Dioxin concentrations in the blood of residents and workers at a municipal waste incinerator.

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1. Introduction

In 1994 the results of a private study towards the amount of PCDDs and PCDFs in blood and breast milk from a resident living close to the municipal waste incinerator in Duiven (AVIRA) gave rise to concern. The blood sample, collected in july 1993, contained increased amounts of heptaCDD, octaCDD and octaCDF (resp. 149, 3092 and 26 pg/g blood fat). The breast milk sample, collected in august 1994, showed a normal PCDDs/PCDFs pattern. In addition analyses of the fat from a sheep that used to graze close to the waste incinerator also showed relatively high concentrations heptaCDD, octaCDD and octaCDF.
It is als known that in the past the flyash from the waste incinerator was stored in so called big bags at the site of the incinerator. In order to test the possibility that direct exposure to flyash blown away from the site is the cause of the increased amounts of certain congeners in the blood of the resident further study was done.

2. Aim

The first aim of this study is to determine if exposure to flyash blown away from the storage site near the waste incinerator in Duiven has lead to increased PCDDs/PCDFs in the blood of people living or working *near* the incinerator. The second aim is to determine if occupational exposure to flyash or slag has lead to increased PCDDs/PCDFs in the blood of people working *at* the waste incinerator in Duiven.

3. Methods

study population
5 residents (1 woman and 4 men) living more than 15 years close to the incinerator and 5 workers working more than 14 years at the incinerator were selected. The workers with the greatest likelihood of occupational exposure to flyash were selected. In addition 10 workers of a water purifying plant situated next to the incinerator were also included in this study.

analyses
For each of the subjects, whole blood samples (500 ml) were collected by routine venapuncture. One worker at the waste incinerator dropped out of the study because shortly before the blood sample had to be taken he gave 500 ml blood as a donor. The blood samples were analysed for PCDDs and PCDFs by high resolution gaschromatography/mass spectrometry. The analyses were done by the department of Environmental and Toxicological Chemistry of the University of Amsterdam.

questionnaire
To account for other potential sources of exposure the subjects had to fill in a questionnaire. They were asked a.o. for diet habits, smoking habits and the use of pesticides.

4. Main results

Table 1 presents the means (SD, ranges) for the PCDD/PCDF concentrations in the blood of the workers at the waste incinerator (WI), the residents, the workers at the water purifying plant (ZOG) and 5 control persons of the Dutch general population from a previous study by the National Institute of Public Health (1993, study not published). When the mean concentrations for the 4 workers are compared with the residents, significant increases were found for heptaCDD, octaCDD, hexaCDF, heptaCDF en octaCDF. When the mean concentrations for the 4 workers are compared with the ZOG workers heptaCDD, octaCDD, hexaCDF and heptaCDF are significantly increased. The concentrations found in the residents and ZOG workers are comparable with the concentrations found in the blood of the 5 control subjects (controls in table 1).
The mean I-TEQ values found in this study are within the range of mean I-TEQ values found in different German studys from 1989-1993 (40.8 - 21.7)[1].

5. Discussion

The results are similar to those previously reported by Schecter et al[2]. Schecter found significant increases for 10 workers at an older German municipal waste incinerator for octaCDD, hexaCDF and heptaCDF compared with 25 controls. As already suggested by Schecter the increased concentrations of some congeners are probably due to exposure to flyash and/or slag in the working proces.
On account of the results of the questionnaire it is unlikely that other potential sources of exposure are responsible for the differences between the workers at the waste incinerator on the one hand and de residents and the ZOG workers on the other hand.
Increased amounts of PCDDs/PCDFs were not found in the blood of residents living close to the incinerator, so the increased amounts of heptaCDD, octaCDD and octaCDF found in the blood from the resident mentioned in the introduction were not explained.

6. Conclusion

Living or working *near* the waste incinerator does not lead to higher concentrations in the blood of PCDDs and PCDFs. Working *at* the waste incinerator leads to higher concentrations in the blood of some congeners. This is probably due to occupational exposure to flyash and/or slag. The higher concentrations are not supposed to give adverse health effects.

7. References

[1]) Päpke, O., M. Ball, A. Lis (1994): PCDD/PCDF in humans, a update of background data. Chemosphere 29, 2355-2360.

[2]) Schecter, A., O. Päpke, M. Ball, A. Lis, P. Brandt-Rauf (1995): Dioxin concentrations in the blood of workers at municipal waste incinerators. Occupational and Environmental Medicine 52, 385-387.

Table 1: mean concentrations (SD, range) PCDDs/PCDFs in the blood in pg/g blood fat.

	workers WI (n=4)	residents (n=5)	workers ZOG (n=10)	controls (n=5)
Age	43.8 (3.9, 40-48)	45.6 (6.3, 36-53)	unknown	unknown
TetraCDD	3.6 (1.8, 1.3-5.3)	4.2 (2.7, 1.8-8.7)	3.8 (1.1, 2.6-5.6)	4.9
PentaCDD	13.3 (5.6, 5-17)	12.1 (2.1, 8.5-14)	12.9 (3.0, 9.7-20)	12.2
HexaCDD	73.2 (23.5, 44.5-101.7)	67.4 (18.6, 45.6-89.9)	71.7 (20.3, 46.6-106.2)	70.9
HeptaCDD	124.3* (64.0, 40-194)	37.8 (9.2, 26-46)	60.8 (25.3, 32-102)	80.4
OctaCDD	1163.3* (250.5, 933-1407)	670.2 (337.9, 318-1224)	649.6 (538.7, 196-1995)	865.3
TetraCDF	0.7 (0.3, 0.4-1.1)	0.6 (0.4, 0.3-1.2)	0.8 (0.2, 0.5-1.1)	1.0
PentaCDF	30.0 (15.0, 11-43.8)	22.8 (5.3, 19-32)	25.8 (9.2, 16-44)	24.4
HexaCDF	33.1* (13.9, 16.1-44.8)	17.1 (2.6, 14.4-20.4)	18.5 (5.6, 13.4-28)	18.8
HeptaCDF	28.3* (7.9, 18-37)	15.2 (4.8, 8.9-20)	14.2 (4.0, 7.9-19)	13.8
OctaCDF	2.7* (0.6, 1.8-3.1)	1.6 (0.7, 0.7-2.6)	3.9 (5.1, 0.9-18)	n.d.
I-TEQ	38.3 (15.0, 18.2-51.5)	31.4 (7.4, 24.3-43)	33.7 (8.6, 22.7-52.4)	33.8

* t-test: P<.05