

PROBLEMS AND CHALLENGES WITH DIOXINS AND PCBs OVER TIME - FROM ENVIRONMENTAL SOURCES TO THE FEED AND FOOD CHAIN

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PCDDs and PCDFs (“dioxins”) can be formed as unintentional by-products in a number of chemical processes as well as in almost every combustion process. PCBs are intentionally produced chemicals, that were manufactured for decades before the ban in marketing and use was adopted in 1985. Due to their persistence and bioaccumulation, PCDD/F and PCB are internationally recognised Persistent Organic Pollutants (POPs). Due to their toxic effects, a number of measures were taken to detect possible sources for these contaminants and to stop or reduce their release into the environment.

Many studies were performed in the 1980ies/early 1990ies. In 1990 and 1992, the German Federal Environment Agency and the German Health Authority organized international symposiums on dioxins covering a wide range of aspects including sources, legal measures and toxicological evaluation (^{1, 2}). An important conclusion was that emissions should be reduced in order to lower intake levels of dioxins below 1 pg TEQ/kg bw. Municipal waste incineration was detected as important source for environmental levels and a maximum level of 0.1 ng TEQ/m³ proposed.

During the 1990ies, the food chain got into the focus with several incidents, in particular the Belgian dioxin crisis caused by a feed additive heavily contaminated with PCBs (³), the contamination of citrus pulp pellets as a result of use of heavily contaminated lime (⁴) and the contamination of clay used as feed additive (^{5, 6, 7}).

This led to the re-evaluation of the safety of food with regard to dioxin intake by the Scientific Committee on Food (SCF) of the European Commission (^{8, 9}) and by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) (^{10, 11}). SCF derived a tolerable weekly intake (TWI) of 14 pg 2,3,7,8-TCDD/kg bw, JECFA a provisional tolerable monthly intake (PTMI) of 70 pgWHO-PCDD/F-PCB-TEQ/kg bw.

With the signing and ratification of the Stockholm Convention on POPs (¹²), the international community has signalled its commitment to eliminate or reduce production and emissions of initially twelve important POPs into the environment, among them PCDDs, PCDFs and PCBs. The global WHO/UNEP-coordinated exposure studies on levels of POPs in human milk (¹³) contribute to the evaluation of the effectiveness of the Stockholm Convention and allow to derive conclusions on setting of priorities in countries / regions, also with regard to levels of PCDD/Fs and PCBs.

In 2001, the European Community developed a strategy for dioxins, furans and PCBs for a better protection of human health and of the environment from the effects of dioxins and PCBs (¹⁴.) The integrated and systematic approach is based on two pillars:

- 1) reduction of the presence of dioxins and PCBs in the environment;
- 2) reduction of the presence of dioxins and PCBs in feed and food.

Food of animal origin is a predominant source of human exposure to dioxins and PCBs. As food contamination is directly related to feed contamination, an integrated approach is followed to reduce dioxin/PCB incidences all along the food chain, i.e. from feed materials through food-producing

animals to humans. These legislative measures concerning feedingstuffs and foodstuffs consists now of two pillars:

1. the establishment of maximum levels at a strict but feasible level in food (¹⁵) and feed (¹⁶),
2. the establishment of action levels acting as a tool for “early warning” of higher than desirable levels of dioxins in food (¹⁷) or feed (see ¹⁶).

Tendencies for reduced levels in the food chain can be observed. Remaining problems are caused by incidents, in particular contamination of feedingstuff, and by elevated levels in some kinds of food of animal origin, in particular if environmental levels might contribute to the dioxin intake of animals (in addition to the intake of feedingstuff).

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- ¹ Umweltbundesamt und Bundesgesundheitsamt (1990) Eintragsbelastung zur Reduzierung der Dioxinbelastung dringend erforderlich, Bundesgesundhbl. 8/90, 350 - 354
 - ² Umweltbundesamt und Bundesgesundheitsamt (1993) Dioxine und Furane - ihr Einfluß auf Umwelt und Gesundheit, Bundesgesundhbl. Sonderheft/93, 3 - 14
 - ³ Broeckaert F and Bernard A (2000) Polychlorinated biphenyls (PCBs) and dioxins (PCDD/Fs) in the Belgian contaminated food chain: sources, profiles and correlations. Final report, Brussels: Federal Ministry of Agriculture
 - ⁴ Malisch R (2000) Increase of the PCDD/F-contamination of milk, butter and meat samples by use of contaminated citrus pulp, Chemosphere 40: 1041 - 1053
 - ⁵ Rappe C, Bergeck S, Fiedler H, Cooper KR (1998) PCDD and PCDF contamination in catfish feed from Arkansas, USA, Chemosphere 36: 2705 - 2720
 - ⁶ Ferrario J, McDaniel D, Byrne C (1999) The isomer distribution and congener profile of polychlorinated dibenzo-p-dioxins (PCDDs) in ball clay from the Mississippi Embayment (Sledge, Mississippi) Organohalogen Compd 40: 95 - 99
 - ⁷ Jobst H, Aldag R (2000) Dioxine in Lagerstätten-Tonen. Z. Umweltchem. 12: 2 - 4
 - ⁸ European Commission, Scientific Committee on Food (2000) Opinion of the SCF on the Risk Assessment of Dioxins and Dioxin-like PCBs in Food, SCF/CS/CNTM/DIOXIN/8 Final of 23 November 2000
 - ⁹ European Commission, Scientific Committee on Food (2001) Opinion of the SCF on the Risk Assessment of Dioxins and Dioxin-like PCBs in Food, Update based on new scientific information available since the adoption of the SCF opinion on 22 November 2000, CS/CNTM/Dioxin/20 final, adopted on 30 May 2001
 - ¹⁰ R. Canady, K. Crump, M. Feeley, J. Freujer, M. Kogevinas, R. Malisch, P. Verger, J. Wilson and M. Zeilmaker (2002) Polychlorinated dibenzodioxins, polychlorinated dibenzofurans, and coplanar biphenyls, WHO Food Additives Series 48 “Safety evaluation of certain food additives and contaminants, prepared by the fifty-seventh meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA), IPCS (International Programme on Chemical Safety), World Health Organization, Geneva, 2002, p. 451 – 664
 - ¹¹ World Health Organisation WHO (2002) Technical Report Series 909, Evaluation of certain food additives and contaminants, fifty-seventh report of the Joint FAO/WHO Expert Committee on Food Additives
 - ¹² Stockholm Convention on Persistent Organic Pollutants (POPs), <http://www.pops.int>
 - ¹³ WHO (2007) WHO protocol Fourth WHO-Coordinate Survey of Human Milk for Persistent Organic Pollutants in Cooperation with UNEP Guidelines for Developing a National Protocol, Revised.

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- ¹⁴ Communication from the Commission to the Council, the European Parliament and the Economic and Social Committee: Community Strategy for Dioxins, Furans and Polychlorinated Biphenyls, Official Journal of the European Communities, 17.11.2001, C 322/2
- ¹⁵ COMMISSION REGULATION (EU) No 1259/2011 of 2 December 2011 amending Regulation (EC) No 1881/2006 as regards maximum levels for dioxins, dioxin-like PCBs and non dioxin-like PCBs in foodstuffs, Official Journal of the European Union L 320/18
- ¹⁶ COMMISSION REGULATION (EU) No 277/2012 of 28 March 2012 amending Annexes I and II to Directive 2002/32/EC of the European Parliament and of the Council as regards maximum levels and action thresholds for dioxins and polychlorinated biphenyls , Official Journal of the European Union L 91/1
- ¹⁷ COMMISSION RECOMMENDATION of 23 August 2011 on the reduction of the presence of dioxins, furans and PCBs in feed and food (2011/516/EU) Official Journal of the European Union L 218/23