



Dioxin and Furan Analysis

Lancaster Laboratories has established a premier dioxin and furan testing laboratory that utilizes three cutting-edge Thermo Scientific DFS high-resolution gas chromatographs/high-resolution mass spectrometers (HRGC/HRMS) for dioxin and furan analysis. Capitalizing on our 30 years of experience in organic extractions, we designed and built a laboratory dedicated exclusively for the preparation of dioxin and furan samples.

We hold NELAP accreditation from the Pennsylvania Department of Environmental Protection, ISO 17025 accreditation through A2LA and DoD ELAP accreditation for the analysis of dioxin and furan congeners in water and solid samples by EPA Method 1613B and SW-846 Method 8290A.

Why Choose Lancaster Laboratories?

At Lancaster Laboratories, we have integrated the analysis of dioxins and furans into the high-quality data and sample handling systems you have come to expect from us. We've put special emphasis on the analysis of dioxins and furans by:

- Dedicating three Thermo Scientific DFS high-resolution gas chromatographs/high-resolution mass spectrometers (HRGC/HRMS) for the analysis of dioxins and furans.
- Controlling environmental factors for the preparation and extensive cleanup of samples by building space dedicated specifically for dioxin and furan preparation and analysis.
- Substituting a ¹³C isotope to eliminate the background contribution of the method suggested ¹³⁷Cl isotope.
- Using 17 labeled compounds instead of the method-suggested 15 labeled compounds.

Lancaster Labs also has extensive experience in providing various deliverable formats, both electronic and hardcopy, to summarize analytical and quality control results.



Why is Dioxin Testing Important to You?

Dioxins and furans are anthropogenic compounds created as unintended by-products from several human activities. Some of these activities include the chlorine bleaching of paper products, incomplete or partial combustion and the production of certain types of chemicals. Dioxins and furans are the more commonly used names that have been associated with polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), with the most toxic being 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

Dioxins and furans are characterized by the chemical backbone and the number of chlorines substituted on the backbone. The chemical structures for dioxins and furans may be found in Figure 1.

Dioxins and furans are persistent environmental pollutants that have been extensively studied and shown to bioaccumulate in the environment. More than 90 percent of human exposure is through the consumption of food—mainly meat, dairy products, fish and shellfish. Dioxins are very toxic, and issues surrounding their impact to the environment and human health exposure have been studied and documented for decades. Dioxins and furans have shown toxic effects in animal studies and damage to reproductive and immune systems and are carcinogenic.

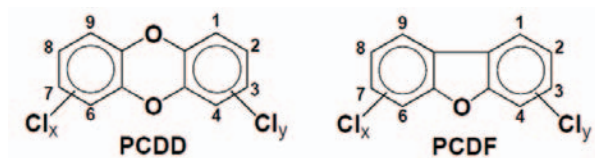


Sample Preparation

One of the challenges of sample preparation for dioxin testing is controlling environmental factors so that very low concentrations of PCDD/PCDF can be reliably detected. Extensive experience with trace organic residue analysis allows Lancaster Labs to understand the controls that are needed for preparing samples for dioxin testing and has served as a good springboard for developing this service. Liquid/liquid and Dean-Stark extractors are used to prepare samples for analysis on HRGC/HRMS. The extractions are followed by column cleanups to aid the detection of dioxins and furans.



Figure 1



Testing Capabilities

EPA Method 1613B and SW-846 Method 8290A provide for the analysis and reporting of 17 specific dioxin and furan isomers, as listed in Table 1. Of the 17 isomers reported by these methods, seven are polychlorinated dibenzo-p-dioxins, and 10 are polychlorinated dibenzofurans.

Lancaster Laboratories offers several reporting format options to meet your specific project needs. Options include the reporting of only 2,3,7,8-TCDD or all 17 target isomers. Report formats are available that include the total dioxins and furans within a homologue series as well as total dioxins and furans. Toxic Equivalents (TEQ) will also be reported using the Toxic Equivalency Factor (TEF) values specified in your Quality Assurance Project Plan (QAPP).




Table 1

Compound	MRL		Toxic Equivalency Factors (TEFs)			
	Water (pg/L)	Soil (pg/g)	USEPA 1987	NATO-I 1989	WHO 1998	WHO 2005
2,3,7,8-TCDD	2	1	1	1	1	1
1,2,3,7,8-PeCDD	10	5	0.5	0.5	1	1
1,2,3,4,7,8-HxCDD	10	5	0.04	0.1	0.1	0.1
1,2,3,4,7,8-HxCDD	10	5	0.04	0.1	0.1	0.1
1,2,3,7,8,9-HxCDD	10	5	0.04	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDD	10	5	0.001	0.01	0.01	0.01
1,2,3,4,6,7,8,9-OCDD	20	10	0	0.001	0.0001	0.0003
2,3,7,8-TCDF	2	1	0.1	0.1	0.1	0.1
1,2,3,7,8-PeCDF	10	5	0.1	0.05	0.05	0.03
2,3,4,7,8-PeCDF	10	5	0.1	0.5	0.5	0.3
1,2,3,4,7,8-HxCDF	10	5	0.01	0.1	0.1	0.1
1,2,3,6,7,8-HxCDF	10	5	0.01	0.1	0.1	0.1
1,2,3,7,8,9-HxCDF	10	5	0.01	0.1	0.1	0.1
2,3,4,6,7,8-HxCDF	10	5	0.01	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDF	10	5	0.001	0.01	0.01	0.01
1,2,3,4,7,8,9-HpCDF	10	5	0.001	0.01	0.01	0.01
1,2,3,4,6,7,8,9-OCDF	20	10	0	0.001	0.0001	0.0003

Glossary of Dioxin Terms

- EDL** Estimated Detection Limit. The minimum concentration required to produce a signal-to-noise ratio of 2.5. The EDL is calculated for each analyte in every sample.
- MRL** Minimum Reporting Limit. The concentration of the lowest acceptable calibration point for the analyte.
- EMPC** Estimated Maximum Possible Concentration. The concentration that results from the signal present at the retention time of an analyte when the ions meet all the method-specified qualification criteria except the ion abundance ratio.
- OPR** Ongoing Precision and Recovery standard. A blank spiked with known quantities of analytes. Like a Laboratory Control Sample (LCS), it is used to measure the laboratory's performance.
- TEF** Toxic Equivalency Factors. Values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
- TEQ** Toxic Equivalents. The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing all of the resultant values.
- PCDD** Polychlorinated dibenzo-p-dioxin
- PCDF** Polychlorinated dibenzofuran
- PPQ** Parts per quadrillion (pg/L or pg/kg)
- PPT** Parts per trillion (ng/L or pg/g)
- TCDD** Tetrachlorinated dibenzo-p-dioxin



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