Human Levels and Trends

Olaf Päpke and Arnold Schecter

This session is comprised of 23 presentation covering levels and trends of persistent organic pollutants. The presentations cover mainly PCDDs/Fs and PCBs as well as a number of other persistent organic pollutants or POPs such as DDTs, HCHs, HCB, polybrominated diphenyl ethers (PBDEs) flame retardants and others. The session consists of 8 oral presentations and 15 poster presentations from scientists representing 22 countries including Australia, Belgium, Brazil, Canada, China, Denmark, the Faeroe Islands, Finland, Germany, Greece, Indonesia, India, Italy, Japan, Korea, Malaysia, Norway, Sweden, Taiwan, United Kingdom, and USA. The various materials analysed include human milk, blood and placenta and various types of food.

Information on time trends for brominated and chlorinated compounds are presented in 6 papers.

For **Brazil**, Krauss et al. report on organochlorine pesticides in human milk. Comparing results for milk collected in 1992 and 2000, only total DDTs show a distinct decline from 1,706 to 618 ng/g lipid.

For **Sweden**, Darnerud et al. describe a decrease of PCB 28, 153 and DDE in human milk between 1996 and 2003. The decline was observed at between 7 and 12 % per year.

Schecter and colleagues reported on 2 opposite time trends for the **United States** when looking at pooled blood samples collected in 1973 and 2003. PBDEs showed strong increase in concentration while dioxins and dioxin-like PCBs declined strongly during the time span of 30 years.

Similar observation are made by Fängström et.al. for human milk from the **Faroe Islands**. The milk samples, collected at three time points between 1987 and 1999, showed strong increase for total PBDEs from 1.5 to 7.2 ng/g lipid while PCBs showed a moderate decline between 2.3 and 1.8 µg/g lipid.

Temporal changes of PCDDs/Fs, PCBs and organochlorine (OC) pesticides in human milk from Murmansk, **Russia** and Tromsö, **Norway** are presented by Polder et al. They analyzed samples collected in Murmansk and in Tromsö in 1993 and 2000. The observed decrease, given in %, is reported as follows:

Total OCs	Murmansk: 52 %	Tromsö: 34 %
$TEQ_{PCDDs/Fs}$	Murmansk: 42 %	Tromsö: 49 %

Trends in the dioxin and PCB content of the **United Kingdom** diet are presented by Fernandes et al. Dietary exposure of the UK population to dioxins and PCB s was monitored by analysis of food group samples from the Total Diet Studies (TDS), collected in the UK as part of the TDS from 1982, 1992, 1997 and 2001. The authors pointed out that the concentration for all food groups declined over the 19 year period covered by the surveys. The reduction in TEQ_{PCBs} was observed to be significantly lower than that observed for the dioxins for the various food groups – on average less than half the reduction in measured levels of dioxins.

Interesting results are provided by Ohta et al. They reported on values for PBDEs, TBBPA, TBPs, PCDDs/Fs and especially for PXDDs/Fs (X = Cl/Br) and PBDDs/Fs in **Japanese** human milk. In all cases, values found in primiparae were significantly higher compared to values in multiparae. Even for the PXDDs/Fs and PBDDs/Fs all composite samples showed positive findings. The distribution

for PCDDs/Fs, PXDDs/Fs and PBDDs/Fs was found on TEQ basis at about 80 %, 17 % and 3 % respectively.

Wittsiepe/Fürst et al. provide results for recent contamination of PCDD/F and dioxin-like PCBs in blood and milk from 169 **German** mothers. The investigation demonstrates the current background levels found in Germany, make a contribution for the assessment of pre- and postnatal exposure of infants and shows correlation between the two matrices. A good correlation between lipid based PCDD/F and PCB levels in blood and milk was found for most congeners. Depending on the chlorination and molecular weight different distributions in the two matrices could be found for some congeners. E.g. OCDD was found to be about 3 times higher in blood compared to milk. Based on $TEQ_{(PCDDs/Fs\ and\ PCBs)}$ nearly identical values were found in blood and milk: 26.4/28.4 and 26.4/27.3 (median/arithmetic mean) respectively.

A similar study has been performed by Harden/Müller et al. for **Australia**. They analysed 96 pooled blood samples originating from a total of 9090 (!) individual samples, and 17 pooled human milk samples were prepared from a total of 157 individual milk samples. Blood samples were obtained according to stratification criteria such as age, gender and geographical areas. Overall the levels in the Australian population are found to be very low by international standards and comparable with those observed in New Zealand population. The mean and median levels of dioxin-like compounds expressed in $TEQ_{PCDDs/Fs\ and\ PCBs}$ values for all pooled samples were 10.9 pg TEQ/g lipid and 8.3 pg TEQ/g lipid respectively. For males and females the mean levels were 10.4 pg TEQ/g lipid and 11.5 pg TEQ/g lipid respectively.

Patterson et al. report results for age-specific reference range levels using TEQ and TCDD data of 588 individuals from four studies for 4 age groups from the **United States.** The authors cannot exclude that a number of limitations may affect the results including decline of dioxin values during the period of sampling, change of methodology, and change of method detection limit during collection time of sampling (1996-2001).

Rescue workers, including fire fighters present at the New York City World Trade Center (WTC) following the September 11 terrorist attacks, were exposed to large quantities of dust, smoke and fumes from the collapse and fire. Dahlgren et al. analysed blood samples collected several years after the incident from 11 workers who all volunteered for work the day of the collapse and for several days afterwards. The concentrations reported for most of the rescue workers - with some notable exceptions with apparent exposure - were not usually elevated at the time analyzed.

Concentrations of PBDEs in human milk, blood and in food from the **United States** are reported by Schecter et al. The levels of PBDEs in recently collected 52 milk samples of U.S. mothers range between 6.2 and 419 ng TEQ/g lipid at a median of 34 ng/g. These values are 10 to 100 fold higher than in European mothers. PBDE values of 29 blood samples are quite similar between 5.5 an 351 ng TEQ/g lipid, median was found at 31 ng/g. In this series women have higher PBDE levels than men. The authors present detailed information on the contamination of US- food from a US market basket survey and the resulting daily intake for various age groups showing highest intake in nursing infants. In passing, congener profiles in human milk, blood, and food are compared with environmental sample profiles from carpet sweeping and computer case wipings.

A variety of contaminants like perfluoroalkylated compounds, PCBs, PCDDs/Fs and organochlorine pesticides (OVP) in **Belgium** serum are reported by Van Wouwe et al. Mean values for selected components (in ng/g lipid) are PFOS: 2269, total PCBs: 505, DDE: 365, HCH: 23. Determination of PCDDs/Fs were performed by GC/HRMS and CALUX. A good correlation was found for the TEQ values at 26.1 and 26.9 pg/g respectively.

The first study on dioxins and dioxin-like PCBs for the **Greek** population is presented by Leondiadis et al. They analyzed 62 blood and 8 milk from Greek individuals, mainly for PCBs. The authors could demonstrate regional differences for PCB concentration when looking at the Athens and a rural area. In general, the TEQ values for blood (n=10) and milk (n=8) are relatively low at 11.3 pg TEQ/g lipid and 13.8 pg TEQ/g lipid respectively.

Data from a comparison of hexachlorobenzene residues in placentas from **Finland** and **Denmark** are presented by Shen et al. Generally the HCB levels in Danish samples are found to be higher than in the Finnish samples. Analyses are planned on associations or causal relationships of male urogenital malformations with the exposure levels in future studies.

La Rocca et al. analyzed levels of PCBs, DDT, DDE, and DDD in **Italian** Human blood samples. The aim of the study was to increase the present understanding about the distribution of PCBs (in total 60 congeners were measured) in human whole blood.

Comparison of congener concentrations and profiles of PCBs between 21 Yu-cheng children and a potential food source are submitted by Lung et al., **Taiwan**. The authors observed a remarkable similarity between the PCB pattern observed in Yu-cheng children and that of a potentially significant PCB source, a fish species tilapia, a highly popular local cultured and consumed fish.

Persistent organic pollutants in human breast milk collected in 2 northeastern **China** provinces Dalian and Shenyang (n = 20 samples each) were reported by Kunisue et al. DDTs and HCHs were predominant in milk from both provinces. Levels were reported at 2100 and 870 ng/g lipid for DDTs and 1400 and 550 ng/g lipid for HCHs respectively. These levels were 1 – 2 orders of magnitude higher than other POPs. Means value for $TEQ_{PCDDs/Fs\ and\ PCBs}$ originating from 5 pools (n = 5 each pool) are found at 7.7 pg/g lipid.

Three presentations looked at the levels of organochlorines in **Indonesia, Malaysia** and **India**. The first data for human breast milk from **Malaysia** are reported for dioxins, PCBs, and organochlorine pesticides by Sudaryanto et al. The authors analyzed 9 samples for dioxins and dioxin-like PCBs and 17 for PCBs and OC- pesticides. Mean values for dioxins and dioxin-like PCBs are at 14 pg TEQ/g lipid. Highest concentration were found for DDTs at 1600 ng/g lipid, other OCs are reported at 1 or 2 order of magnitudes lower.

Data on geographical distribution, accumulation kinetics, and infants' health risk of organochlorines in human breast milk from **Indonesia** is given by Sudaryanto et al. The 55 samples are from 4 different areas (coastal area, agricultural, dumping site and city/suburban). Again, DDT and its metabolites show the highest concentration of all OCs measured. Mean values for DDTs of the 4 groups range between 630 and 1300 ng/g lipid. The highest concentration for DDTs measured in an individual from the agriculture group was reported at 15,000 ng/g lipid.

23 individual human milk samples from Ahmedabad, **India** were analyzed by Kashyap et al for PCDDs and PCDFs. The concentration found ranges between 2.5 and 14.2 pg TEQ/g lipid at a mean of 6.2 pg/g.