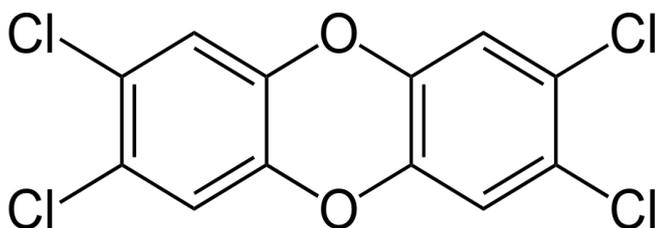


Dioxins and Furans (PCDD, PCDF)



Chemical Structure of Tetrachlorodibenzodioxin. This is a PCDD or polychlorinated dibenzodioxin. Source: Wikipedia

What are Dioxins and Furans?

The word 'dioxin' is commonly used to describe the family of related polychlorinated dibenzo dioxins (PCDDs) and polychlorinated dibenzo furans (PCDFs). Certain dioxin-like polychlorinated biphenyls (PCBs) with similar toxic properties are also included under the term "dioxins". Some 419 types of dioxin-related compounds have been identified but only about 30 of these are considered to have significant toxicity. Within these large classes of compounds, 7 PCDDs, 10 PCDFs and 12 PCBs have toxicity equivalency factors assigned to them.

Although the 17 PCDD/PCDF compounds share certain physical and chemical characteristics, toxicity varies greatly. In fact, the least toxic of these compounds is estimated to be about 10,000 times less toxic than the most toxic (and well-studied) compound 2,3,7,8-TCDD. To interpret the biomonitoring data for PCDD/PCDFs in soil, the toxicity of each of these 17 compounds must be understood. A common measure of toxicity for PCDDs/PCDFs is based on an assessment of the total toxic equivalency (TEQ). TEQs are obtained by multiplying the concentration of each PCDD and PCDF compound by its toxic equivalency factor (TEF) and summing up the results for each PCDD/PCDF compound present. An example of how TEQ is calculated within a soil sample is shown in the following table.

Dioxins occur in the environment as complex mixtures. Dioxins were not intentionally manufactured. The main source of dioxins is as a by-product during the manufacture of industrial chemicals like PCP, and 2,4,5 T. Natural sources of dioxin are released from volcanic activity and bush fires.

Example of how TEQ is calculated as a function of congener concentration and toxicity weighting (TEF). The data is for Biocell 1a, control biocell for mycoremediation.

Congener Name	Result	TEF	TEF - Adjusted Concentration
2,3,7,8-TCDD	12.4	1	12.4
1,2,3,7,8-PeCDD	18.8	1	18.8
1,2,3,4,7,8-HxCDD	19.8	0.1	1.98
1,2,3,6,7,8-HxCDD	456	0.1	45.6
1,2,3,7,8,9-HxCDD	126	0.1	12.6
1,2,3,4,6,7,8-HpCDD	16400	0.01	164
Octachlorodibenzo-p-dioxin (OCDD)	194000	0.0003	58.2
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	2.58	0.1	0.258
1,2,3,7,8-PeCDF	9.32	0.03	0.28
2,3,4,7,8-PeCDF	11.6	0.3	3.48
1,2,3,4,7,8-HxCDF	175	0.1	17.5
1,2,3,6,7,8-HxCDF	73.2	0.1	7.32
1,2,3,7,8,9-HxCDF	12.5	0.1	1.25
2,3,4,6,7,8-HxCDF	36.3	0.1	3.63
1,2,3,4,6,7,8-HpCDF	4830	0.01	48.3
1,2,3,4,7,8,9-HpCDF	600	0.01	6
Octachlorodibenzofuran (OCDF)	47000	0.0003	14.1
		TEQ	416

How are we exposed to dioxin?

Dioxins are persistent organic pollutants (POPs) found in all environments. Their resistance to degradation means they may be transported over long distances and because of their persistence, dioxins released to the environment many years ago continue to contribute to current-day exposure and thus present human and environmental health concerns.

The major source of dioxin exposure is through diet, which is responsible for more than 90% of human exposure. Dioxins accumulate in the food chain. They are fat-soluble so are absorbed and stored in the fatty tissue of animals and may persist in human fatty tissue for months or years.

In 2012, the World Health Organisations (WHO's) International Agency for Research on Cancer (IARC) classified the dioxin congener 2,3,7,8-TCDD as a "known human carcinogen". Studies have also shown that chemical workers who are exposed to high levels of dioxin have an increased risk of cancer and other diseases. More research is needed to determine the long-term effects of low-level dioxin exposures on cancer risk, immune function, reproduction and development.

Where can I get further Information about dioxins?

<http://www.health.govt.nz/publication/dioxins-technical-guide>