# MATERIAL FLOW BASED STRATEGY FOR DIOXIN-LIKE PCB LEVELS IN FEED AND FOOD ACROSS THE EUROPEAN UNION AND DIETARY INTAKE ESTIMATION

Reinhard Joas[1], Alexander Potrykus[1], Rudolf Schott[2], Jamshid Hosseinpour[3], Horst Rottler[3]

[1]BiPRO GmbH, Grauertstr. 12, 81545 Munich, Germany
[2]AFC Consult GmbH, Rauscherstraße 15/14, 1200 Vienna, Austria
[3]Oekometric GmbH, Berneckerstr. 17 – 21, 95448 Bayreuth, Germany

## Introduction

The European Commission follows in its Community Strategy for Dioxins, Furans and Polychlorinated Biphenyls the opinion of the Scientific Committee for Food, that human exposure should not exceed 14 pg WHO-TEQ/kg body weight/week[1]. Several studies have been performed collecting information on the presence of dioxins and dioxin-like PCBs in food and feed[2,3]. However, still major gaps in the current data exist, in particular with regard to dioxin-like PCBs.

Against this background a research project[4] was focused on the collection and analysis of samples in order to generate data on the occurrence of PCBs in food and feed in a systematic way across the European Union. Additionally it was the intention of the project to collect information on sources, contamination of environmental compartments and pathways most likely to lead to the occurrence of contamination levels.

The present abstract is focusing on the European-wide and material-flow based sampling strategy and the resulting dietary intake estimation. For analytical results see [5].

## Materials and methods

To fulfil the objectives of the project two types of material flows have been investigated:

1. the flow of PCBs
2. the flow of fat related to important feed and food components as a major basis for intake and accumulation processes of PCBs

The data for flow 1 lead to major results such as

- relevant sources for contaminations
- contaminations of environmental compartments
- contamination of feedingstuffs and food
- estimation of the dietary intake

Flow 2 mainly serves as a basis to establish a sampling plan and to calculate weekly intakes. Due to the high fat solubility of PCBs the flow of fat allows to establish a sampling plan according to representative criteria with respect to the importance of products and regions. The sampling strategy was based on process related material flow stations (production orientated) and the importance of feed and food components. Accordingly sampling was realised on a representative basis at different levels of the production processes.

About 2,600 individual samples have been collected in 8 regions and for 42 individual types of feed and food products. Analyses have been done on compound samples[5].

With the analytical results of these samples new data and a systematic overview on contamination levels of PCBs for EU member states is available.

| product category | products | samples |
|---|---|---|
| meat and animal fat | 4 | 397 |
| dairy products | 5 | 496 |
| eggs | 1 | 51 |
| fish and fish oil | 3 | 117 |
| cereals | 4 | 296 |
| vegetable oils | 4 | 274 |
| oil seeds | 3 | 125 |
| other plant products | 10 | 352 |
| feedingstuffs, oil cakes, green crop | 7 | 464 |
| bone and blood meal | 1 | 15 |
| sum | 42 | 2,587 |

**Figure 1.** collection of samples

Based on the analytical results and the investigated fat flow a dietary intake estimation has been carried out by the following steps:

- calculation of the EU average WHO-PCB-TEQ level content of all analysed products
- calculation of the EU average consumption of fat per day, capita and product
- calculation of the WHO-PCB-TEQ intake per product, day and capita
- estimation of the WHO-PCB-TEQ intake of products which have not been analysed
- estimation of the total average WHO-PCB-TEQ intake per week and kg bodyweight

**Results and discussion**

Three groups of the tested samples can be qualitatively classified focussing on fat based results:

| | |
|---|---|
| Vegetable oils, oil seeds, eggs and tree nuts | low contamination levels |
| Milk, milk products, meat, meat products | medium contamination levels |
| Fish and fish oil samples | high contamination levels |

As consequences of the analytical results[5] and taking into account available literature, the following theses could be derived:

1. *Importance of fish based ingredients for food products*

Fish based feed and food ingredients do usually significantly contribute to the PCB-TEQ burden of the resulting feed or food product. This can be explained with the high contamination values of fish and

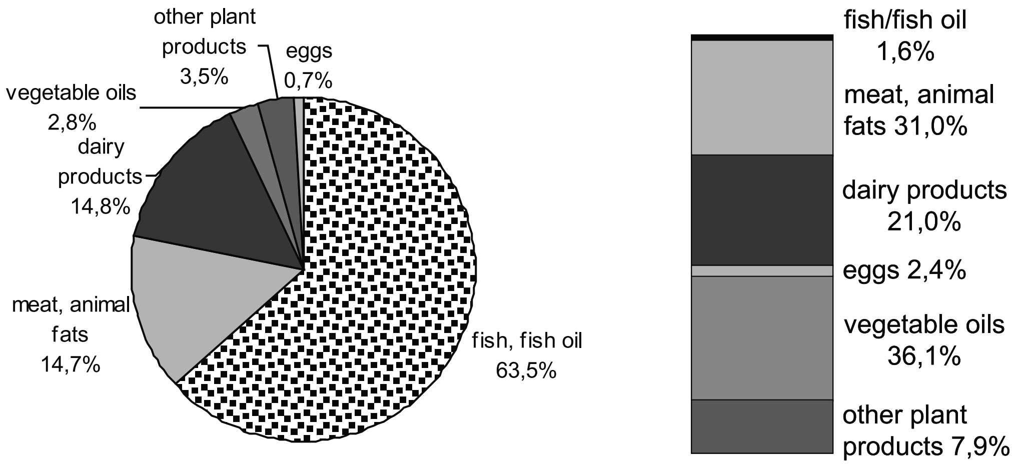


**Figure 2.** contribution to average dietary intake of PCBs and corresponding fat intake

fish products. This is not the case if originally low contaminated or in a secondary processing step decontaminated fish or fish product is used.

*2. Importance of processing and selection of feedingstuff ingredients*

Results from the present study indicate that vegetable oils are equally or slightly less contaminated than oilseeds but some of the oilcakes are higher. This indicates the possible influence of processing in feedingstuff production. Furthermore the origin of feedingstuff is important. This can be shown by the fact, that e.g. fish meal produced from raw material from EU waters is significantly higher contaminated compared to that from the Pacific Ocean [3]. This shows an important influence of the selection of compound feedingstuff ingredients and leads to the thesis, that due to processing and selection processes of plants and plant products the production of feedingstuffs may result in contamination levels below the contamination of natural feed ingredients.

*3. Importance of processing and selection of foodstuff ingredients*

Processing (e.g. cleaning) and selection of food ingredients can influence contamination levels. Due to cleaning and selection processes, products can show altered concentrations after being processed. Accordingly products could be identified showing lower levels after processing than the corresponding raw materials ( e.g. pig meat ranges from 0.24 – 0.38 and the following product pig lard ranges from 0.07 to 0.26 pg PCB-TEQ/g fat; some vegetable oils are slightly less contaminated than corresponding oilseeds) and often following dairy products show lower levels than milk.

The estimated average weekly intake is 14 pg WHO-PCB-TEQ/kg bodyweight ranging from 7 pg to 21 pg WHO-PCB-TEQ/kg bodyweight. It has to be mentioned that the basis for this intake assessment is a production oriented approach based on the analyses of feed and food components at different stations of the material flow. Consequently effects within preparation and consumption of food are not taken into consideration.

Based on the collected samples the following chart shows the estimation for the contribution of important food groups to the average weekly intake of PCB-TEQs:

Compared with the recommendation of the Scientific Committee for Food a maximum weekly intake of 14 pg total WHO-TEQ/kg bodyweight for dioxins and PCBs it can be stated that PCBs contribute significantly to this intake and can even cover the whole tolerable intake. Considering the additional intake of dioxins (ranging from 2.8 to 10.5 pg I-TEQ/kg bodyweight per week3) the dietary exposure exceeds the tolerable weekly intake for a considerable part of the Europeans.

**Acknowledgement**

We wish to thank the European Commission, DG Environment and DG Sanco which funded this project. We also like to thank all institutions and companies that supported the project with samples and information.

**References**

1. European Commission, Communication from the Commission to the Council, the European Parliament and the economic and social Committee, *Community Strategy for Dioxins, Furans and Polychlorinated Biphenyls*, COM(2001) 593 final, 24 October 2001

2. European Commission, DG Health and Consumer Protection: *Opinion of the Scientific Committee on Animal Nutrition on the dioxin contamination of feedingstuffs and their contribution to the contamination of food of animal origin*, adopted on 06.11.2000

3. European Commission, Health & Consumer Protection Directorate-General, Reports on tasks for scientific cooperation; Report of experts participating in Task 3.2.5; *Assessment of dietary intake of dioxins and related PCBs by the population of EU Member States*, 7 June 2000

4. European POPs Expert Team (EPET), *Preparatory actions in the field of dioxin and PCBs,* on behalf of the European Commission, Brussels, April 2002

5. Hosseinpour J., Rottler H., Joas R., Potrykus A., Schott R. (2002), Organohalogen Compounds, submitted