

Levels of Chlororganics and PAHs in the Former GDR

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1. Introduction

In order to evaluate pollution levels in the GDR, actual data on organic trace substances are required. With this aim data on selected organochlorines, PAHs, and PCDD/Fs were acquired during the spring of 1990. Chlorinated hydrocarbons and PAHs were measured in the air and in needles of *Picea abies* while PCDD/F were measured in milk, soil and needles from selected locations. The highly industrialized area of Halle - Leipzig was selected as sampling area.

2. Atmospheric Levels in the Leipzig Area

The gaseous-, as well as the particle- associated fractions of organochlorines and PAHs were investigated using a glass fiber filter/adsorbent (XAD2) sampling train (Kaupp, 1989)). Table 1 shows the atmospheric levels of chlorinated hydrocarbons and PAHs measured on May 14, 1990 in Rötha, 15 km south of Leipzig. For comparison the corresponding data for Bayreuth, a background area in Northern Bavaria, are given. Substantial differences were observed only for DDT/DDE and PAHs, which were found to be up to 13 times higher in the region around Leipzig. Comparing the levels of chlorobenzenes, HCHs or PCBs, no significant differences between the two sampling sites can be found. This is remarkable in view of the fact that a West German background area was compared with a traditional East German industrial region. It would appear that there are no extraordinary emissions of these substances in the Leipzig area.

Table 1: Atmospheric Levels of Organochlorines and PAHs in the Area of Leipzig (Rötha, 14.5.1990) and Bayreuth (22.4.-3.5.1990)

Leipzig	pg/m ³	% Particle-bound	Bayreuth	pg/m ³	% Particle-bound
Σ 1,2,3,5- and 1,2,4,5-Tetrachlorobenzene	138	<0.1	Σ 1,2,3,5- and 1,2,4,5-Tetrachlorobenzene	111	<0.1
Pentachlorobenzene	122	<0.1	Pentachlorobenzene	111	<0.1
Hexachlorobenzene	272	<0.1	Hexachlorobenzene	305	<0.1
a- HCH	255	<0.1	a- HCH	159	<0.1
g- HCH	1578	1.0	g- HCH	689	0.25
Pentachloroanisol	10.3	n.n.	Pentachloroanisol	8.1	<0.1
p,p'-DDE	115	10	p,p'-DDE	14.2	1.8
p,p'-DDT	127	40.6	p,p'-DDT	24.8	23.3
Tetrachlorobiphenyl (No.52)	26	5.2	Tetrachlorobiphenyl (No.52)	19.3	0.6
Pentachlorobiphenyl (No.101)	12.7	5.6	Pentachlorobiphenyl (No.101)	20	1.0
Hexachlorobiphenyl (No.138)	8.6	32.5	Hexachlorobiphenyl (No.138)	10.8	2.9
Fluoranthene	13370	27	Fluoranthene	4696	13.12
Benzo(e)pyrene	3070	>99.9	Benzo(e)pyrene	540	>99.3
Benzo(a)pyrene	4760	>99.9	Benzo(a)pyrene	346	>99.3
Perylene	599	>99.9	Perylene	50	>99.3
Benzo(ghi)perylene	3340	>99.9	Benzo(ghi)perylene	558	>99.3

Atmospheric Particle Load: 92 µg/m³

37 µg/m³

Comparison of the levels in Table 1 also shows the dependence of vapour/particle partitioning on the atmospheric particle load at similar temperatures. It can be assumed that, the three-fold higher particle load in the Leipzig atmosphere leads to a substantially higher amount of particle associated PCBs, HCHs, DDT and DDE.

3. Organochlorines in Spruce Needles

Organochlorine pesticides, PCBs and PCDD/Fs were determined in spruce needles from five locations in the Halle - Leipzig - Bitterfeld metropolitan area in May 1990. Previous investigations (Reischl et al. 1988; McLachlan et al. 1989) have demonstrated that spruce needles are a suitable and integrative bioindicator for atmospheric pollutant levels. Twelve month old *Picea abies* needles were sampled near industrial sources and in rural regions in order to determine background levels. The sample clean-up and details of the GC/MS-analysis are described elsewhere (Reischl et al. 1987; Reischl et al. 1989). In addition, selected data from Northern Bavaria are presented for comparison.

a) **Organochlorine Pesticides and PCBs**

The levels for organochlorine pesticides and PCBs are summarized in Tables 2a (Halle - Leipzig) and 2b (Northern Bavaria). Significant differences between the two regions were observed only for DDE and DDT, which are 10 to 50 times higher in the Leipzig area. This agrees with the air measurements (Table 1) and indicates more recent use of DDT in the former GDR. The concentration ranges of the other organochlorine compounds in the GDR show no essential differences between rural and industrialized areas.

Table 2a: Levels of Organochlorines in Spruce Needles from the Halle - Leipzig Area
ng/g DW

	1	2	3	4	5
Σ 1,2,3,5- and 1,2,4,5-					
Tetrachlorobenzene	0.27	0.26	0.13	0.30	0.42
Pentachlorobenzene	0.41	<0.06	0.32	0.70	0.51
Hexachlorobenzene	1.77	2.80	2.41	2.70	1.14
a- HCH	4.65	3.57	5.36	2.25	3.26
g- HCH	24.7	11.9	8.93	16.2	14.1
p,p'-DDE	24.0	20.2	19.4	47.2	27.7
p,p'-DDT	30.5	7.81	11.7	20.6	17.8
Tetrachlorobiphenyl (No. 52)	0.41	0.40	0.25	0.3	0.11
Pentachlorobiphenyl (No. 101)	0.85	0.53	0.47	0.61	0.76
Hexachlorobiphenyl (No.138)	2.15	0.81	1.10	0.98	0.50
Heptachlorobiphenyl (No.180)	0.57	<0.30	0.16	<0.30	0.25

(1) Rötha, NW of Espenhain; (2) Lubast, Nature Reserve of the Dübener Heide; (3) Friedersdorf, NE of Bitterfeld; (4) Großkugel, NE of Buna/Leuna; (5) Rückmarsdorf, W of Leipzig

Table 2b: Atmospheric Levels of Organochlorines in Spruce Needles from Northern Bavaria
ng/g DW

	Nürnberg ¹⁾	Hof ²⁾
Σ 1,2,3,5- and 1,2,4,5-		
Tetrachlorobenzene	n.a.	n.a.
Pentachlorobenzene	n.a.	n.a.
Hexachlorobenzene	3.2	1.2
a- HCH	10.0	11.4
g- HCH	27.6	28.2
p,p'-DDE	1.1	0.74
p,p'-DDT	2.6	0.63
Tetrachlorobiphenyl (No.52)	n.a.	0.19
Pentachlorobiphenyl (No.101)	2.6	0.47
Hexachlorobiphenyl (No.138)	2.2	0.71
Heptachlorobiphenyl (No.180)	n.a.	0.46

¹⁾ Mean of 10 Samples; ²⁾ Mean of 7 Samples; The needles correspond to the vegetation period 1988/89
n.a. = not analyzed

b) PCDDs / and PCDFs

In Figure 1 and Figure 2 the mean levels of the PCDD/F homologue groups at the selected sampling sites are compared. The concentration range measured in the Halle - Leipzig area (Figure 1) are similar to those from the Nürnberg area (Figure 2). Also, it can be seen that the congener pattern of the samples from the Halle-Leipzig area is in good agreement with the pattern in Hof (Figure 2), which can be characterized as a rural background area mainly affected by long range transport of combustion products.

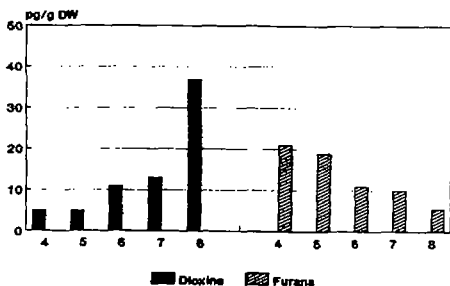


Figure 1: Levels of Homologue Groups in Spruce Needles from Halle-Leipzig Area (Mean of 4 samples)

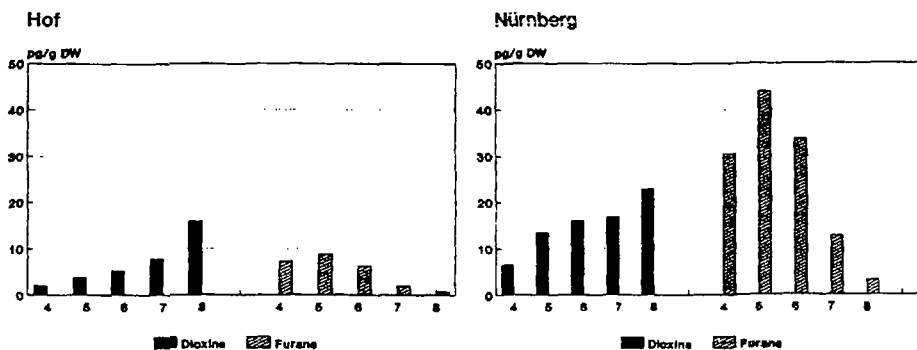


Figure 2: Levels of Homologue Groups in Spruce Needles from Hof (Mean of 7 Samples) and Nürnberg (Mean of 10 Samples)

4. PCDD and PCDF in Soil

In the Halle-Leipzig area, soil samples from 0-10cm depth were taken at the following 5 locations:

Friedersdorf (4 km NE Bitterfeld), meadow; Großkugel (20 km W Leipzig), meadow; Rückmarsdorf (8 km W Leipzig), cornfield; Rötha (12 km S Leipzig), meadow.

Large variations in the overall concentration and in the isomer patterns were observed (see Figure 3). Lowest concentrations were found in the Großkugel soil, which were nevertheless several times higher than concentrations found in soils without sewage sludge fertilization from the Bayreuth area (McLachlan, Reissinger 1990). The soil of Rötha shows higher concentrations but a similar pattern. However, compared to the Bayreuth area samples the Cl_8DD values were elevated. The Rückmarsdorf soil sample displayed a distinct PCDD/F-pattern, typical for the PCDD/F contamination found in pentachlorophenol. Extremely high values were detected in the sample from Friedersdorf near Bitterfeld, where Cl_7DD and Cl_8DD are particularly concentrated.

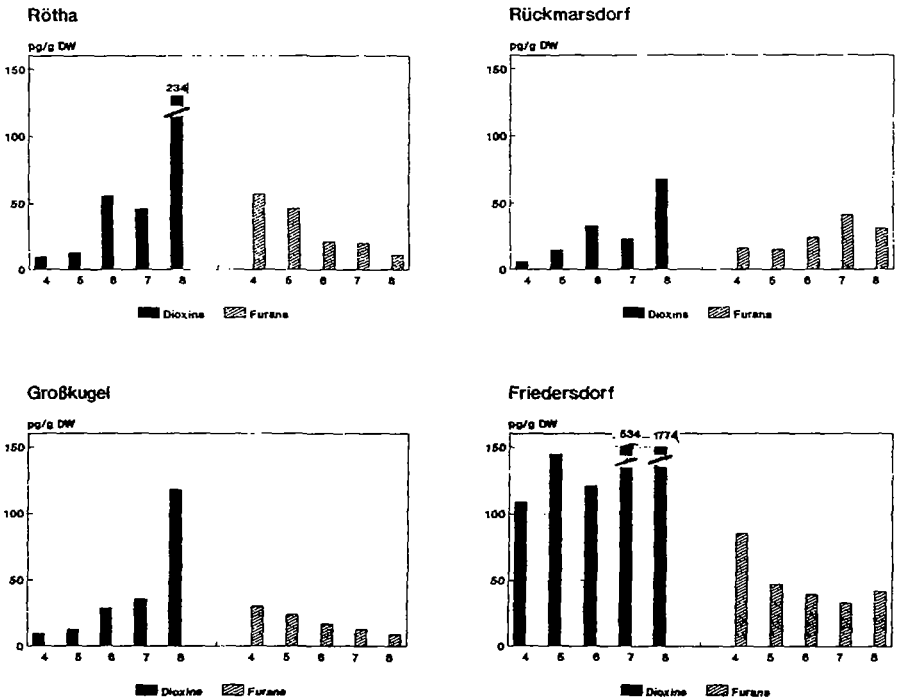


Figure 3: Levels of Homologue Groups in Soil Samples from the Halle-Leipzig Area

5. PCDD and PCDF in Milk

In addition to the spruce needles, one milk sample from the Leipzig area was analyzed for PCDD/Fs. The I-TEQ of 1.93 pg/g fat were in the same range as usually found in Western Germany (Beck et al., 1987).

6. Conclusions

For the organochlorines, with the exception of DDT, no differences were observed between Northern Bavaria and some highly industrial locations in the GDR. Therefore, in our opinion, the antiquated industrial processes which are still employed in the GDR are not responsible for the present levels of organochlorine compounds there. The generally higher particle load of the GDR atmosphere may lead to higher deposition rates of low volatile organochlorines. Little is known about the soil history, but the strong enrichment of Cl₆DD may be explained by the use of pentachlorophenol or sewage sludge as the soils from Friedersdorf and Rückmarsdorf indicate. As a consequence of this study further investigations should focus on soil contamination of the former GDR.

References

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