

ENVIRONMENTAL LEVELS - POSTERS

PCDD/Fs AND PCBs CONCENTRATIONS IN THE AMBIENT AIR OF THE GREATER THESSALONIKI AREA/GREECE

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Introduction

In March 1999, there was a great public awareness about the possible environmental implications in the Balkan area due to NATO air strikes in Yugoslavia. The release of toxic and carcinogenic substances from the 2-month bombardment of several industrial targets, such as oil refineries, electric power plants, petrochemical and pharmaceutical plants, fuel reservoirs, transformer stations and other chemical industries, put both the local population and natural environment under clear threat.

In this study, the possibility of transboundary transfer of released pollutants to Northern Greece through the atmosphere was examined. Thus, total suspended particulates (TSP) were collected from an urban and a semi-rural area and analysed for PCDDs, PCDFs and PCBs. Concentrations were evaluated in relation to meteorological data (wind direction and speed, temperature, air mass trajectories, etc.)

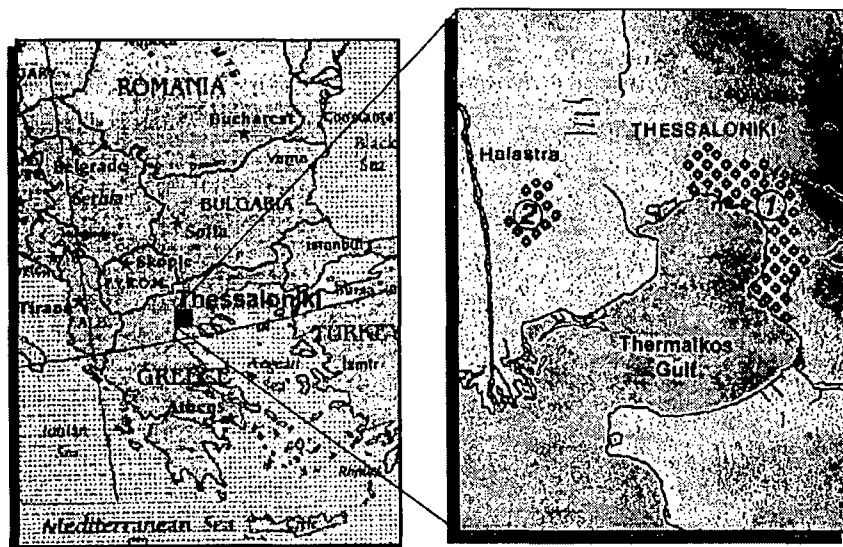


Figure 1: Location of sampling points (SP) 1 and 2

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Area description

During the period March to October 1999, a total of 47 TSP samples were collected from an urban and a semi-rural location (SP 1 and SP 2 in Fig.1) and analysed for PCDD/Fs and PCBs. Sampling point 1 was located on the busiest crossroads of the city of Thessaloniki. Thessaloniki is one of the most densely populated Greek cities with approximately 1.000.000 inhabitants. The city is surrounded by several stable residential communities, while an extended industrial area is located northwesterly. Oil refining, petrochemical, fertilizer production, non-ferrous metal smelting, iron and steel manufacturing, metal recovery facilities, electrolytic MnO₂ production, scrap metal incineration, tire production and lubricating oil recovery are the main industrial activities. Sampling point 2 was located at the outskirts of the residential community Halastra, about 20 km west of Thessaloniki. Agriculture and cattle raising are the major local activities.

Methods and Materials

TSP samples were collected on glass fibre filters (203x254 mm) with 99% collection efficiency for particles with aerodynamic diameter 0.3 µm. High volume air samplers (General Metal Works) were used for this purpose. Samples were collected from a height of about 3m above ground level within an average flow rate of 40 CFM. All samplings had a 24 h duration. Loaded and unloaded filters were weighed after 48 h conditioning in a darkened desiccator.

The filter samples were Soxhlet extracted with toluene. A mixture of ¹³C₁₂-labelled standards (PCDD/Fs and PCBs) were added prior to extraction. A multistep clean-up procedure was followed. The analysis was carried out using HRGC/HRMS (Fisons Autospec Ultima system) for PCDD/Fs and a GC/MSD (HP 5890/5971a) for the detection of 6 PCBs congeners (no. 28, 52, 101, 138, 153, 180). Detailed descriptions of the procedures are reported elsewhere¹ For the calculation of I-TEQs and -PCBs the congeners lower than detection limit were not regarded.

Results and Discussion

The observed concentrations of PCDD/Fs for the 47 samples ranged from 4.4 to 119 fg I-TEQ/m³ for SP 1 and from 2.1 to 177.8 fg I-TEQ/m³ for SP 2 (Table 1). During the seven months of investigation this leads to a mean level of 21.0 fg I-TEQ/m³ in SP 1 and 24.4 fg I-TEQ/m³ in SP 2. No remarkable differences between the two locations were observed, although relatively higher concentrations for the urban area (SP 1) were expected.²

sampling point 1 (urban area)				sampling point 2 (semi-rural area)			
Sampling date	wind-direction	I-TEQ fg/m ³	-PCBs pg/m ³	Sampling date	wind-direction	I-TEQ fg/m ³	-PCBs pg/m ³
20.03.1999	E/NE	44.40	5.36				
07.04.1999	NW/W	37.60	11.85				
21.04.1999	W/SW	17.56	6.00	(15)21.04.1999	NW/SW	113.75	0.65
27.04.1999	NW	9.83	13.57	26-28.04.1999	NW	14.80	1.10
				01-03.05.1999	W/NW	57.75	2.83
03.05.1999	NW/W	36.49	29.16	04.05.1999	S	177.88	6.26
11.05.1999	NW	8.08	7.53	10.05.1999	NW	6.80	4.50
17.05.1999	N	14.35	7.41	17.05.1999	N	28.15	5.00
25.05.1999	N	11.00	8.00	24.05.1999	N	2.26	3.60
03.06.1999	SW/W	6.16	nc	03.06.1999	SW/W	17.70	5.45

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sampling point 1 (urban area)				sampling point 2 (semi-rural area)			
Sampling date	wind-direction	I-TEQ fg/m ³	-PCBs pg/m ³	Sampling date	wind-direction	I-TEQ fg/m ³	-PCBs pg/m ³
11.06.1999	NE/S	11.00	11.66	10.06.1999	NE/E/S	2.68	5.65
17.06.1999	S	6.71	8.00	17.06.1999	S	3.46	1.65
22.06.1999	SW/W	18.69	3.63	22.06.1999	SW/W	2.97	nd
28.06.1999	S/SW	7.37	7.72	29.06.1999	NW/NE	3.53	nd
06.07.1999	NE	7.49	4.59	07.07.1999	NE	2.83	nd
23.07.1999	S/E	8.40	5.40	22.07.1999	N/NE/SE	2.48	nd
5.08.1999		11.56	4.54	4.08.1999		3.68	1.10
19.08.1999		6.66	11.86				
30.08.1999		6.65	10.40				
10.09.1999	N/NE	17.93	11.45	11.09.1999	E	9.32	nd
16.09.1999	S/W	4.41	5.48	17.09.1999	S	13.36	0.88
23.09.1999	W	34.02	20.89	23.9.1999	W	10.28	nd
30.09.1999	SW/S	12.12	6.82	29.09.1999	S	10.36	nd
8.10.1999	N	31.65	5.20	8.10.1999	N	5.72	0.88
14.10.1999	W/NW	35.81	10.81	13.10.1999	N/NW	45.57	15.63
20.10.1999	W/SW	119.00	29.18	23.10.1999	S	2.13	7.05

nd: not detected

Table 1: PCDD/Fs and PCBs concentrations in ambient air of the greater Thessaloniki area

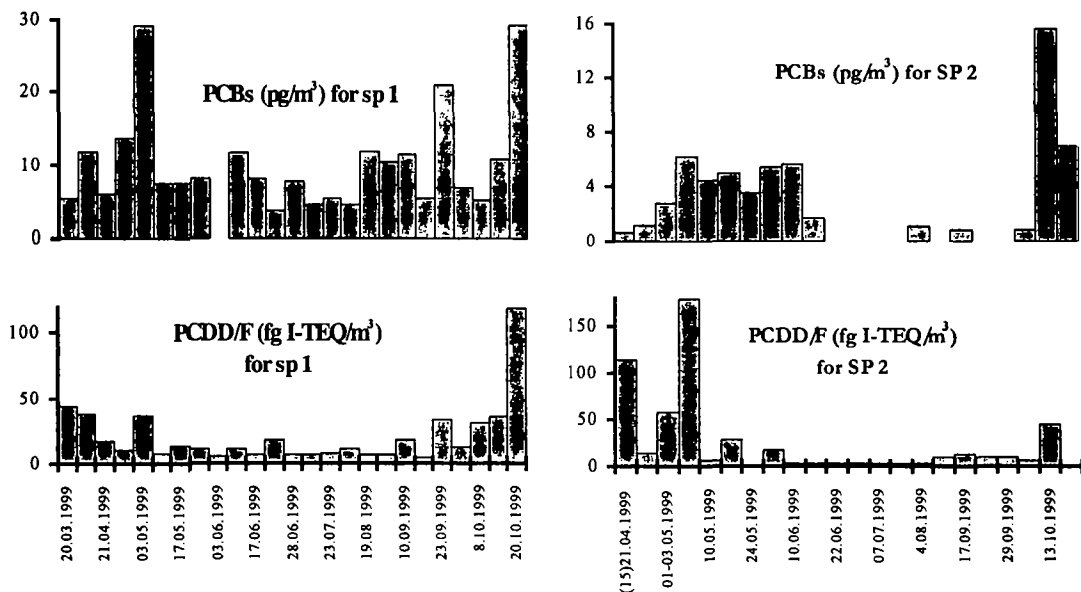


Figure 2: Comparison of PCDD/F (fg I-TEQ/m³) and -PCBs (pg/m³) for the two sampling points

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The ambient air concentrations of PCDD/Fs determined in the region of Thessaloniki are in good agreement with the results from other European countries.^{3,4} SP 1 (Thessaloniki) can be classified as "lower polluted" urban area. Pollutant concentrations varied remarkably during the sampling period. A direct influence of a source near to the sampling point can not be excluded. For the region of Thessaloniki there is no detailed inventory concerning PCDD/Fs or PCBs sources.

Correlation of the PCDD/Fs and PCBs levels with meteorological data was not apparent. High values of contaminants were not associated with a preferred wind direction. Therefore, no evidence was found for a possible transboundary transfer of released pollutants from the region of Serbia to Northern Greece. For example, on May 17th and 25th strong north winds were registered but an increase of the measured concentrations of PCDD/Fs and PCBs could not be detected.

The concentrations of PCBs ranged for SP 1 from 3.63 to 29.18 $\mu\text{g}/\text{m}^3$ and for SP 2 from 0.65 to 15.63 $\mu\text{g}/\text{m}^3$. The mean level for SP 1 (urban) was 10.3 $\mu\text{g}/\text{m}^3$ and for SP 2 (rural) 4.15 $\mu\text{g}/\text{m}^3$ thus exhibiting a clear increase in the urban area. A comparison of the PCDD/Fs and PCBs levels for each sampling day (see Fig. 2) showed no strict correlation. Only in some cases high PCBs concentrations were associated with high levels of PCDD/Fs in the TSP samples. For both type of contaminants decreasing levels were observed during the hot summer month July and August. This is in agreement with results of other authors.^{2,3}

Mean TSP concentrations in ambient air were for SP 1 152 $\mu\text{g}/\text{m}^3$ and for SP 2 120 $\mu\text{g}/\text{m}^3$. The urban area had a slightly higher concentration, what is normally expected. But both values are three to five times higher than concentrations of TSP measured in other European urban areas.² The mean PCDD/F content of suspended particulate matter was 123.8 ng I-TEQ/kg in SP 1 and 169.5 ng I-TEQ/kg in SP 2.

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