

LEVELS OF PCDD/Fs IN HUMAN BLOOD OF PEOPLE WORKING IN A MUNICIPAL SOLID WASTE INCINERATION PLANT

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Introduction

The public acceptance of waste incineration changed dramatically in 1977, one year after the Seveso accident, when Kees Olie from University of Amsterdam found traces of PCDD/F in flue ashes of a municipal solid waste incineration plant.¹ From a ideal solution, waste incineration became a synonym of worst environmental pollution.

After recognizing this finding, several studies on remediation and abatement technique finally lead to technical solutions allowing waste incineration without high emission of PCDD/F.

Only incineration plants equipped with sophisticated technology, efficient management and real emission control, can have acceptably low emissions.

Nevertheless, for people working in these plants, reading some preoccupant news about thermal waste management practically every day, emission control is not sufficient to guarantee a secure working place. Occupational safety measurements shall be offered to employees working in places potential risk of PDDD/F body burden.

Materials and Methods

Participants were 13 people, potentially exposed, working in the incineration plant equipped with sophisticated abatement technology or working in the landfill site of the bottom ash of the plant. The control group was formed by 11 people, working in the laboratory or in the administration, all on a volunteer basis. The average age and sex distribution of the two groups were similar.

Blood samples were taken under medical control by a clinical laboratory. Also the lipid determination by clinical laboratory tests and the separation in serum and plaques were performed there. Samples were then stored frozen at -20°C until analysis. Before analysis serum samples were spiked with ¹³C₁₃ labelled standards and after digestion with formic acid, isolation of PCDD/F was done using a C 18 solid phase extraction (SPE) procedure followed by a multi-column automated cleanup (Power-Prep FMS).² The analytes were separated by HRGC using an DB-5 ms capillary column (Agilent) and quantified by HRMS (Thermo MAT 95 XP) using selected ion monitoring (SIM) at 10.000 resolving power. Human serum NIST standard reference material 1589a was analysed within the sample batches for quality control.

Results and Discussion

The results regarding the potentially exposed people are presented in Table 1, whereas in Table 2 the results related to the control group are reported. The average concentration in serum of the potential exposed group was found to be 8,5 pg I-TEQ/g lipid. The control group had a slightly higher average of 9,7 pg I-TEQ/ g lipid. This data doesn't suggests for the investigated people any workplace specific exposure risk.

Compared to other similar studies, the concentrations are also relatively low. In Germany (1995) an average concentration of 32,88 pg I-TEQ/g lipid of incineration plant workers and 30,65 pg I-TEQ/ g lipid of the control group was found.^{3,4} In Portugal (2004) 14,9 (exposed) respectively 15,5 (control) pg I-TEQ/g lipid were found.⁵

Figure 1:

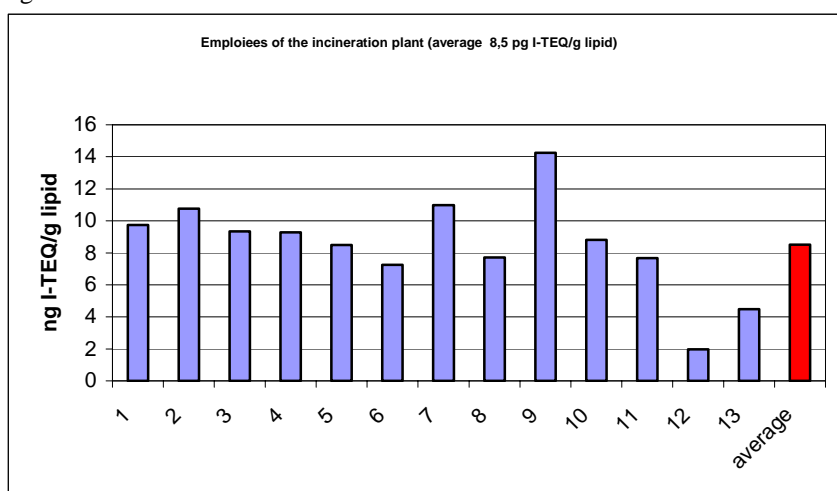
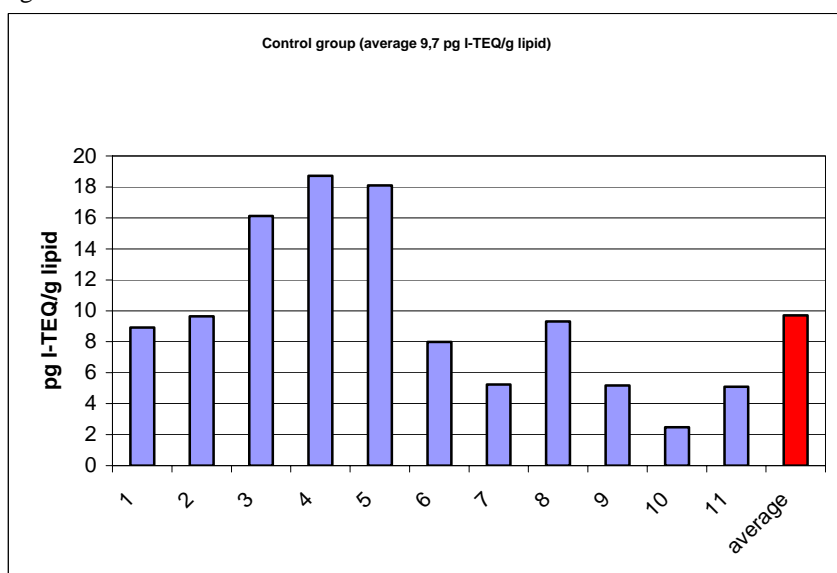


Figure 2:



Occupational exposure

The limit of the present study is clearly the relatively low number of participants (volunteers). For epidemiological studies a larger number of participants would be required. But nevertheless some interesting aspect can be focused out.

The two youngest persons (age 20 years) one within the potential exposed group, the other within the control group, presented also the lowest concentration of PCDD/F. In both cases about 2 pg I-TEQ/ g lipid could be detected, whereas forty years old people, regardless the group, had nearly ten time higher PCDD/F concentrations.

Fortunately the environmental levels of PCDD/F are declining since two decades and so younger people have a lower risk to be exposed. The accumulation in lipid tissue of the body and the resistance of persistent organic pollutants to metabolize, can explain why older people in generally have higher PCDD/F levels than younger persons. The introduction of an age specific Dioxin TEQ reference range, like proposed by Patterson et al. seems to be also necessary in occupational exposure studies.⁶

References

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