

# SURVEY OF DIOXINS AND DIOXIN-LIKE COMPOUNDS IN ANIMAL FEED IN POLAND

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## Introduction

Animal feeding practices have changed considerably over the past years and industry concentrated methods have become the predominant model for animal feed production. Animal feeds may include different contaminated ingredients which can have adverse effect on human health. They compose of complete feed products derived from a multitude of raw materials of plant and animal origin, as well as pharmaceutical and industrial sources.

Chemical contaminants of animal feed include dioxins, such as PCDDs, PCDFs and dl-PCBs. Dioxins contaminations of environment are mostly the result of human activity including industrial processes involving emissions, which also can contaminate plants and feedingstuffs of plant origin. Dioxins in feedingstuffs can also be present due to origin of the raw components. When these lipophilic compounds are ingested by food-production animals, they bio-accumulate in fat tissues, making animal feed a significant source of human exposure to dioxins and PCBs through food-production animals.

Exposure of the European population to dioxins is in 90% attributable to foods of animal origin. Due to dioxin carry-over into foods of animal origin, feedingstuffs are the main input source of dioxins. With regard to reduce dioxin levels in feedingstuffs, the European Community set up maximum permit levels. If the maximum levels are exceeded it is no longer allowed to market or use as feedingstuffs.

The official animal feed survey in Poland was carried out from 2004 to 2009 on the basis of Recommendation 2004/704/EC of the European Commission in the frame of national monitoring program. The analysis of the feedingstuffs was performed at the new Polish dioxin laboratory in National Veterinary Research Institute in Pulawy.

## Materials and Methods

### Sampling

Feed samples were taken in representative way by veterinary inspection throughout Poland. The samples were grinded and the moisture content was determined followed by analysis for dioxin and PCB.

### Analysis

The requirements for the analysis of dioxins and dl-PCBs laid down in the Commission Directive 13/2006 were fulfilled. Two methods of dioxin determination were used: screening method was carried out with the XDS CALUX bioassay and confirmation of suspected samples was done by HRGC/HRMS method. In period 2004 to 2009 over 887 feed samples were analyzed (Table 1).

**Bioassay.** Feed samples were analyzed by biological screening procedure with XDS CALUX bioassay and HRGC/HRMS analysis was used for confirmation of suspected samples. Method was validated, expanded uncertainty was estimated and the requirements of dioxin and dl-PCB analysis laid down in the Commission Directive 2004/704 and Commission Regulation 13/2006 were fulfilled. Quality assurance was done by double sample determination, using reagent blank, spiked samples, certified and by natural contaminated control samples and control charts. Number of the false positive results was about 7% and no false negatives were found. The precision of the method was acceptable with CV < 30%, suggested for used cell based bioassays in compliance with the Commission Directive.

**HRGC/HRMS method.** Chemical confirmatory method was previously described (3,4).

## Results and Discussion

An overview of the obtained results is presented in the table 1. All values are recalculated to a moisture content of 12% as prescribed in the regulation 2006/13/EC. The 887 analyzed samples are listed according to the respective group in the EU document with range and the maximum permit limits (in WHO-TEQ).

Of the 887 feedingstuffs to which a statutory maximum level applies, only 11% of tested samples after analysis by screening method were "suspected" (Table. 2). Out of 100 fish meal samples 27 contained PCDD, PCDF and dl-PCB above permit level (Table. 2) what was confirmed by HRGC/HRMS method. Among contaminated feed components (besides fish meal) dried corn and beet pulps were contaminated by dibenzofurans (Figure 1).

From 2004 to 2009, in Poland a total of 887 samples of feedingstuffs (including additives and premixtures) were tested in the framework of the official dioxin feed survey. Baltic Sea origin fish meal and fish oil are the most heavily contaminated feed materials. Animal fat was identified as the next contaminated material. All other feed materials of animal and plant origin had relatively low levels of dioxin contamination with early mentioned exceptions.

The obtained results show that feedingstuffs in Poland have dioxin contents and dioxin-like PCBs which are far below the maximum permit levels in the European Union. This survey was continued over several years in order to monitor the development and to provide a scientific basis to the results.

As food contamination is directly related to feed contamination, an integrated approach must be adopted to reduce dioxin incidence throughout the food chain, i.e. from feed materials through food-producing animals to humans. The introduction of measures relating to feed materials and feedingstuffs is therefore a crucial step towards reducing dioxin intake by humans.

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## References

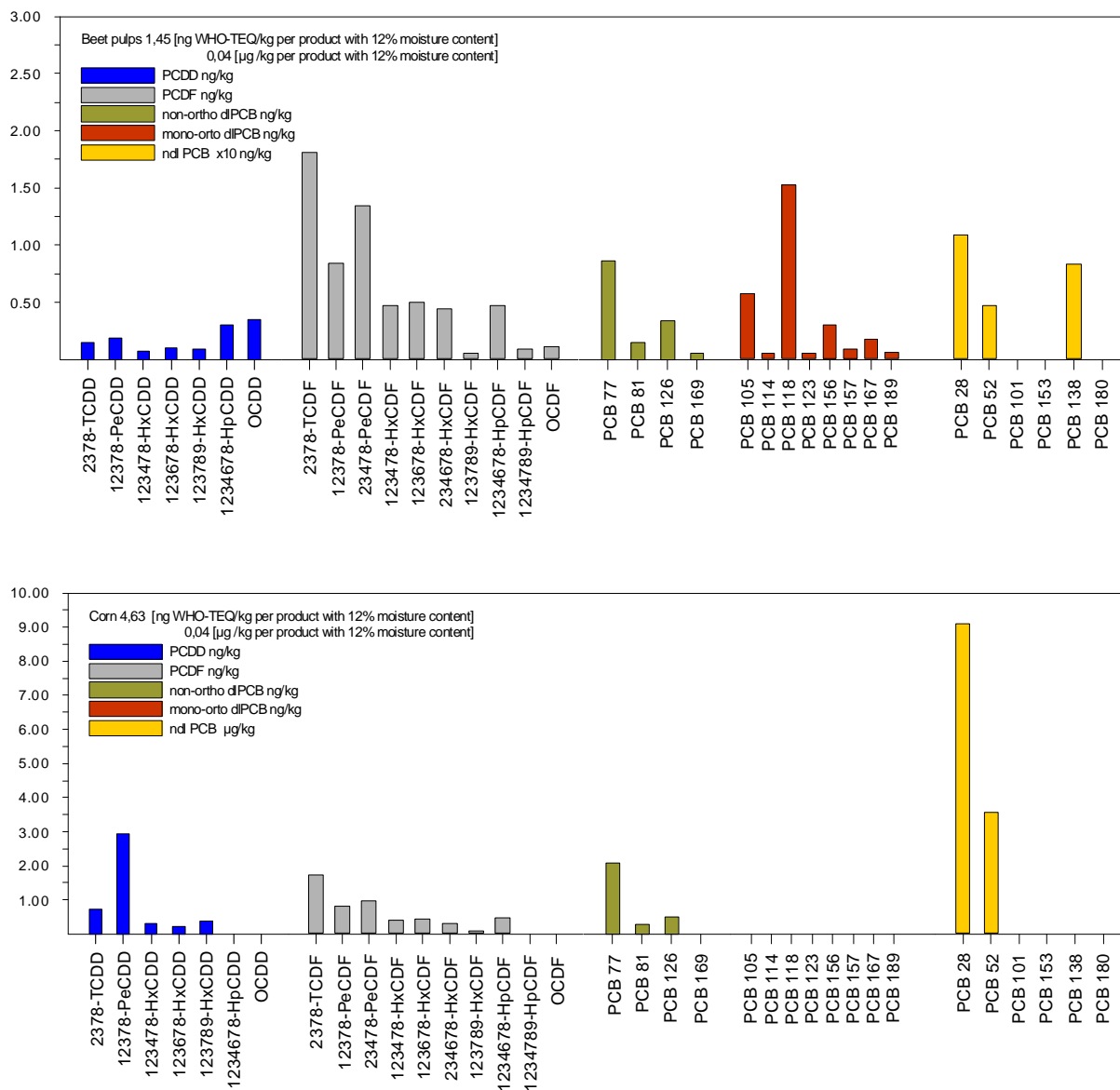
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**Table 1. PCDD/PCDF/ dl-PCB levels in feed and feed components (ng WHO-TEQ/kg of feed with moisture content 12%)**

Item	Product	Range (ng/kg)	Permit level (ng/kg)
1	Compound feedingstuff, n= 493	0,01 – 0,37	0,75
2	Fish meal, n=177	0,05 – 9,73	1,25
3	Feed material of plant origin, n= 96	0,01 – 0,29	0,75
4	Vegetable oil, n= 31	0,02 – 0,48	0,75
5	Feed for fish, pet food, n=11	0,03 – 0,47	2,25
6	Milk powder, n=12	0,03 – 0,30	0,75
7	Fish oil, n= 4	0,05 – 2,80	6,0
8	Feed materials of animal origin, n=41	0,01 – 0,53	1,0

**Table 2. Number of non-compliant feed samples**

Year	Number of samples analyzed (in %)				
	Tested	CALUX positive	HRGC/HRMS confirmed	false positive	false negative
2004	204 (100)	25 (12)	14 (7)	11 (26)	0
2005	174 (100)	19 (11)	2 (1)	17 (10)	
2006	150 (100)	31 (21)	3 (2)	28 (19)	
2007	88 (100)	3 (3)	2 (2)	1 (1)	
2008	84 (100)	6 (7)	3 (4)	3 (4)	
2009	187 (100)	16 (9)	3 (2)	3 (2)	
Total	887 (100)	100 (11)	27 (3)	63 (7)	



**Figure 1. PCDDs, PCDFs and PCBs congener profiles in contaminated beet pulp pellets (upper) and corn (lower). PCDD, PCDF and dl-PCB content was 1,45 ng WHO-TEQ/kg and 4,43 ng WHO-TEQ/kg respectively.**