



Scientific Facts on Dioxins

Source document:

[IPCS - WHO \(1998\)](#)

Summary & Details:

[GreenFacts \(2004\)](#)

[Information on our Three-Level Structure](#)

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Context - Dioxins are mainly released by human activities such as incineration and fuel combustion. Some dioxins and some "dioxin-like" PCBs are known to be harmful.

In 2008, the facts presented here are still considered a valid reference. Since 1998, there have been no big changes in our scientific understanding of dioxins - other than to strengthen the conclusions that dioxins are bad actors. General dioxin levels have since continued to drop both in the environment and in people.

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1. What are dioxins?

1.1 "[Dioxins](#)" refers to a group of chlorinated [organic chemicals](#) with similar chemical structures. Some have harmful properties, depending on the number and position of [chlorine](#) atoms in their chemical structure. One of the most harmful dioxins is known as [TCDD](#). Some [PCBs](#), which have similar properties, are considered "dioxin-like". [More...](#)



1.2 Unlike [PCBs](#) which were used in several industrial applications, [dioxins](#) have no uses. They are formed unintentionally and predominantly released as byproducts of human activities such as incineration and fuel combustion. They are also formed in minor quantities by natural processes such as forest fires and volcanoes. [More...](#)

1.3 [Dioxins](#) travel through the air and deposit on water or land. In water, dioxins initially bind to small particles or plankton. On land, dioxins deposit on plants or bind to the soil, most often without contaminating [groundwater](#). Animals [accumulate](#) dioxins in fat through their food;

[concentrations](#) increase at each step in the food chain. [More...](#)

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2. How are humans exposed to dioxins?

2.1 Over 90% of the human [intake](#) of [dioxins](#) is through food, mainly from animal origin. The [intake](#) is ten to hundred times higher for breast fed babies than for adults with respect to their body weight. In most industrialized countries, [dioxin exposure](#) has been reduced by almost 50% compared to the early 90's. [More...](#)

2.2 Local populations have been accidentally [exposed](#) to high [dioxin](#) levels, e.g. in [Seveso](#) (Italy) after an explosion at a chemical factory, or in Japan and Taiwan with people eating [rice oil](#) accidentally contaminated with [PCBs](#) and [dioxins](#). In the past, some workers have also been highly exposed to dioxins in waste incineration or chemical plants. [More...](#)

2.3 [Dioxins](#) are slowly bio-transformed in the body and are not easily eliminated. They tend to [accumulate](#) in fat and in the liver. By interacting with a [cellular receptor](#), dioxins can trigger biological effects such as hormonal disturbances and alterations in [cell](#) functions. The mechanism of dioxin [toxicity](#) is similar in man and other vertebrates. [More...](#)

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3. What are the effects of dioxins in laboratory animals?

3.1 [Toxic dioxins](#) may cause non-[cancer](#) effects to animals, affecting development, reproduction, the immune system and the uterus. Human [background exposures](#) in industrialized countries have sometimes reached levels at which these effects were seen in animals. [More...](#)

3.2 In laboratory testing, [TCDD](#) and some other types of [dioxins](#) increase the number of [cancers](#) in several animal species, in both sexes. They do not initiate cancers but promote the growth of existing precancerous [cell](#). [More...](#)

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4. What are the effects of dioxins on human health?

4.1 For workers accidentally [exposed](#) to the highest [doses](#) of [dioxins](#), studies estimate that the [risk of cancer](#) increases by about 40%. However, the average [exposure](#) of the general population is much lower. [More...](#)

4.2 Some delay in nervous system development as well as changes of behavior were seen in children of mothers who had been highly [exposed](#) to [dioxins](#) and [PCBs](#). In some cases these effects occurred even at current [background levels](#). The effects were likely due to [exposure](#) through the placenta rather than through breast milk. However, at least in one case high levels of PCBs and dioxins in breast milk were shown to affect young children's [neurobehavioural test](#) results. [More...](#)

4.3 Other non-[cancer](#) effects observed on adults accidentally [exposed](#) to high levels of [toxic dioxins](#) include: diabetes, liver and heart diseases, skin problems (e.g. [chloracne](#)), [conjunctivitis](#), fatigue, malaise and slowed nervous reactions. [More...](#)

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5. How can dioxin exposure be linked to health effects?

5.1 The International Agency for Research on [Cancer \(IARC\)](#) of the World Health Organization ([WHO](#)) has proposed a [model](#) linking [TCDD exposure](#) to cancer in humans. However, studies on rodents show a wide variety of [dose-effect relationships](#). [More...](#)

5.2 [Models](#) can not yet predict adequately non-[cancer](#) effects in humans but may be used to help understand the effects observed. [More...](#)

5.3 The evaluation of [risk](#) posed by mixtures of various [dioxin](#) types is more complicated. A [Toxic Equivalency Factor \(TEF\)](#) value has been determined for each [toxic dioxin](#). Using these values, a total [Toxic Equivalent \(TEQ\)](#) value can be calculated for any dioxin mixture. [More...](#)

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6. Evaluation and conclusions

6.1 [Dioxin](#) levels in food, environmental [samples](#) and breast milk have decreased over the 1990s. In most industrialized countries, the [daily dioxin intake](#) is currently in the order of 1 to 3 [pg I-TEQ/kg body weight per day](#). [More...](#)


6.2 At very high dioxin exposure, the risk for all cancers combined appears to increase. Non-cancer effects include cardiovascular diseases, diabetes and changes in blood composition. Infants of accidentally highly exposed mothers showed severe developmental and neurological effects. [More...](#)

6.3 A Tolerable Daily Intake (TDI) of 1 to 4 pg I-TEQ per kg body weight per day has been established for dioxins by the World Health Organization (WHO). The upper limit of 4 is provisional: the ultimate goal is to reduce human intake levels below 1 pg I-TEQ per kg body weight per day. This value was derived from the lowest doses causing adverse effects in experimental animals, divided by a safety factor of 10. This Tolerable Daily Intake (TDI) should be seen as an average over a life-time, implying that this value may be exceeded occasionally for short periods without expected health consequences. [More...](#)

6.4 Although breast-fed infants are more exposed to dioxins, under normal conditions the many beneficial effects of human milk generally outweigh the risks. Dioxin levels in human milk have been reduced since the early 90's. [More...](#)

Note from the editor: In 2008, these conclusions are still considered valid. Since 1998, there have been no big changes in our scientific understanding of dioxins - other than to strengthen the conclusions that dioxins are bad actors. General dioxin levels have since continued to drop both in the environment and in people.

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This Digest is a faithful summary of  the leading [scientific consensus report](#) produced in 1998 by the International Programme on Chemical Safety (IPCS) of the World Health Organization (WHO): "[Executive Summary of the Assessment of the health risk of dioxins](#)" [Learn more...](#)

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9-10-2009

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