OCCURENCE DATA IN FOOD AND HUMAN EXPOSURE ASSESSMENT TO PCDD/Fs AND DL-PCBs

CONTAM Opinion on dioxins and DL-PCBs in food and feed

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European Food Safety Authority

STARTING POINT – OCCURRENCE DATA

- Call for annual data collection of chemical contaminant occurrence data in food and feed among the member states
- Sampling year cut-off: **January 2010 – December 2016**
- **824,905** analytical results of **35,252** samples were available
- Samples are submitted according to **FoodEx** classification and description system
- Samples analyzed for
  - all **29 congeners**, or
  - the **17 PCDD/Fs**, or
  - the **12 DL-PCBs**, or
  - Only some of the congeners

DATA CLEANING (1)

Corrections were made in connection with:

- Misreported analytical results, analytical methods, measurement unit errors
- Mistakes in food classification (FoodEx)
- Missing information on 1) how the results were expressed, 2) %fat or %moisture
- Correction of the data to the expression as set in the legislation:

FOOD

Foods of animal origin (excluding offals, fish meat): **fat weight**

All the other food samples: **whole weight**

FEED

All feeds: **88% dry matter**

DATA CLEANING (2)

96,937 (12%) analytical results were excluded of the total due to:

- Samples were analyzed with inappropriate analytical method (6%),
- Samples taken with suspect sampling (3.9%), or prescreened with CALUX method (0.9%),
- Confirmed outliers (0.1%),
- Duplicates (0.3%),
- Expression of results was not in line with the legislation and the correction was not possible (0.4%),
- Samples were coming from Total Diet Studies (TDS) (0.2%).

DATA MANAGEMENT AND VALIDATION

- Extraction of **Food** and **Feed** samples

- Selection of samples where **all** congeners were available for the groups of 17 PCDD/Fs, 12 DL-PCBs, or all 29 PCDD/Fs & DL-PCBs.

24,987 food samples (for **20,806** with all the 29 congeners)

2,442 feed samples (for **2,153** with all the 29 congeners)

Application of WHO_{2005}-TEF

weighted sum of 12, 17 or 29 congeners for each sample

ANALYTICAL PERFORMANCE CRITERIA SET IN THE LEGISLATIONS

- **17 congeners:** sample excluded if total LOQ > **1/5 Maximum Limit (ML)**
- **12 congeners:** sample excluded if total LOQ > **1/3 Action Limit (AL)**
- **29 congeners:** sample included only if the two criteria above are met

Occurrence data on food after the appliation of the criteria

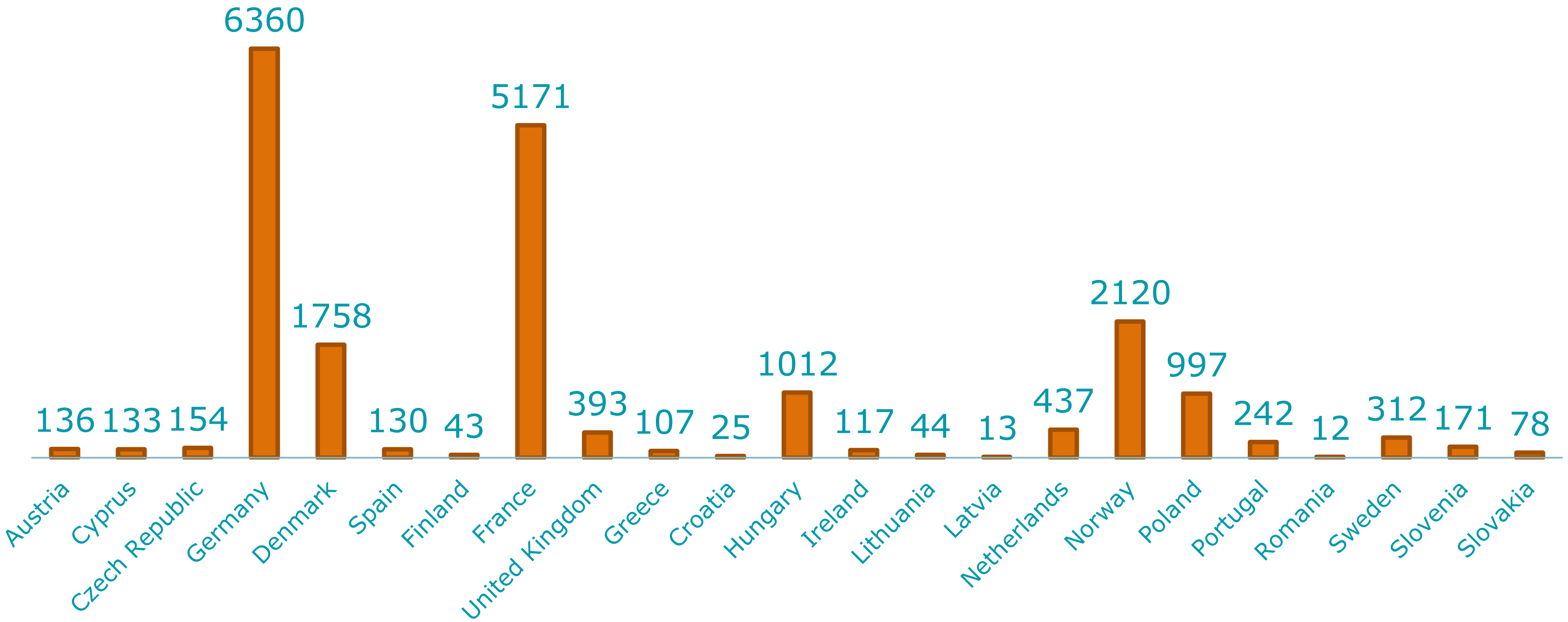
17 PCDD/Fs
20,273 samples complied with the criterion

12 DL-PCBs
22,974 samples complied with the criterion

PCDD/Fs and DL-PCBs:
19,965 samples complied with **both** criteria

FOOD SAMPLES FROM THE PERIOD OF 2010-2016

Sampling countries of the 19,965 food samples with all 29 congeners



OCCURRENCE 29 CONGENERS (17 PCDD/FS + 12 DL PCBS) IN FOOD

Top 5 food categories with the **highest mean contamination for samples in whole weight and fat weight** (pg WHO_{2005}-TEQ/g) with a minimum of 6 samples

Whole weight			
Food category	**N samples**	**Mean (LB)**	**Mean (UB)**
Fish offal (unspecified)	911	21.68	22.25
Eels (Apodes)	258	9.17	9.21
Barbel (Barbus)	39	6.01	6.02
Whitefish (Coregonus)	53	4.46	4.46
Sprat (Sprattus sprattus)	91	3.43	3.47
Fat weight			
Pheasant meat (Phasianus colchius)	11	8.29	8.55
Horse, asses, mules or hinnies meat	80	6.23	6.26
Boar meat (wild pig) (Sus scrofa)	207	5.28	5.45
Venison meat (Cervus spp.)	148	3.51	3.63
Goose eggs	10	3.54	3.60

See more details in (Annex II, Table 2 A,B,C)

COMPREHENSIVE CONSUMPTION DATA

The EFSA Comprehensive European Food Consumption Database contains data:

- 24-hour recall or dietary record method
- data collected at individual level
- most recent data within each country
- random sample at national level
  - different age classes, from infants to elderly
  - special population groups
- All data classified according to FoodEx

FOOD CONSUMPTION DATA

Age class	Age range (years)	Number of surveys*	Number of countries*
Infants	0 – 1	6	6
Toddlers	1 – 3	10	9
Children	3 - 10	18	15
Adolescents	10 - 18	17	14
Adults	18 - 65	17	16
Elderly	65 - 75	14	13
Very elderly	> 75	12	12
Special population group		2	2




* surveys with more than one day per subject

EXPOSURE ASSESSMENT IN FOOD: GENERAL CONSIDERATIONS

- **Chronic exposure assessment only**
  - Food consumption and body weight data were used at the individual level
  - Mean occurrence data (pooled EU data) were used for all surveys
  - In case of samples in fat weight, the fat content of the food consumed was estimated using the % fat from the country specific composition table in the Comprehensive Database. When the % fat was missing the random hot deck imputation technique was used to fill the gaps.
- **Dietary exposure estimated using two datasets:**
  - Assessment group A: 29 congeners (17 PCDD/Fs + 12 DL-PCBs)
  - Assessment group B: 17 PCDD/Fs

GROUPING THE OCCURRENCE AND CONSUMPTION DATA

Aim: to match occurence and consumption data for the assessment and keep the assessment accurate and reliable.

The grouping used as a basic reference the second level of FoodEx system but a more detailed level was often used to reduce over- and underestimation, e.g.:

individual fish species (3rd level FoodEx) vs. fish meat (2nd level FoodEx)

EXPOSURE RESULTS TO THE 29 CONGENERS (Assessment Group A)

Age class	Mean dietary exposure (pg WHO_{2005}-TEQ/kg bw per day)					95th percentile dietary exposure (pg WHO_{2005}-TEQ/kg bw per day)				
		Minimum		Maximum			Minimum		Maximum	
	N	LB	UB	LB	UB	N	LB	UB	LB	UB
Infants	6	0.44	0.66	1.16	1.42	5	1.38	1.89	2.81	3.28
Toddlers	10	0.68	0.88	2.12	**2.57**	7	2.02	2.38	5.05	5.94
Other children	18	0.56	0.71	2.01	2.45	18	1.52	1.73	6.02	**6.63**
Adolescents	17	0.3	0.39	1.27	1.5	17	0.91	1.07	4.06	4.34
Adults	17	0.42	0.49	1.11	1.3	17	0.94	1.18	2.87	3.11
Elderly	14	0.39	0.52	1.27	1.37	14	0.76	0.93	3.61	3.82
Very elderly	12	0.43	0.57	1.21	1.32	9	0.84	1.04	2.55	2.78

EXPOSURE RESULTS ON THE 17 PCDD/Fs (Assessment Group B)

Age class	N	Mean dietary exposure (pg WHO_{2005}-TEQ/kg bw per day)				N	95th percentile dietary exposure (pg WHO_{2005}-TEQ/kg bw per day)			
		Minimum		Maximum			Minimum		Maximum	
		LB	UB	LB	UB		LB	UB	LB	UB
Infants	6	0.18	0.35	0.47	0.7	5	0.57	0.95	1.06	1.44
Toddlers	10	0.28	0.45	0.92	**1.28**	7	0.67	1.02	1.76	**2.42**
Other children	18	0.21	0.34	0.89	1.25	18	0.47	0.72	1.75	2.27
Adolescents	17	0.11	0.17	0.48	0.68	17	0.3	0.43	1.3	1.62
Adults	17	0.14	0.2	0.36	0.51	17	0.41	0.5	0.97	1.12
Elderly	14	0.19	0.26	0.42	0.52	14	0.35	0.52	1.29	1.37
Very elderly	12	0.2	0.27	0.39	0.5	9	0.38	0.55	0.87	1.03

RESULTS ARE IN LINE WITH PREVIOUS DATA REPORT (2012)

„Toddlers and other children were the most exposed groups, with an average exposure for the sum of dioxins and DL-PCBs of between **1.08** and **2.54** pg TEQ_{WHO05}/kg bw/day and 95th percentile exposure between **2.6** and **9.9** pg TEQ_{WHO05}/kg bw/day."

EFSA (2012). Update of the monitoring of levels of dioxins and PCBs in food and feed. DATA Report.

New results:

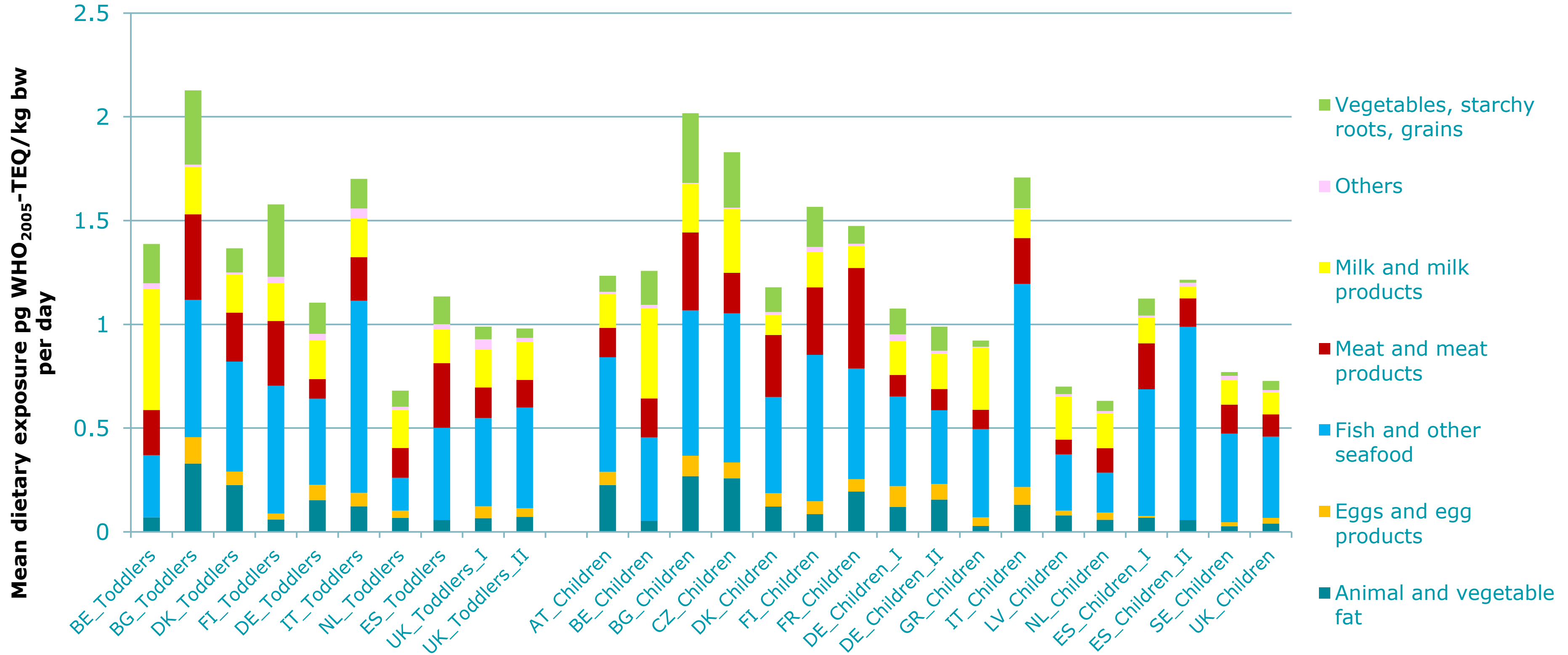
Most exposed groups are still toddlers and children

- Average exposure: between **0.56** and **2.57** pg WHO_{2005}-TEQ/kg bw/day
- 95th percentile exposure: between **1.52** and **6.63** pg WHO_{2005}-TEQ/kg bw/day

MAIN CONTRIBUTORS FOR BOTH ASSESSMENT GROUPS

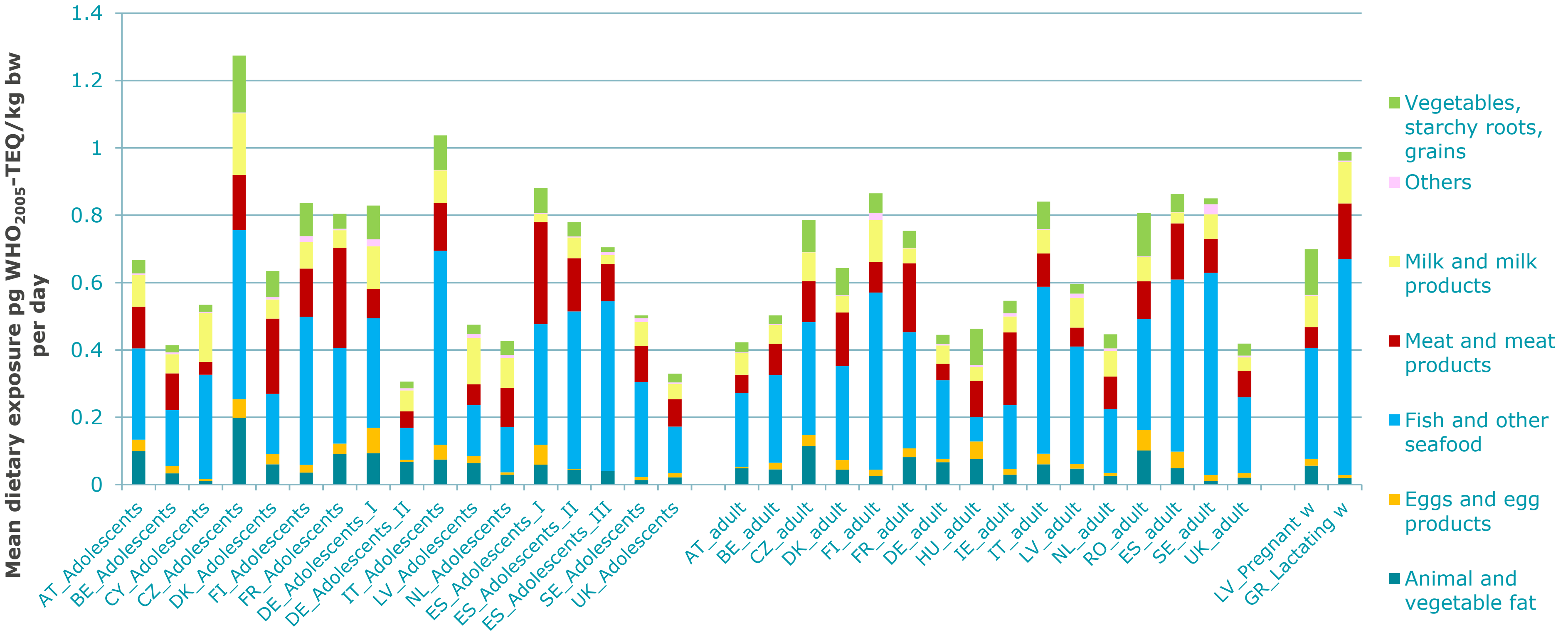
- In all population groups:
  - Fatty fish, unspecified fish meat, fish products
  - Butter
  - Cheese
  - Livestock meat (includes consumption of Beef meat, Goat / kid meat, Horse, asses, mules or hinnies meat, Mutton / lamb meat, Pork / piglet meat, Rabbit meat, Veal meat, n.s. livestock meat)

MAIN CONTRIBUTING FOOD GROUPS FOR TOODLERS AND CHILDREN



Contributors of exposure of the PCDD/Fs and DL-PCBs LB exposure (Assessment group A) among different countries/surveys. Further details: Annex II, Table 6 A-B

MAIN CONTRIBUTING FOOD GROUPS FOR ADOLESCENTS AND ADULTS

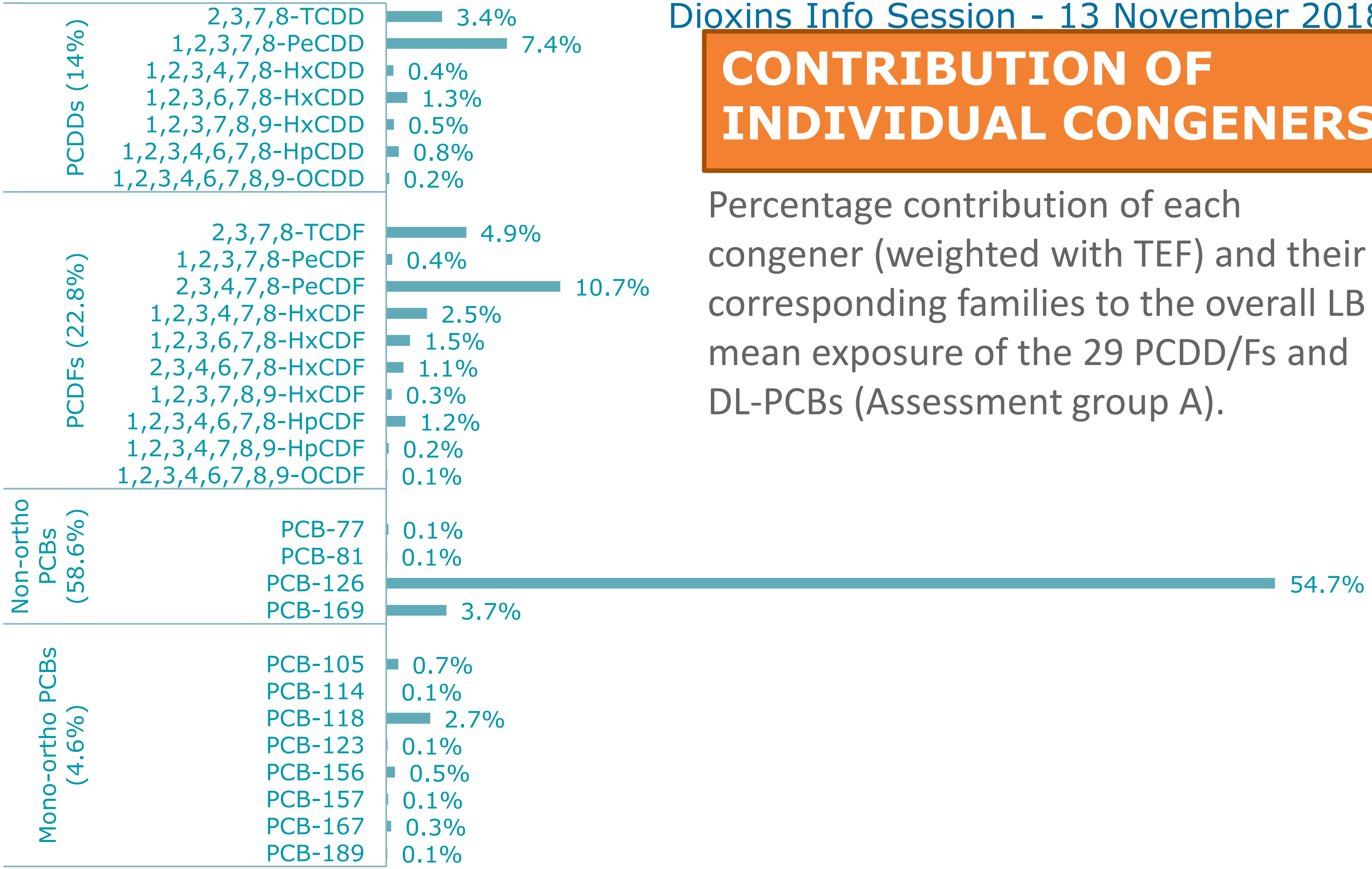


Contributors of exposure of the PCDD/Fs and DL-PCBs LB exposure (Assessment group A) among different countries/surveys. Further details: Annex II, Table 6 A-B

SENSITIVITY ANALYSIS ON EXPOSURE FROM SALMON

- EUROSTAT: large majority of salmon/trout on the EU market is farmed.
- To assess the influence of wild caught salmon/trout in the occurrence data, the exposure was calculated both including and excluding salmon and trout reported as wild caught
- The calculated decrease in the mean exposure ranged from 0 to 10% (similar for LB and UB). At the 95th-percentile exposure, the decrease in the LB exposure ranged from 3 to 23% (at the UB from 3 to 13%)
- The CONTAM Panel considered this uncertainty small, however the impact on exposure can be large when fatty fish, e.g. from the Baltic Sea is regularly consumed

CONTRIBUTION OF INDIVIDUAL CONGENERS



Percentage contribution of each congener (weighted with TEF) and their corresponding families to the overall LB mean exposure of the 29 PCDD/Fs and DL-PCBs (Assessment group A).

POINTS TO HIGHLIGHT (1): INTERNATIONAL CONCENTRATION LEVELS

Chemical concentration data from different countries are often pooled to derive international summary representative concentrations for use in multi-national dietary exposure calculations.

The use of chemical occurrence data at European vs. national level in dietary exposure assessments: A methodological study

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ABSTRACT

A typical EFSA approach to assess dietary exposure is to combine data from national consumption surveys with chemical occurrence data that have been pooled across the EU Member States (pooled approach). This approach was compared to the case where occurrence data were stratified by country and used for food categories where national data were abundant (semi-pooled approach), using cadmium as a case study. Some differences in estimated dietary exposure were observed between the pooled and semi-pooled approach. They were explained by differences, between the national and the European occurrence data, with respect to (1) contamination values and (2) sample proportions of food items classified in the food categories the assessment was based on. The latter aspect highlighted the sensitivity of the approach of directly aggregating monitoring data into food categories. Both the pooled and semi-pooled approach tended to be conservative relative to approaches used at national level. This appears to be attributed to differences in the way the available occurrence data is aggregated. Refinement of the studied methodologies would include a better separation of the food items with high concentration from those with low concentration.

By doing this it is assumed that it is a global market and concentrations from commodities sampled in one country are representative of the others.

POINTS TO HIGHLIGHT (2): METHODOLOGY

- **Chronic exposure**: deterministic approach by using the mean occurrence of pooled EU data and individual consumption data and body weight from the Comprehensive Database.
- Use of food consumption data covering only a few days to estimate high percentiles chronic exposure could result in an overestimation with the methodology described in the opinion.
- **Statistical models:**
  - Scientific project coordinated by RIVM and funded by EFSA in 2010
  - Data should be collected on non-consecutive and independent days → not always respected
  - requires lognormal distribution of the exposure → this should have been assessed for almost 100 population groups

Publications:

Statistical modelling of usual intake (2010), A European tool for usual intake distribution estimation in relation to data collection by EFSA (2012), A comparison by simulation of different methods to estimate the usual intake distribution for episodically consumed foods (2012)