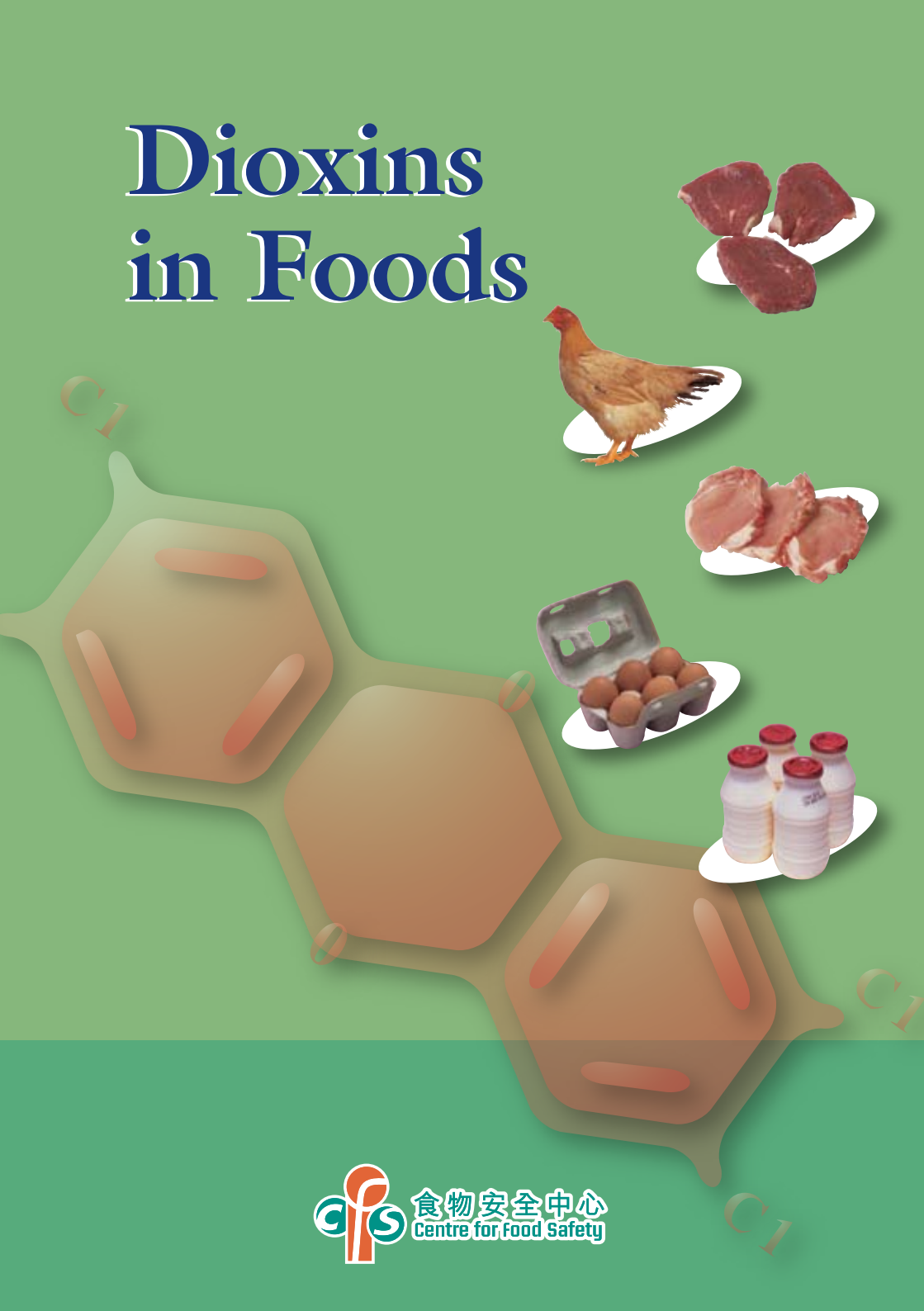
Dioxins in Foods



食物安全中心
Centre for Food Safety

Dioxins in Foods

What are dioxins?

- "Dioxins" are a group of polychlorinated, planar aromatic compounds with similar structures, chemical and physical properties.

- Distinct by their chemical structures, dioxins can be grouped into polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) (Figures 1 and 2).

- There are 75 PCDD and 135 PCDF congeners identified. Dioxins are persistent and accumulate in the environment and biological tissues including food.

Figure 1: PCDDs

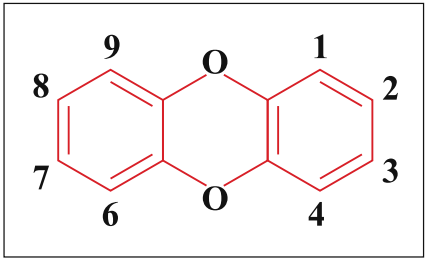
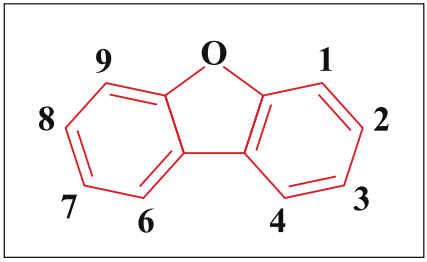


Figure 2: PCDFs



What are the sources of dioxins?

- Dioxins have no commercial application. They are formed mainly as by-products of industrial processes. Examples are incomplete combustion in automobile emissions and incinerators, bleaching of paper pulp, manufacture or use of defoliants and pesticides, as well as emissions by smelting industries.

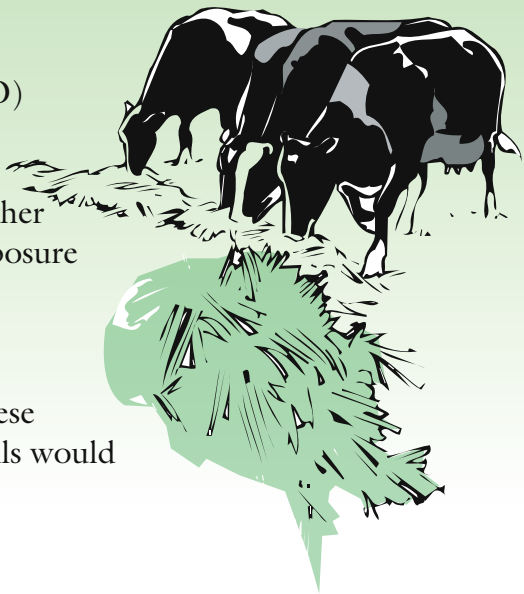
- Dioxins can also be formed naturally during volcanic eruptions and forest fires.

How could we be exposed to dioxins?

- Most dioxins enter the environment by emission to the air, and deposit on water, soil or plants. Besides aerial transportation, soil and water may also be polluted by contaminated sewage sludge or composts, herbicide runoff and erosion from nearby contaminated areas.

- Atmospheric deposition of dioxins on leaves, application of pesticides and spreading of contaminated sewage may pollute leafy vegetables and pastures.

- Dioxins are ubiquitous in the environment, particularly in industrialised countries. The World Health Organization (WHO) estimated that over 90% of human exposure to dioxins is via dietary intake while other routes of environmental exposure such as breathing and skin contact are uncommon.



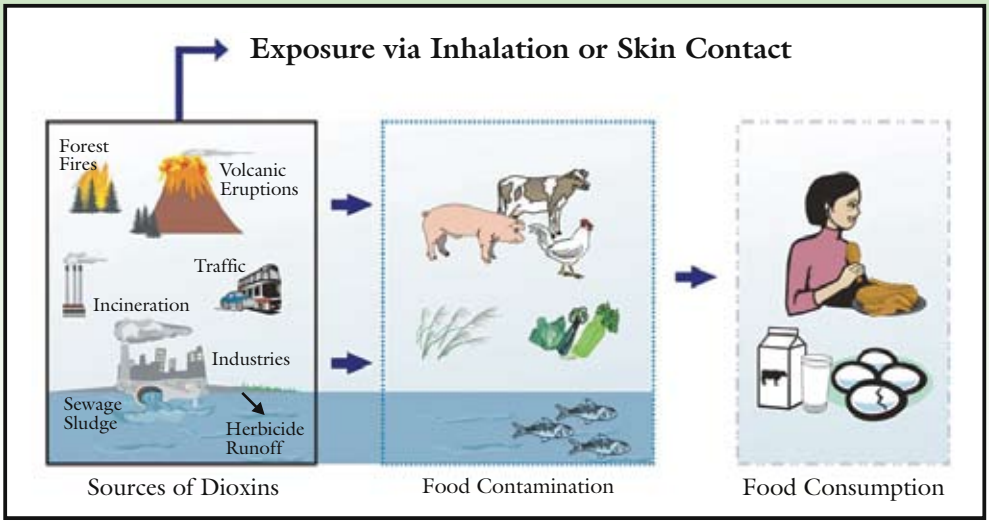
- Food animals that ingest these contaminated plants and soils would lead to dioxin accumulation in their body tissues.

- Dioxins would also enter fish and other aquatic organisms through the ingestion of contaminated sediments in water.

- Meat, poultry, fish, milk, eggs and their products are considered to be the major food sources of dioxins since dioxins tend to accumulate in fat within animals.

- The contribution of occupational exposure to overall dioxin exposure in general population is relatively small.

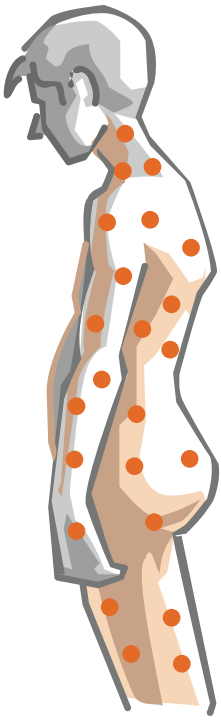
Figure 3: Exposure to Dioxins



What are the health effects upon exposure to dioxins?

- Accidental exposure to large amount of dioxins could lead to the development of chloracne, excessive body hair and other skin lesions such as skin rashes and skin discolouration.

- The International Agency for Research on Cancer (IARC) has classified one of the most toxic dioxin congeners, TCDD, as human carcinogen.



- Animal studies showed that long-term exposure to dioxins may affect the immune system, reproductive function, endocrine system and the developing nervous system. Associations with diabetes, thyroid dysfunction and heart diseases in humans have been reported in some studies.

What is the tolerable intake for dioxins?

- Tolerable daily intake (TDI) refers to the amount of a contaminant, expressed on a body weight basis, which an individual may ingest daily for lifetime without causing any adverse effect. Occasional short-term excessive intake above the TDI would have no health consequence provided the average intake over long periods falls within the recommended range.
  The WHO has recommended that a TDI of 1 to 4 picogram(pg) TEQ per kilogram of body weight for dioxins and dioxin-like compounds in 1998. Nevertheless, the WHO suggested that the dioxin exposure should be reduced to a level below 1 pg TEQ per kilogram of body weight per day. WHO also stressed that the upper range of the TDI of 4 pg TEQ per kilogram of body weight should be considered as a maximal tolerable intake on a provisional basis and that the ultimate goal is to reduce human intake levels below 1 pg TEQ per kilogram of body weight per day.

- The Joint Food and Agriculture Organization / World Health Organization Expert Committee on Food Additives (JECFA) in 2001 viewed that tolerable intakes for dioxins and dioxin-like compounds should be

expressed as a monthly value because they are highly persistent in the environment and body tissues. A Provisional Tolerable Monthly Intake (PTMI) of 70 pg TEQ per kilogram of body weight was then established.

"WHO-TEQ" - the unit for dioxin estimation in food samples

Since different dioxin congeners have different toxicity levels and their concentrations vary with different biological samples, WHO has derived an international agreed toxic equivalency factors (TEFs) for different dioxins and related substances in 1997. Using this WHO-TEF scheme, the toxic equivalent (TEQ) concentrations in a food sample can be obtained by summing the contribution from each congener, which is in turn calculated by multiplying the concentration of each congener with the corresponding TEF.

How to reduce dioxin exposure?

- Environmental control is the primary measure to minimise total exposure to dioxins and this requires global effort from the international community.

- Dioxins tend to accumulate in animal fat. To reduce dietary exposure to dioxins, one could -

1. reduce the consumption of animal fat, e.g.
   * trim fat from meat and meat products;
   * avoid the use of animal fat for food preparation and cooking;
   * use cooking methods that reduce fat (e.g. broiling, baking, etc.).

2. maintain a balanced diet so as to minimise excessive exposure to chemical contaminants from a small range of food items.

For further information and enquiries, please call the Food and Environmental Hygiene Department's hotline on 2868 0000.

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