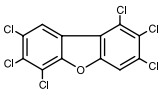
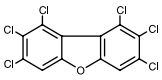
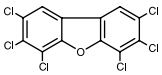
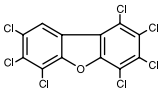
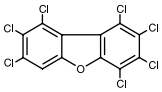
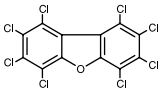
## $^{13}C_{12}$ Labeled Chlorofuran Standards

| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| EF-987 | **2,3,4,6,7,8-Hexachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-974 | **1,2,3,4,6,7,8-Heptachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-5054 | **1,2,3,4,6,8,9-Heptachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-988 | **1,2,3,4,7,8,9-Heptachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-983 | **Octachlorodibenzofuran ($^{13}C_{12}$,99%)** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |

## Unlabeled Chlorofuran Standards

| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| ULM-1712-1.2 | **Dibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-1785 | **2-Monochlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-1789 | **2,8-Dichlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-1790 | **1,2,3-Trichlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-1793<br>EF-1793-C | **2,4,8-Trichlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane<br>Crystalline solid | 1.2 mL<br>1 mg |
| EF-4030 | **1,2,3,9-Tetrachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-918 | **1,2,7,8-Tetrachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-939 | **1,2,8,9-Tetrachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-944 | **1,3,6,8-Tetrachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-4031 | **2,3,4,7-Tetrachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-903<br>EF-903-C | **2,3,7,8-Tetrachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane<br>Crystalline solid | 1.2 mL<br>1 mg |
| EF-953<br>EF-953-M<br>EF-953-C | **1,2,3,7,8-Pentachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane<br>50 ± 2.5 µg/mL in Methanol | 1.2 mL<br>1.2 mL<br>1 mg |
| EF-954 | **1,2,3,8,9-Pentachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-942-50 | **1,3,4,6,8-Pentachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-956<br>EF-956-C | **2,3,4,7,8-Pentachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane<br>Crystalline solid | 1.2 mL<br>1 mg |

## Unlabeled Chlorofuran Standards

| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| EF-943-50 | **1,2,3,4,6,8-Hexachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-964<br>EF-964-C | **1,2,3,4,7,8-Hexachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane<br>Crystalline solid | 1.2 mL<br>1 mg |
| EF-965 | **1,2,3,4,8,9-Hexachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EF-962 | **1,2,3,6,7,8-Hexachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-967<br>EF-967-C | **1,2,3,7,8,9-Hexachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane<br>Crystalline solid | 1.2 mL<br>1 mg |
| EF-968 | **2,3,4,6,7,8-Hexachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-973 | **1,2,3,4,6,7,8-Heptachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-975 | **1,2,3,4,7,8,9-Heptachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane | 1.2 mL |
| EF-982<br>EF-982-C | **Octachlorodibenzofuran** |  | 50 ± 2.5 µg/mL in Nonane<br>Crystalline solid | 1.2 mL<br>10 mg |

Other isomers may be available on a special request basis. Please inquire.

## Unlabeled Chlorofuran Standards for Elution Profiling

*All concentrations are ~25 ng/mL in Nonane*

| Catalog # | Compound | Amount |
|---|---|---|
| JR-F01-25 | **1,2,3,4-TetraCDF** | 0.2 mL |
| JR-F02-25 | **1,2,3,6-TetraCDF** | 0.2 mL |
| JR-F03-25 | **1,2,3,7-TetraCDF** | 0.2 mL |
| JR-F04-25 | **1,2,3,8-TetraCDF** | 0.2 mL |
| JR-F05-25 | **1,2,3,9-TetraCDF** | 0.2 mL |
| JR-F06-25 | **1,2,4,6-TetraCDF** | 0.2 mL |
| JR-F07-25 | **1,2,4,7-TetraCDF** | 0.2 mL |
| JR-F08-25 | **1,2,4,8-TetraCDF** | 0.2 mL |
| JR-F09-25 | **1,2,4,9-TetraCDF** | 0.2 mL |
| JR-F10-25 | **1,2,6,7-TetraCDF** | 0.2 mL |
| JR-F11-25 | **1,2,6,8-TetraCDF** | 0.2 mL |
| JR-F12-25 | **1,2,6,9-TetraCDF** | 0.2 mL |
| JR-F13-25 | **1,2,7,8-TetraCDF** | 0.2 mL |
| JR-F14-25 | **1,2,7,9-TetraCDF** | 0.2 mL |
| JR-F15-25 | **1,2,8,9-TetraCDF** | 0.2 mL |
| JR-F16-25 | **1,3,4,6-TetraCDF** | 0.2 mL |
| JR-F17-25 | **1,3,4,7-TetraCDF** | 0.2 mL |
| JR-F18-25 | **1,3,4,8-TetraCDF** | 0.2 mL |
| JR-F19-25 | **1,3,4,9-TetraCDF** | 0.2 mL |
| JR-F20-25 | **1,3,6,7-TetraCDF** | 0.2 mL |
| JR-F21-25 | **1,3,6,8-TetraCDF** | 0.2 mL |
| JR-F22-25 | **1,3,6,9-TetraCDF** | 0.2 mL |
| JR-F23-25 | **1,3,7,8-TetraCDF** | 0.2 mL |
| JR-F24-25 | **1,3,7,9-TetraCDF** | 0.2 mL |
| JR-F25-25 | **1,4,6,7-TetraCDF** | 0.2 mL |
| JR-F26-25 | **1,4,6,8-TetraCDF** | 0.2 mL |
| JR-F27-25 | **1,4,6,9-TetraCDF** | 0.2 mL |
| JR-F28-25 | **1,4,7,8-TetraCDF** | 0.2 mL |
| JR-F29-25 | **1,6,7,8-TetraCDF** | 0.2 mL |
| JR-F30-25 | **2,3,4,6-TetraCDF** | 0.2 mL |
| JR-F31-25 | **2,3,4,7-TetraCDF** | 0.2 mL |
| JR-F32-25 | **2,3,4,8-TetraCDF** | 0.2 mL |
| JR-F33-25 | **2,3,6,7-TetraCDF** | 0.2 mL |
| JR-F34-25 | **2,3,6,8-TetraCDF** | 0.2 mL |
| JR-F35-25 | **2,3,7,8-TetraCDF** | 0.2 mL |
| JR-F36-25 | **2,4,6,7-TetraCDF** | 0.2 mL |
| JR-F37-25 | **2,4,6,8-TetraCDF** | 0.2 mL |
| JR-F38-25 | **3,4,6,7-TetraCDF** | 0.2 mL |
| JR-F39-25 | **1,2,3,4,6-PentaCDF** | 0.2 mL |
| JR-F40-25 | **1,2,3,4,7-PentaCDF** | 0.2 mL |
| JR-F41-25 | **1,2,3,4,8-PentaCDF** | 0.2 mL |
| JR-F42-25 | **1,2,3,4,9-PentaCDF** | 0.2 mL |
| JR-F43-25 | **1,2,3,6,7-PentaCDF** | 0.2 mL |
| JR-F44-25 | **1,2,3,6,8-PentaCDF** | 0.2 mL |

| Catalog # | Compound | Amount |
|---|---|---|
| JR-F45-25 | **1,2,3,6,9-PentaCDF** | 0.2 mL |
| JR-F46-25 | **1,2,3,7,8-PentaCDF** | 0.2 mL |
| JR-F47-25 | **1,2,3,7,9-PentaCDF** | 0.2 mL |
| JR-F48-25 | **1,2,3,8,9-PentaCDF** | 0.2 mL |
| JR-F49-25 | **1,2,4,6,7-PentaCDF** | 0.2 mL |
| JR-F50-25 | **1,2,4,6,8-PentaCDF** | 0.2 mL |
| JR-F51-25 | **1,2,4,6,9-PentaCDF** | 0.2 mL |
| JR-F52-25 | **1,2,4,7,8-PentaCDF** | 0.2 mL |
| JR-F53-25 | **1,2,4,7,9-PentaCDF** | 0.2 mL |
| JR-F54-25 | **1,2,4,8,9-PentaCDF** | 0.2 mL |
| JR-F55-25 | **1,2,6,7,8-PentaCDF** | 0.2 mL |
| JR-F56-25 | **1,2,6,7,9-PentaCDF** | 0.2 mL |
| JR-F57-25 | **1,3,4,6,7-PentaCDF** | 0.2 mL |
| JR-F58-25 | **1,3,4,6,8-PentaCDF** | 0.2 mL |
| JR-F59-25 | **1,3,4,6,9-PentaCDF** | 0.2 mL |
| JR-F60-25 | **1,3,4,7,8-PentaCDF** | 0.2 mL |
| JR-F61-25 | **1,3,4,7,9-PentaCDF** | 0.2 mL |
| JR-F62-25 | **1,3,6,7,8-PentaCDF** | 0.2 mL |
| JR-F63-25 | **1,4,6,7,8-PentaCDF** | 0.2 mL |
| JR-F64-25 | **2,3,4,6,7-PentaCDF** | 0.2 mL |
| JR-F65-25 | **2,3,4,6,8-PentaCDF** | 0.2 mL |
| JR-F66-25 | **2,3,4,7,8-PentaCDF** | 0.2 mL |
| JR-F67-25 | **1,2,3,4,6,7-HexaCDF** | 0.2 mL |
| JR-F68-25 | **1,2,3,4,6,8-HexaCDF** | 0.2 mL |
| JR-F69-25 | **1,2,3,4,6,9-HexaCDF** | 0.2 mL |
| JR-F70-25 | **1,2,3,4,7,8-HexaCDF** | 0.2 mL |
| JR-F71-25 | **1,2,3,4,7,9-HexaCDF** | 0.2 mL |
| JR-F72-25 | **1,2,3,4,8,9-HexaCDF** | 0.2 mL |
| JR-F73-25 | **1,2,3,6,7,8-HexaCDF** | 0.2 mL |
| JR-F74-25 | **1,2,3,6,7,9-HexaCDF** | 0.2 mL |
| JR-F75-25 | **1,2,3,6,8,9-HexaCDF** | 0.2 mL |
| JR-F76-25 | **1,2,3,7,8,9-HexaCDF** | 0.2 mL |
| JR-F77-25 | **1,2,4,6,7,8-HexaCDF** | 0.2 mL |
| JR-F78-25 | **1,2,4,6,7,9-HexaCDF** | 0.2 mL |
| JR-F79-25 | **1,2,4,6,8,9-HexaCDF** | 0.2 mL |
| JR-F80-25 | **1,3,4,6,7,8-HexaCDF** | 0.2 mL |
| JR-F81-25 | **1,3,4,6,7,9-HexaCDF** | 0.2 mL |
| JR-F82-25 | **2,3,4,6,7,8-HexaCDF** | 0.2 mL |
| JR-F83-25 | **1,2,3,4,6,7,8-HeptaCDF** | 0.2 mL |
| JR-F84-25 | **1,2,3,4,6,7,9-HeptaCDF** | 0.2 mL |
| JR-F85-25 | **1,2,3,4,6,8,9-HeptaCDF** | 0.2 mL |
| JR-F86-25 | **1,2,3,4,7,8,9-HeptaCDF** | 0.2 mL |
| JR-F87-25 | **1,2,3,4,6,7,8,9-OctaCDF** | 0.2 mL |

## Unlabeled Chlorodioxin Standards for Elution Profiling

*All concentrations are ~25 ng/mL in Nonane*

| Catalog # | Compound | Amount |
|---|---|---|
| JR-D01-25 | **1,2,3,4-TetraCDD** | 0.2 mL |
| JR-D02-25 | **1,2,3,6-TetraCDD** | 0.2 mL |
| JR-D03-25 | **1,2,3,7-TetraCDD** | 0.2 mL |
| JR-D04-25 | **1,2,3,8-TetraCDD** | 0.2 mL |
| JR-D05-25 | **1,2,3,9-TetraCDD** | 0.2 mL |
| JR-D06-25 | **1,2,4,6-TetraCDD** | 0.2 mL |
| JR-D07-25 | **1,2,4,7-TetraCDD** | 0.2 mL |
| JR-D08-25 | **1,2,4,8-TetraCDD** | 0.2 mL |
| JR-D09-25 | **1,2,4,9-TetraCDD** | 0.2 mL |
| JR-D10-25 | **1,2,6,7-TetraCDD** | 0.2 mL |
| JR-D11-25 | **1,2,6,8-TetraCDD** | 0.2 mL |
| JR-D12-25 | **1,2,6,9-TetraCDD** | 0.2 mL |
| JR-D13-25 | **1,2,7,8-TetraCDD** | 0.2 mL |
| JR-D14-25 | **1,2,7,9-TetraCDD** | 0.2 mL |
| JR-D15-25 | **1,2,8,9-TetraCDD** | 0.2 mL |
| JR-D16-25 | **1,3,6,8-TetraCDD** | 0.2 mL |
| JR-D17-25 | **1,3,6,9-TetraCDD** | 0.2 mL |
| JR-D18-25 | **1,3,7,8-TetraCDD** | 0.2 mL |
| JR-D19-25 | **1,3,7,9-TetraCDD** | 0.2 mL |
| JR-D20-25 | **1,4,6,9-TetraCDD** | 0.2 mL |
| JR-D21-25 | **1,4,7,8-TetraCDD** | 0.2 mL |
| JR-D22-25 | **2,3,7,8-TetraCDD** | 0.2 mL |
| JR-D23-25 | **1,2,3,4,6-PentaCDD** | 0.2 mL |
| JR-D24-25 | **1,2,3,4,7-PentaCDD** | 0.2 mL |
| JR-D25-25 | **1,2,3,6,7-PentaCDD** | 0.2 mL |

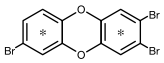
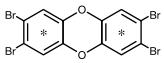
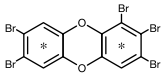
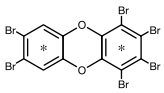
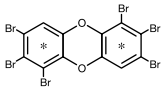
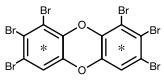
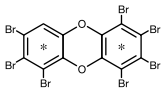
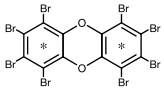
| Catalog # | Compound | Amount |
|---|---|---|
| JR-D26-25 | **1,2,3,6,8-PentaCDD** | 0.2 mL |
| JR-D27-25 | **1,2,3,6,9-PentaCDD** | 0.2 mL |
| JR-D28-25 | **1,2,3,7,8-PentaCDD** | 0.2 mL |
| JR-D29-25 | **1,2,3,7,9-PentaCDD** | 0.2 mL |
| JR-D30-25 | **1,2,3,8,9-PentaCDD** | 0.2 mL |
| JR-D31-25 | **1,2,4,6,7-PentaCDD** | 0.2 mL |
| JR-D32-25 | **1,2,4,6,8-PentaCDD** | 0.2 mL |
| JR-D33-25 | **1,2,4,6,9-PentaCDD** | 0.2 mL |
| JR-D34-25 | **1,2,4,7,8-PentaCDD** | 0.2 mL |
| JR-D35-25 | **1,2,4,7,9-PentaCDD** | 0.2 mL |
| JR-D36-25 | **1,2,4,8,9-PentaCDD** | 0.2 mL |
| JR-D37-25 | **1,2,3,4,6,7-HexaCDD** | 0.2 mL |
| JR-D38-25 | **1,2,3,4,6,8-HexaCDD** | 0.2 mL |
| JR-D39-25 | **1,2,3,4,6,9-HexaCDD** | 0.2 mL |
| JR-D40-25 | **1,2,3,4,7,8-HexaCDD** | 0.2 mL |
| JR-D41-25 | **1,2,3,6,7,8-HexaCDD** | 0.2 mL |
| JR-D42-25 | **1,2,3,6,7,9-HexaCDD** | 0.2 mL |
| JR-D43-25 | **1,2,3,6,8,9-HexaCDD** | 0.2 mL |
| JR-D44-25 | **1,2,3,7,8,9-HexaCDD** | 0.2 mL |
| JR-D45-25 | **1,2,4,6,7,9-HexaCDD** | 0.2 mL |
| JR-D46-25 | **1,2,4,6,8,9-HexaCDD** | 0.2 mL |
| JR-D47-25 | **1,2,3,4,6,7,8-HeptaCDD** | 0.2 mL |
| JR-D48-25 | **1,2,3,4,6,7,9-HeptaCDD** | 0.2 mL |
| JR-D49-25 | **1,2,3,4,6,7,8,9-OctaCDD** | 0.2 mL |

**For convenience, CIL has bundled these standards by level of chlorination. Kits are available for tetra through hexa dioxins and tetra through hepta furans. A comprehensive kit containing all available standards is also available.**

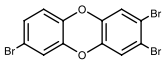
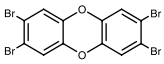
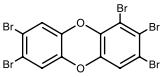
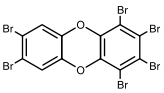
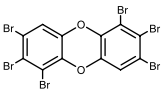
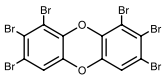
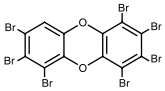
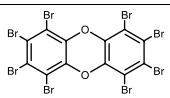
| | | |
|---|---|---|
| JR-TCDD-KIT | **Comprehensive Tetrachlorodibenzo-*p*-dioxin Column Defining Kit** | 1 kit |
| JR-TCDF-KIT | **Comprehensive Tetrachlorodibenzofuran Column Defining Kit** | 1 kit |
| JR-PECDD-KIT | **Comprehensive Pentachlorodibenzo-*p*-dioxin Column Defining Kit** | 1 kit |
| JR-PECDF-KIT | **Comprehensive Pentachlorodibenzofuran Column Defining Kit** | 1 kit |
| JR-HXCDD-KIT | **Comprehensive Hexachlorodibenzo-*p*-dioxin Column Defining Kit** | 1 kit |
| JR-HXCDF-KIT | **Comprehensive Hexachlorodibenzofuran Column Defining Kit** | 1 kit |
| JR-HPCDF-KIT | **Comprehensive Heptachlorodibenzofuran Column Defining Kit** | 1 kit |

| | | |
|---|---|---|
| JR-PCDD/F-KIT | **Comprehensive Polychlorinated Dioxin and Furan Column Defining Kit**<br>**Includes all 136 "JR" dioxin and furan congeners** | 1 kit |

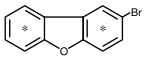
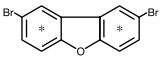
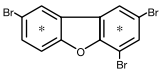
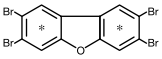
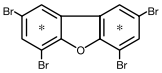
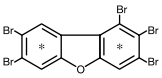
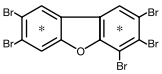
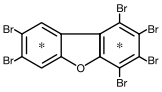
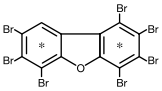
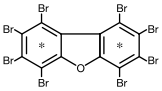
## $^{13}C_{12}$ Labeled Bromodioxin Standards

| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| ED-2532 | **2,3,7-Tribromodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-1440<br>NEW ED-1440-1.2 | **2,3,7,8-Tetrabromodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| ED-1450<br>NEW ED-1450-1.2 | **1,2,3,7,8-Pentabromodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| ED-2534<br>NEW ED-2534-1.2 | **1,2,3,4,7,8-Hexabromodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| ED-5237<br>NEW ED-5237-1.2 | **1,2,3,6,7,8-Hexabromodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| ED-5238<br>NEW ED-5238-1.2 | **1,2,3,7,8,9-Hexabromodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| NEW ED-5357<br>NEW ED-5357-1.2 | **1,2,3,4,6,7,8-Heptabromodibenzo-*p*-dioxin ($^{13}C_{12}$, 99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| ED-5089-1.2 | **Octabromodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in 70% Nonane/30% Toluene | 1.2 mL |

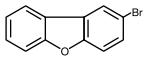
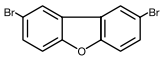
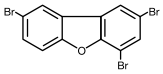
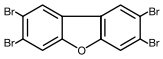
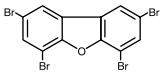
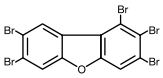
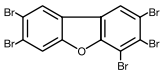
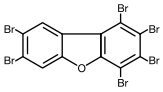
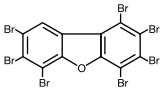
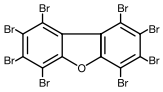
## Unlabeled Bromodioxin Standards

| | | | | |
|---|---|---|---|---|
| ED-1763 | **2,3,7-Tribromodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| ED-1441<br>NEW ED-1441-1.2 | **2,3,7,8-Tetrabromodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL<br>1.2 mL |
| ED-1451<br>NEW ED-1451-1.2 | **1,2,3,7,8-Pentabromodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL<br>1.2 mL |
| ED-1462<br>NEW ED-1462-1.2 | **1,2,3,4,7,8-Hexabromodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL<br>1.2 mL |
| ED-1465<br>NEW ED-1465-1.2 | **1,2,3,6,7,8-Hexabromodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL<br>1.2 mL |
| ED-1466<br>NEW ED-1466-1.2 | **1,2,3,7,8,9-Hexabromodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL<br>1.2 mL |
| NEW ED-5356<br>NEW ED-5356-1.2 | **1,2,3,4,6,7,8-Heptabromodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in 70% *n*-Nonane/30% Toluene | 8 x 1.2 mL<br>1.2 mL |
| ED-1481<br>ED-1481-1.2 | **Octabromodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in 70% *n*-Nonane/30% Toluene | 8 x 1.2 mL<br>1.2 mL |

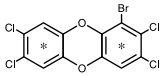
## $^{13}C_{12}$ Labeled Bromofuran Standards

| | Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|---|
| NEW | EF-5076 | **2-Monobromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL |
| | EF-5078 | **2,8-Dibromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL |
| NEW | EF-5080 | **2,4,8-Tribromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL |
| | EF-1442<br>NEW EF-1442-1.2 | **2,3,7,8-Tetrabromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| | EF-5082<br>NEW EF-5082-1.2 | **2,4,6,8-Tetrabromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| | EF-1452<br>EF-1452-1.2 | **1,2,3,7,8-Pentabromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| | EF-1454<br>NEW EF-1454-1.2 | **2,3,4,7,8-Pentabromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| | EF-1463<br>EF-1463-1.2 | **1,2,3,4,7,8-Hexabromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in Nonane | 4 x 1.2 mL<br>1.2 mL |
| | EF-5259<br>NEW EF-5259-1.2 | **1,2,3,4,6,7,8-Heptabromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in 70% Nonane/30% Toluene | 4 x 1.2 mL<br>1.2 mL |
| NEW<br>NEW | EF-5266<br>EF-5266-1.2 | **Octabromodibenzofuran ($^{13}C_{12}$,99%)** |  | 5 ± 0.5 µg/mL in 70% Nonane/30% Toluene | 4 x 1.2 mL<br>1.2 mL |

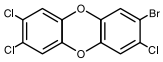
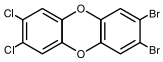
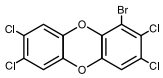
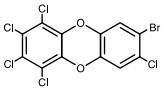
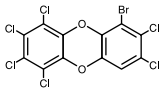
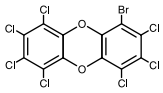
## Unlabeled Bromofuran Standards

| | Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|---|
| NEW | EF-5075 | **2-Monobromodibenzofuran** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL |
| | EF-5077 | **2,8-Dibromodibenzofuran** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL |
| NEW | EF-5079 | **2,4,8-Tribromodibenzofuran** |  | 5 ± 0.5 µg/mL in Nonane | 8 X 1.2 mL |
| | EF-1443 | **2,3,7,8-Tetrabromodibenzofuran** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL |
| NEW | EF-1443-1.2 | | | | 1.2 mL |
| | EF-5081 | **2,4,6,8-Tetrabromodibenzofuran** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL |
| | EF-1453 | **1,2,3,7,8-Pentabromodibenzofuran** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL |
| NEW | EF-1453-1.2 | | | | 1.2 mL |
| | EF-1455 | **2,3,4,7,8-Pentabromodibenzofuran** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL |
| NEW | EF-1455-1.2 | | | | 1.2 mL |
| | EF-1464 | **1,2,3,4,7,8-Hexabromodibenzofuran** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL |
| NEW | EF-1464-1.2 | | | | 1.2 mL |
| | EF-1486 | **1,2,3,4,6,7,8-Heptabromodibenzofuran** |  | 5 ± 0.5 µg/mL in 70% Nonane/30% Toluene | 8 x 1.2 mL |
| | EF-1486-1.2 | (CP: 96%) | | | 1.2 mL |
| | EF-5263 | **Octabromodibenzofuran** |  | 5 ± 0.5 µg/mL in 70% Nonane/30% Toluene | 8 x 1.2 mL |
| NEW | EF-5263-1.2 | | | | 1.2 mL |

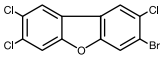
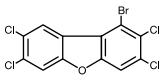
## $^{13}C_{12}$ Labeled Mixed Bromo/Chlorodioxin Standards

| Catalog # | Compound | | Concentration | Amount |
|---|---|---|---|---|
| EBC-2509 | **1-Bromo-2,3,7,8-Tetrachlorodibenzo-*p*-dioxin ($^{13}C_{12}$,99%)** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |

## Unlabeled Mixed Bromo/Chlorodioxin Standards

| | | | | |
|---|---|---|---|---|
| EBC-1743 | **2-Bromo-3,7,8-Trichlorodibenzo-*p*-dioxin** (CP: 95%) |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EBC-1741 | **2,3-Dibromo-7,8-Dichlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EBC-2501 | **1-Bromo-2,3,7,8-Tetrachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EBC-2504 | **2-Bromo-3,6,7,8,9-Pentachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EBC-2505 | **1-Bromo-2,3,6,7,8,9-Hexachlorodibenzo-*p*-dioxin** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EBC-2507-A | **1-Bromo-2,3,4,6,7,8,9-Heptachlorodibenzo-*p*-dioxin** |  | 5 ± 0.5 µg/mL in Nonane | 8 x 1.2 mL |

## Unlabeled Mixed Bromo/Chlorofuran Standards

| | | | | |
|---|---|---|---|---|
| EBC-2500 | **3-Bromo-2,7,8-Trichlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |
| EBC-2503 | **1-Bromo-2,3,7,8 Tetrachlorodibenzofuran** |  | 50 ± 5 µg/mL in Nonane | 1.2 mL |