Organohalogen Compounds, Volume 61, Pages 518-521 (2003)

REGIONAL TRENDS OF POPs IN EUROPEAN AMBIENT AIR

Ivan Holoubek[1], Eva Brörström-Lundén[2], Jan Duyzer[3], Victor Shatalov[4], Jana Klánová[1], Jiří Kohoutek[1]

[1] RECETOX - TOCOEN & Associates, Kamenice 126/3, 625 00 Brno, Czech Republic
[2] IVL Swedish Environmental Research Institute, PO Box 47086, S-402 58 Göteborg, Sweden
[3] TNO MEP, P.O.Box 342, 7300 AH Apeltoorn, Netherlands
[4] Meteorological Synthesizing Centra - East of EMEP, Architektor Vlasov Str. 51, 117 393 Moscow, Russia

Introduction

Air is an important transport medium for PTS in general. Reporting ambient air concentrations reflects the concentration during the sampling period but, due to rapid transport and fast mixing of pollutants in air, PTS concentrations will change quite rapidly

Heavy metals and persistent organic pollutants (POPs) were included in EMEP's monitoring programme in 1999. However, by 1995, co-operation concerning heavy metals and POPs between EMEP and other international programs was extended. This co-operation included the establishment of a database and collection of already available data on POPs among the participants. A number of countries have been reporting POPs within the EMEP area in connection with different national and international programmes such as HELCOM, AMAP, OSPARCOM, MEDPOP.

Methods and Materials

Few of the sites have reported data for POPs to date (Table 1). The stations are generally located distant from local emission sources in order to be representative for a larger region (Figure 1).

Table 1: List of monitoring stations included in the POP data base

Country	Station codes	Station name	Location		Height above sea
			Lat.	Long.	(m)
Belgium	BE0004R	Knokke	51º21'N	3º20'E	0
Czech Republic	CZ0003R	Kosetice	49º35'N	15º05'E	534
Iceland	IS0091R	Stórhöfdi	63º24'N	20º17'W	118
Ireland	IE0002R	Turlough Hill	53º02'N	6º24'W	420
Netherlands	NL0009R	Kollumerwaard	53º20'N	6º17'E	0
Norway	NO0042G	Spitsbergen, Zeppelinfjell	78º54'N	11º53'E	474
	NO0099R	Lista	58º06'N	6º34'E	13

Table 2: General information about sampling and analysis of POPs in air (1999)

Country	Sites	POPs	Sampling period	Sampler	Analytical methods
Czech. Rep	CZ0003R	PAHs, PCBs, DDTs, HCHs, HCB	24 hrs every week	High volume	GC-MS
Iceland	IS0091R	PCBs, pesticides	15d	High volume	
Norway	NO0042G	PAH, pesticides, HCHs, HCB, PCBs	48h	High volume	GC-MS
	NO0099R	α-HCH, γ-HCH, HCB	48h	High volume	GC-MS

GC-MS: Gas chromatography with mass spektrometry

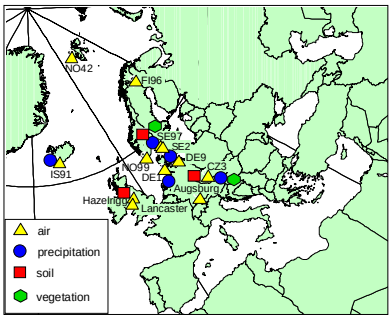


Figure 3: Location of monitoring stations, which have reported data to the EMEP heavy metal and POP database

Results and Discussion

In order to quantify regional atmospheric cycling of POPs as well as to develop a policy to reduce this pollution measurements are needed. Data of POP concentrations measured at European remote or background sites within regional monitoring programs (EMEP) and various other research programs have been included in the MEPOP-program[1-4]. Regional concentrations and deposition fluxes of selected POPs and the spatial and temporal variation across Europe have been investigated. The sites included were Košetice in the Czech Republic in central Europe, Rörvik, which is a coastal station at the Swedish West Coast, Pallas, a sub-arctic area in northern Finland and Preila in Lithuania at the Baltic Sea. In the Netherlands, measurements of selected POPs in air and precipitation have also been carried out for a period of two years at 18 stations including one at the sea.

A seasonal variation in the atmospheric concentrations of POPs was found at all the sampling sites, but the concentrations also varied as a result of the origin of the air masses. The highest PAH levels occurred during the winter periods, while the levels of PCBs and pesticides were higher during warmer periods. Figures 2 and 3 show temporal trends for α-HCH and γ-HCH in air at 6 stations. The concentration level of α-HCH at the Norwegian stations is relatively high compared to the other stations, but decreasing. This is probably due to higher input of technical HCH at high latitudes[5] (Breivik et al., 1999).

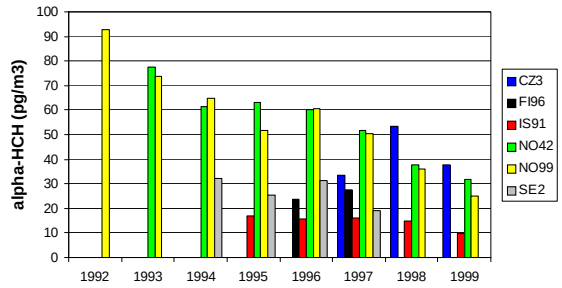


Figure 2: Annual weighted means for α-HCH during 1992-1999

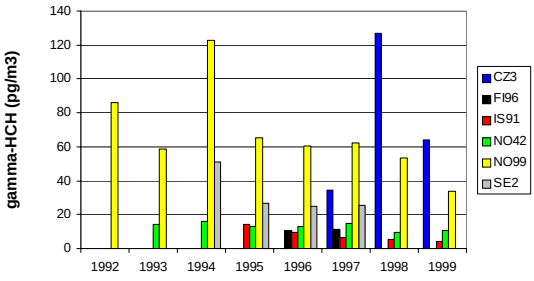
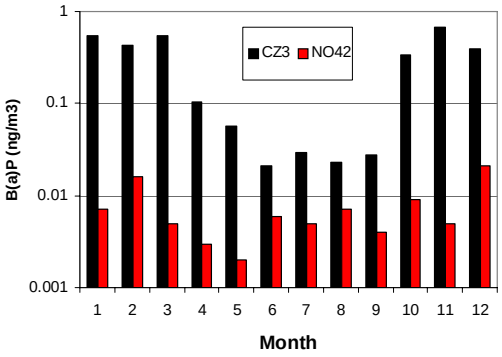


Figure 3: Annual weighted means for γ-HCH during 1992-1999

Benzo(a)pyrene (also other PAHs) is rapidly destroyed by UV. In the absence of local sources, therefore, a pronounced seasonal trend is to be expected, which is seen especially for CZ03 (Figure 4). Data for PTS have been reported only from countries around the North and Baltic Seas, in the Arctic and from the Czech Republic.

Figure 4: Concentrations of benzo(a)pyrene in air+aerosol at two EMEP-stations, 1999.



Significant regional differences in the atmospheric concentrations of POPs over Europe were identified. The annual average atmospheric concentrations of PCB (sum of seven) and PAH (sum of 12), from measurements carried out between 1996 – 2001 are given in Figure 5. The levels from the Netherlands represent average values from 18 stations.

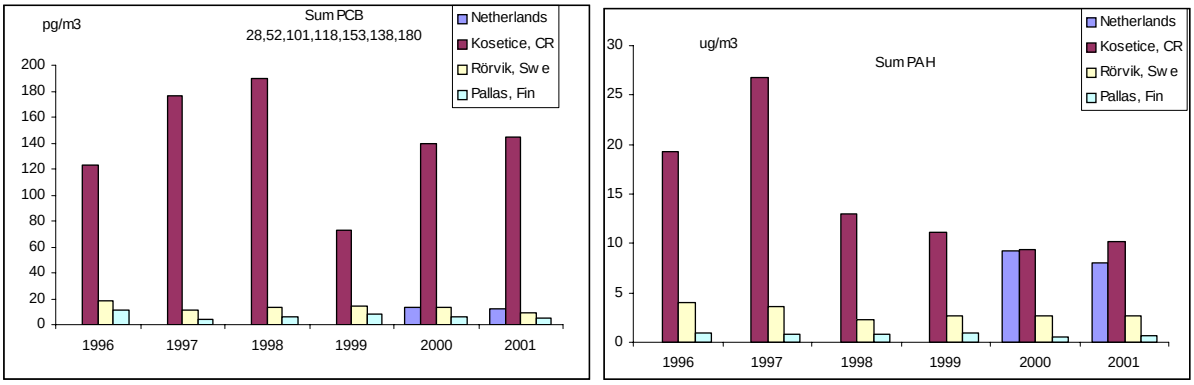


Figure 5: Annual average atmospheric concentrations of PCB (sum of seven) and PAH (sum of 12), from three European sites 1996-2001.

The highest concentrations of PCBs occurred at Košetice in the Czech Republic while lower concentrations were found in Scandinavia, declining from Rörvik at the Swedish West Coast to Pallas in northern Finland. The average concentrations found in the Netherlands were in the same level or somewhat higher compared to the Swedish west coast.

The highest concentrations of PAHs were measured at Košetice while lower concentrations were found in Scandinavia, declining from Rörvik at the Swedish West Coast to Pallas in northern Finland. Benzo(a)pyrene was also was measured at the Baltic station Preila, where the concentrations were significantly higher compared to the Košetice levels [6]. The PAHs concentrations in the Netherlands were in the same level as in the Czech Republic during 2000-2001 indicating the short distance to source areas at these sites.

No significant time trend was observed in the annual averages for PCB and PAH but there were indications of slightly declining levels, especially for individual components, which is demonstrated for PCB –153 at the two sampling sites Rörvik and Pallas in Figure 6.

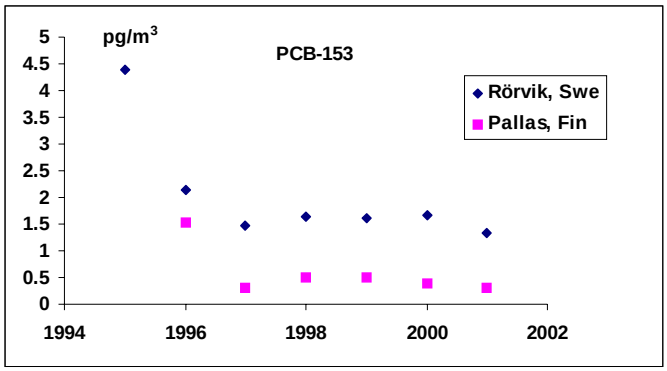


Figure 6: Annual averages of PCB 153 at the Swedish West Coast and in northern Finland

Acknowledgements

The presented results are part of UN ECE EMEP activities and represent the national contributions of Czech Republic, Finland, The Netherlands and Sweden.

Reference

1. Holoubek I., Alcock R., Brorström-Lundén, E., Kočan A., Petrosjan V., Roots O., Shatalov V. et al. (2003): Regionally Based Assessment of Persistent Toxic Substance - Region III - Europe Report, Number of project: GF/CP/4030-00-20, Number of subproject: GF/XG/4030-00-86, for UNEP Chemicals: Masaryk University, Brno, Czech Republic, 180 pp.
2. EMEP (1998): EMEP Expert Meeting on Measurements of Persistent Organic Pollutants (POPs) in Air and Precipitation. Lillehamer, Norway, 11-14 November 1997. Proceedings ed. By A. Lukewille, NILU, EMEP/CCC-Report 8/98.
3. Munthe J., Palm A. (eds.): The Atmospheric Cycling of Mercury and Persistent Organic Pollutants - Final Report of EUROTRAC Project. March 2003, 85 pp.
4. Holoubek, I., Kocan, A., Holoubkova, I., Hilscherova, K., Kohoutek, J., Falandysz, J., Roots, O. (2000): Persistent, Bioaccumulative and Toxic Chemicals in the Central and Eastern European Countries - State-of-the-Art Report. The 2nd version. TOCOEN REPORT No. 150a, May 2000. RECETOX - TOCOEN & Associates, Brno, Czech Republic. Internet: http://recetox.chemi.muni.cz/.
5. Breivik, B., Pacyna, J. M., Munch, J. (1999): Use of α–, β– and γ–hexachlorocyclohexane in Europe 1970-1996. *Sci. Total Environ.* 239, 151-163.
6. Vana, M., Holoubek, I., Pacl, A., Pekarek, J., Smrckova, V., Machalek, P., Helesic, J., Seda, Z., Adamec, V., Janouch, M., Honzak, J., Ansorgova, A., Kohoutek, J., Holoubkova, I., Shatalov, V., Dutchak, S., Fottova, D., Hruska, J., Hofman, J., Andel, P. (2001): Quality of the Natural Environment in the Czech Republic at the Regional Level. Results of the Košetice Observatory. CHMI Praha, 189 p., ISBN 80-85813-88-2.