THE FATE OF SELECTED ORGANIC COMPOUNDS IN THE ENVIRONMENT PART VI. PCBs, PCDDs AND PCDFs IN AMBIENT AIR IN CZECHOSLOVAKIA

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We have undertaken a study aimed at determining polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) in the ambient air in Czechoslovakia. This study is a part of Project TOCOEN (Toxic Organic COmpounds in the ENvironment) /1/ and will provide baseline atmospheric concentrations of these compounds in various parts of Czechoslovakia. It is necessary for understanding the fate of these compounds in the environment (this is a basic idea of the Project).

All samples were collected at three sites in Czechoslovakia. These sites are described in Figure - sites 1, 3 and 7. The sites can be described as follows:

- TOCOEN model area no. 1 - represent urban area - Brno - residental and industrial area, model site is surroundings municipal waste incinerator,
- TOCOEN model area no. 3 - rural (background) area - Košetice - south Bohemia, station GEMS (Global Emission Monitoring System),
- TOCOEN model area no. 7 - suburban - Chropyně - a small town with a plastic factory with plastic waste incinerator.

More details are described in Table 1.

Special precleaned polyurethane foam (PUF) was used as adsorbent. The sampled volume of air and sampling date are described in Table 1 also. The PUFs were extracted in Soxhlet extractor using toluene for 12 hrs, evaporated, 13C-la-

labelled surrogates of PCBs, PCDDs and PCDFs were added to the residues, and residues were cleaned-up by used of combined clean-up columns(H2SO4, NaOH, AgNO3), column were eluted with n-hexane and eluates were applied to the second combined clean-up column with charcoal and to the third with ICN Alumina B Super I. The first fraction (15 ml of 2% DCM in n-hexane) was eluted for the determination of PCBs (after clean-up on the column with florisil). The second fraction (12 ml of 50% DCM in n-hexane) was used for the determination of PCDDs and PCDFs.

For the separation of PCBs a capillary column PONA (25 m x 0.25 I.D., He 110 kPa) was used, splitless techniques, temperature program: 130 ^{o}C (0.5 min.)/ 30 ^{o}C.min^{-1}/190 ^{o}C/2.5 ^{o}C.min^{-1}/290 ^{o}C. Characteristic ions of ICB-OCB were detected by mass-spectrometer HP 5985A in SIM mode (open-split interface). For the separation of PCDDs and PCDFs a capillary column HP-17 (25 m x 0.2 mm I.D., He, 110 kPa) connected directly to the mass selective detector HP 59708 was used. Temperature program was 150 ^{o}C/30 ^{o}C.min^{-1}/230 ^{o}C/1.5 ^{o}C. min^{-1}/275 ^{o}C, splitless technique.

With one exception no isomer specific analysis were made but the total levels of all isomers in congener groups were determined. Most of the congeners were below the detection level. The samples from Brno and Chropyně were not suitable for this measurement, because the sampling volumes were low. The total levels of PCDDs and PCDFs (and PCBs also) reported in samples from Košetice described the Czechoslovak background of PCBs, PCDDs and PCDFs pollution. We found significant levels of PCBs in samples from all sampling sites (but below Czechoslovak recommended hygienic limit - 170 ng.m(-3)), the highest levels were found in the surroundings Brno MWI. The results of these measurements are given in Table 2-4. The results of 16 the highest toxic isomer specific analysis of high-volume sample from Košetice are given in Table 5.

REFERENCES

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Table 1: Characteristics of sampling sites

Number of sample	TOCOEN number of site	Sampling site	Date Volume/m3/
Brno - surroundings of Municipal Wste Incinerator (MWI)			
1	1/6	Street Gajdošova-urban part of town, industrial part with high density of traffic, 1 km from MWI (NW)	08/03/89[a] 27.36
2	1/7	Zábrdovice-swimming pool in town, urban part, industrial, 2.5 km from MWI (NW)	08/03/89[a] 24.49
3	1/8	Neighbourhood Slatina, 1 km from MWI (SSE)	09/03/89[a] 14.77
4	1/9	Šlapanice-small town 4 km from MWI (SE)	09/03/89[a] 18.43
5	1/6	Street Gajdošova	05/07/89[b] 57.15
6	1/7	Zábrdovice	05/07/89[b] 63.30

Table 1: continued

Number of sample	LOCDEN number of site	Sampling site	Date / Volume/m3/
	Chropyné - small town in Central Moravia, surroundings of Technoplast (plastic factory) (TC)		
7	7/1	Chropyně-farm, 2 km from TC (SE)	05/09/89[c] / 100.11
8	7/1	Chropyně-farm	06/09/89[c] / 91.92
9	7/2	Chropyně, near the townhall, centre of town, 1 km from TC (WWS)	06/09/89[c] / 101.27
	Košetice - Station GEMS, South Bohemia (GEMS)		
10	3/1	Area of Station GEMS, Košetice	16/03/89 / 325
11	3/1		08-09/06/89 / 612.5
12	3/1		18-21/09/89 / 1675
13	3/1		22-27/01/90 / 4025

Table 2: Levels of PCBs in ambient air at selected sites of Czechoslovakia

Number of sample	Levels of PCBs /ng.m^{-3}/ TrCB	TCB	PeCB	HeCB	HpCB	OCB	ΣPCBs
			Brno - surroundings of MWI				
1	<0.05	2.2	2.2	8.3	2.0	0.2	14.9
2	<0.45	13.7	1.7	7.1	0.6	<0.2	23.1
3	<0.15	5.0	1.8	9.4	2.1	<0.15	18.3
4	<0.70	2.5	3.5	8.2	<1.4	<1.6	14.2
5	NA	1.0	3.0	3.8	<0.2	ND	7.6
6	NA	0.2*	5.2	4.6	0.9	ND	10.9
			Chropyně - surroundings of TC				
7	NA	NA	1.94	1.67	<0.13	<0.1	3.61
8	NA	NA	3.0	2.12	<0.2	<0.17	5.12
9	NA	NA	2.55	<0.07	<0.05	<0.03	2.55
			Košetice - surroundings of GEMS				
10	<0.003	0.2	0.4	0.8	<0.005	<0.007	1.4
11	NA	NA	0.23	0.43	<0.01	ND	0.66
12	NA	0.02	0.29	0.28	<0.01	<0.01	0.59
13	NA	0.037	0.110	0.050	0.007	0.001	0.204

Table 3: Levels of PCDDs in ambient air at selected sites of Czechoslovakia

Number of samples	Levels of PCDDs /pg.m^{-3}/ TCDD	PeCDD	HeCDD	HpCDD	OCDD	∑PCDDs
	Brno - surroundings of MWI					
1	< 4	< 5	< 30	< 10	< 9	ND
2	< 2	< 60	NA	< 70	< 9	ND
3	< 9	< 20	< 90	< 40	< 50	ND
4	< 5	< 10	< 70	< 30	< 30	ND
5	< 7	< 9	< 13	< 48	< 530	ND
6	< 4	< 6	< 9	< 28	< 110	ND
	Chropyně - surroundings of ICH					
7	< 1.4	< 0.8	< 1.4	< 1.4	3.5	3.5
8	< 0.8	< 0.6	< 1.2	< 1.7	5.0	5.0
9	< 0.8	< 0.7	< 1.2	< 1.3	4.3	4.3
	Košetice - surroundings of GEMS					
10	< 0.5	< 2	< 5	< 4	< 4	ND
11	< 0.2	< 0.5	2.1	3.9	8	6.0
12	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	0.2

Table 4: Levels of PCDFs in ambient air at selected sites of Czechoslovakia

Number of samples	Levels of PCDFs /pg.m^{-3}/ TCDF	PeCDF	HeCDF	HpCDF	OCDF	∑PCDFs	∑PCDD+PCDF
1	< 4	< 5	< 30	< 10	< 9	ND	ND
2	< 2	< 60	NA	< 70	< 9	ND	ND
3	< 9	< 20	< 90	< 40	< 50	ND	ND
4	< 5	< 10	< 70	< 30	< 30	ND	ND
5	< 7	< 9	< 13	< 48	< 530	ND	ND
6	< 4	< 6	< 9	< 28	< 110	ND	ND
7	< 1.2	< 0.8	< 1.4	< 1.4	< 2.2	ND	3.5
8	< 0.6	< 0.6	< 1.2	< 1.7	< 2.6	ND	5.0
9	< 0.8	< 0.7	< 1.2	< 1.3	< 3	ND	4.3
10	< 0.5	< 2	< 5	< 4	< 4	ND	ND
11	< 0.2	< 0.5	2.9	2.6	< 8	5.5	11.5
12	< 0.2	< 0.1	< 0.2	< 0.2	< 0.3	ND	0.2

Table 5: Levels of PCDDs and PCDFs in sample of ambient air from Košetice (22-27/01/90)

Compounds	/pg.m^{-3}/	Compounds	/pg.m^{-3}/	Compounds	/pg.m^{-3}/
2378-TCDD	0.45	2378-TCDF	0.02	OCDD	0.47
Other TCDD	0.03	Other TCDF	0.67	1234678-HpCDF	2.01
12378-PeCDD	0.08	12378-PeCDF	0.16		
Other PeCDD	0.02	23478-PeCDF	0.08	1234789-HpCDD	0.43
123478-HeCDD	0.03	Other PeCDF	0.86		
123678-HeCDD	0.03	123478-HeCDF	0.22	Other Hp-	1.09
123789-HeCDD	0.03	123678-HeCDF	0.18	OCDF	9.06
Other HeCDD	0.03	123789-HeCDF	0.03	PCDDs	1.17
1234678-HpCDD	0.08	234678-HeCDF	0.12	PCDFs	15.58
Other HpCDD	0.06	Other HeCDF	0.70	=Eqv.2378	0.62