Dioxin Testing

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/ high-resolution mass spectrometry (HRGC/HRMS). Concentrations are determined by measuring the ratio of the analyte to the appropriate isotopically labeled internal standard.

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.

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.

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

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With an 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.

Matrix Spike/Matrix Spike Duplicates are not required QC samples for these analyses. Recoveries are determined from isotope labeled internal standards. Laboratory 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 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 TEQs or total TEQ in a sample.

Congener	Congener Abbreviation	CAS RN	EPA Method 1613B*		SW 846 Method 8290		SW 846 Method 8280A	
2,3,7,8-Tetrachlorodibenzo-p-dioxin	2,3,7,8-TCDD	1746-01-6	2	0.2	10	1.0	10	1.0
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1,2,3,7,8-PeCDD	40321-76-4	10	1.0	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	10	1.0	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	10	1.0	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	10	1.0	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	10	1.0	25	2.5	25	2.5
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	OCDD	3268-87-9	10	1.0	50	5.0	50	5.0
2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-TCDF	51207-31-9	20	2.0	10	1.0	10	1.0
1,2,3,7,8-Pentachlorodibenzofuran	1,2,3,7,8-PeCDF	57117-41-6	2	0.2	25	2.5	10	1.0
2,3,4,7,8-Pentachlorodibenzofuran	2,3,4,7,8-PeCDF	57117-31-4	10	1.0	25	2.5	10	1.0
1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,4,7,8-HxCDF	70648-26-9	10	1.0	25	2.5	25	2.5
1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-HxCDF	57117-44-9	10	1.0	25	2.5	25	2.5
1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-HxCDF	72918-21-9	10	1.0	25	2.5	25	2.5
2,3,4,6,7,8-Hexachlorodibenzofuran	2,3,4,6,7,8-HxCDF	60851-34-5	10	1.0	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	10	1.0	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	10	1.0	25	2.5	25	2.5
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	OCDF	39001-02-0	20	2.0	50	5.0	50	5.0

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