Dioxin and Related Analyses

Dioxin, Furan and Polychlorinated Biphenyl (PCB) Congeners are chlorinated biphenyl compounds that share a common toxicity mechanism. The analyses used to determine these compounds' relative toxicity share common elements that differ from methods used for more traditional analytical determinations. The preferred methods for dioxins and related analyses use isotope dilution, high resolution gas chromatography/mass spectrometry (HRGC/HRMS). Concentrations are determined by measuring the ratio of the analyte to the appropriate isotopically labeled internal standard.

Toxicity Equivalence Factors

Dioxins	NATO, 1989	WHO, 2005
2,3,7,8-TCDD	1	1
1,2,3,7,8-PeCDD	0.5	1
1,2,3,4,7,8-HxCDD	0.1	0.1
1,2,3,6,7,8-HxCDD	0.1	0.1
1,2,3,7,8,9-HxCDD	0.1	0.1
1,2,3,4,6,7,8-HpCDD	0.01	0.01
OCDD	0.001	0.0003
Furans		
2,3,7,8-TCDF	0.1	0.1
1,2,3,7,8-PeCDF	0.05	0.03
2,3,4,7,8-PeCDF	0.5	0.3
1,2,3,4,7,8-HxCDF	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01
OCDF	0.001	0.0003
Co-Planar PCBs		
3,3',4,4'-TCB (77)		0.0001
3,4,4',5-TCB (81)		0.0003
3,3',4,4',5-PeCB (126)		0.1
2,3,3',4,4'-PeCB (105)		0.00003
2,3,4,4',5-PeCB (114)		0.00003
2,3',4,4',5-PeCB (118)		0.00003
2',3,4,4',5-PeCB (123)		0.00003
2,3,3',4,4',5-HxCB (156)		0.00003
2,3,3',4,4',5'-HxCB (157)		0.00003
2,3',4,4',5,5'-HxCB (167)		0.00003
3,3',4,4',5,5'-HxCB (169)		0.03
2,3,3',4,4',5,5'-HpCB (189)		0.00003

Holding Times for dioxins and related compounds are 30 days or longer for extraction and 40 days to a year for the analysis of the extract. These compounds are extremely stable and most published holding times are recommendations only.

Reporting Limits are determined from the lowest concentration used to calibrate each congener. These reporting limits are specified by the method and can be found on reverse of this page.

Recommended Sample Containers:

Matrix	Containers
Liquid	2 1L bottles
Solid	1 4oz jar
Tissues	50 g frozen/wrapped
Air from Source	XAD resin trap (Method 23)
Ambient Air	PUF trap (Method TO 9)

Detection Limits are calculated for each congener in each sample from the response and recovery of the appropriate labeled standard. The detection limits will depend on the matrix, the sample size and instrument performance. Detection limits are reported with each sample result and are usually much lower than the method reporting limits. It is very important to discuss any project specific, detection limit requirements with the laboratory before the project begins.

With a HRGC/HRMS instrument, because the detection limits are calculated for each congener in each sample during each analytical run, the term MDL has no application.

Turn Around Times are usually longer for dioxin and related analyses. With our new Automated Solid Extractor, it is now possible to produce results for a solid sample in 48 - 72 hours after sample receipt. Cleanup procedures are also required before the extract can be analyzed. Our standard turn around time for these analyses is 14 days for an emailed .pdf of the results and 21 days for a final hard copy of a full level IV data package. Rush turn around times (3-7 days) are available upon request.

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Matrix Spike/ Matrix Spike Duplicates are not required QC samples for these analyses. Recoveries are determined from isotope labeled internal standards. Lab control spikes are used to evaluate method consistency. MS/MSD samples may be run for additional project specific QC. This must be requested in advance and are usually billed as separate samples.

Toxicity Equivalence Factors (TEFs) are used to assess the toxicity of a dioxin and "dioxin-like" compounds relative to TCDD. These factors are multiplied by the concentration of the compound to determine the Toxicity Equivalence Quantity (TEQ). Most regulations cite the sum of the TEQ's or total TEQ in a sample.

Second Column Confirmation of TCDF is required when TCDF is detected on the first column. Results from both columns will be included in the report, however the results from the second column are used to evaluate the TCDF level in the samples and to determine the TEQ value for TCDF.

Over Range Samples are samples that have concentrations higher than the linear portion of the calibration curve. These results are flagged with an "E". Over range samples are re-extracted using a smaller sample size so that the results are within the calibration range. This will extend the turn around time for the final report by as much as a week.

DIOXINS & FURANS REPORTING LIMITS			EPA Method 1613B		SW 846 Method 8290		SW 846 Method 8280A	
			Water (pg/L)	Soil (ng/Kg)	Water (pg/L)	Soil (ng/Kg)	Water (ng/L)	Soil (µg/Kg)
CONGENER	CONGENER ABBREVIATION	CAS RN	ppq	ppt	ppq	ppt	ppt	ppb
2,3,7,8-Tetrachlorodibenzo-p-dioxin	2,3,7,8-TCDD	1746-01-6	10	1.0	10	1.0	10	1.0
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1,2,3,7,8-PeCDD	40321-76-4	50	5.0	25	2.5	10	1.0
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	1,2,3,4,7,8-HxCDD	39227-28-6	50	5.0	25	2.5	25	2.5
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	1,2,3,6,7,8-HxCDD	57653-85-7	50	5.0	25	2.5	25	2.5
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	1,2,3,7,8,9-HxCDD	19408-74-3	50	5.0	25	2.5	25	2.5
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	1,2,3,4,6,7,8-HxCDD	35822-39-4	50	5.0	25	2.5	25	2.5
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	OCDD	3268-87-9	100	10.0	50	5.0	50	5.0
2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-TCDF	51207-31-9	10	1.0	10	1.0	10	1.0
1,2,3,7,8-Pentachlorodibenzofuran	1,2,3,7,8-PeCDF	57117-41-6	50	5.0	25	2.5	10	1.0
2,3,4,7,8-Pentachlorodibenzofuran	2,3,4,7,8-PeCDF	57117-31-4	50	5.0	25	2.5	10	1.0
1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,4,7,8-HxCDF	70648-26-9	50	5.0	25	2.5	25	2.5
1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-HxCDF	57117-44-9	50	5.0	25	2.5	25	2.5
1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-HxCDF	72918-21-9	50	5.0	25	2.5	25	2.5
2,3,4,6,7,8-Hexachlorodibenzofuran	2,3,4,6,7,8-HxCDF	60851-34-5	50	5.0	25	2.5	25	2.5
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-HpCDF	67562-39-4	50	5.0	25	2.5	25	2.5
1,2,3,4,7,8,9-Heptachlorodibenzofuran	1,2,3,4,7,8,9-HpCDF	55673-89-7	50	5.0	25	2.5	25	2.5
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	OCDF	39001-02-0	100	10.0	50	5.0	50	5.0