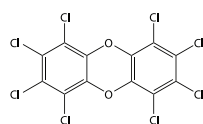
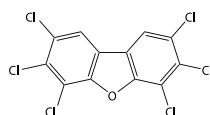


Dioxin/Furan and Dioxin-Like Compounds

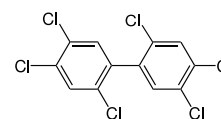
Toxic Equivalency Factors (TEF)



Polychlorinated Dibenzo-p-dioxin



Polychlorinated Dibenzofuran



Polychlorinated Biphenyl

Dioxin and Furan are the common names associated with polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). This group of primarily anthropogenic chemical compounds can be created as unintended byproducts of a number of human activities including: combustion, certain types of chemical production, chlorine bleaching of paper and other industrial processes. Extensive research has concluded that exposure to dioxins and furans can result in biochemical and biological effects in animals and humans. Because these ubiquitous compounds accumulate in biological tissues, dioxins and furans have been in the environmental spotlights for over two decades. Of these compounds, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is the most toxic and has been the most widely investigated.

More recently, researchers have discovered that certain polychlorinated biphenyls (PCBs) are similar in nature to dioxin and appear to pose similar risks to both animals and humans. For risk assessment purposes, a toxicity equivalence procedure has been developed to describe the cumulative toxicity of complex mixtures of these compounds, when encountered in the environment. The procedure involves assigning individual toxicity equivalency factors (TEFs) to the PCDD, PCDF, and PCB congeners in terms of their relative toxicity to 2,3,7,8-TCDD. Three sets of generally accepted TEF values are shown in the table below: the factors endorsed by the USEPA circa 1989, The WHO (World Health Organization) List circa 1998 and those accepted by the WHO, USEPA and most other regulators effective 2005. Calculating the toxic equivalency (TEQ) of a mixture involves multiplying the concentrations of individual congeners by their respective TEF, then adding the individual TEQ's to obtain a total TEQ concentration for the mixture. Pace Analytical's standard Dioxin/Furan data package includes a TEF/TEQ result for each sample, using the WHO /2005 default factors to calculate the result. The other specified factors, sometimes still in use at legacy sites, can be substituted upon request.

For additional information of this nature on Dioxins and related compounds contact: Pace Analytical at (612) 607-1700, or visit our website at www.pacelabs.com/dioxin.

	Specific Isomers	Compound Name	ITE/89 List	WHO/1998	WHO/2005	
Dioxins (PCDD)	1.	2378-TCDD	Tetrachlorodibenzo-p-dioxin	1	1	1
	2.	12378-PeCDD	Pentachlorodibenzo-p-dioxin	0.5	1	1
	3.	123678-HxCDD	Hexachlorodibenzo-p-dioxin	0.1	0.1	0.1
	4.	123478-HxCDD	Hexachlorodibenzo-p-dioxin	0.1	0.1	0.1
	5.	123789-HxCDD	Hexachlorodibenzo-p-dioxin	0.1	0.1	0.1
	6.	1234678-HpCDD	Heptachlorodibenzo-p-dioxin	0.01	0.01	0.01
	7.	12346789-OCDD	Octachlorodibenzo-p-dioxin	0.001	0.0003	0.0003
Furans (PCDF)	8.	2378-TCDF	Tetrachlorodibenzofuran	0.1	0.1	0.1
	9.	12378-PeCDF	Pentachlorodibenzofuran	0.05	0.05	0.03
	10.	23478-PeCDF	Pentachlorodibenzofuran	0.5	0.5	0.3
	11.	123678-HxCDF	Hexachlorodibenzofuran	0.1	0.1	0.1
	12.	123789-HxCDF	Hexachlorodibenzofuran	0.1	0.1	0.1
	13.	123478-HxCDF	Hexachlorodibenzofuran	0.1	0.1	0.1
	14.	234678-HxCDF	Hexachlorodibenzofuran	0.1	0.1	0.1
	15.	1234678-HpCDF	Heptachlorodibenzofuran	0.01	0.01	0.01
16.	1234789-HpCDF	Heptachlorodibenzofuran	0.01	0.01	0.01	
17.	12346789-OCDF	Octachlorodibenzofuran	0.001	0.0001	0.0003	
PCBs (WHO / "Dioxin-Like")	1.	33'44'-TeCB	Tetrachlorobiphenyl (PCB 77)	0.0005	0.0001	0.0001
	2.	344'5'-TCB	Tetrachlorobiphenyl (PCB 81)	-	0.0001	0.0003
	3.	233'44'-PeCB	Pentachlorobiphenyl (PCB 105)	0.0001	0.0001	0.00003
	4.	2344'5'-PeCB	Pentachlorobiphenyl (PCB 114)	0.0005	0.0005	0.00003
	5.	2'344'5'-PeCB	Pentachlorobiphenyl (PCB 118)	0.0001	0.0001	0.00003
	6.	2'344'5'-PeCB	Pentachlorobiphenyl (PCB 123)	0.0001	0.0001	0.00003
	7.	33'44'5'-PeCB	Pentachlorobiphenyl (PCB 126)	0.1	0.1	0.1
	8.	233'44'5'-HxCB	Hexachlorobiphenyl (PCB 156)	0.0005	0.0005	0.00003
	9.	233'44'5'-HxCB	Hexachlorobiphenyl (PCB 157)	0.0005	0.0005	0.00003
	10.	23'44'55'-HxCB	Hexachlorobiphenyl (PCB 167)	0.00001	0.00001	0.00003
	11.	33'44'55'-HxCB	Hexachlorobiphenyl (PCB 169)	0.01	0.01	0.03
	12.	233'44'55'-HpCB	Heptachlorobiphenyl (PCB 189)	0.0001	0.0001	0.00003

