

## HIGH DIOXIN SERUM CONCENTRATIONS IN THE FRENCH DIOXIN AND INCINERATORS STUDY

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### Abstract

Serum analyses of PCDDs, PCDFs and PCBs were carried out in 1030 adults from eight French locations, to identify the determinants of the body-burden of these compounds in the population close to waste incinerators. A descriptive analysis of participants with high serum concentrations (above the 99th percentiles of the distribution of body-burden levels) was conducted to identify common risk factors. The 99th percentiles set the threshold at PCDD/Fs + DL-PCBs > 100 pg TEQ<sub>98</sub>/g lipids, or PCDD/Fs > 50 pg TEQ<sub>98</sub>/g, DL-PCBs > 58 pg TEQ<sub>98</sub>/g, or indicators PCBs > 1 115 ng/g lipids. 26 participants were above at least one of these thresholds. Most of them live in two of the eight locations. However, of the total TEQ only one of these 26 persons lived in an area directly exposed to the emissions of an incinerator, and two of the PCDD/Fs. The usual risk factors are consistent among this population: aged above 57 years, and overweight. Fish and sea-food consumption seems to be a key determinant to the elevated concentration.

### Introduction

France is the European country with the highest number of wastes incinerators: 123 units operating in 2003, 300 in 1998. In 2003, these facilities were used for the treatment of 35% of the waste produced annually. Nowadays, all facilities are respecting the European legislation regarding emissions. However, it is known that some of these incinerators had released elevated amount of dioxins and metals in the environment. The objective of a National exposure survey around waste incinerators was to determine whether the emissions of the incinerators is contributing to the body-burden of PCDD, PCDF, PCB and heavy metals in the neighbouring population. The body burden was estimated through an analysis of PCDD, PCDF and PCB DL levels in blood. The study involved eight locations surrounding eight incinerators. 1030 adults (30-65 years old) with a minimal residence time of 10 years were selected through a random sampling (about 130 persons per location). The method of the study is described elsewhere<sup>1</sup>.

This paper presents a descriptive analysis of participants with elevated levels of PCDDs, PCDFs and PCBs, to identify potential common characteristics of elevated exposure.

### Materials and Methods

Blood levels of PCDD, PCDF and PCB DL were analysed by gas chromatography (GC) coupled to high resolution mass spectrometry (HRMS). Dioxin concentrations were expressed in relation to the blood lipid content, measured by enzymatic techniques<sup>2</sup>. Results were expressed in pg TEQ/g of lipids, using the TEF defined by WHO 1998. Non-detected (<LOD) were substituted by half of the LOD. Non-quantified values (Between LOD and LOQ) were substituted by (LOD+LOQ)/2<sup>3</sup>.

Questionnaires were used to collect data on the health status of the participants, their occupational exposure, their hobbies, and their dietary habits, including the consumption of locally produced food.

Participants were considered to have high levels when their blood concentrations were above the thresholds set at the 99th percentiles of the distribution of body-burden levels.

The following questions were included in the descriptive analysis of these high concentrations:

- Is it linked to the location? The eight incinerators were selected to represent different types of processes and capacities. Some of them are known to have emitted extremely high levels of dioxins in the past.
- Is it consistent with the usual risk factors: sex, age, weight?
- Is it linked to a specific food intake?

### Results and Discussion

The 99th percentiles of the concentrations distribution set the threshold for elevated serum levels at:

- PCDD/F + PCB-DL > 100 pg TEQ<sub>98</sub>/g lipids,
- PCDD/F > 50 pg TEQ<sub>98</sub>/g, PCB-DL > 58 pg TEQ<sub>98</sub>/g lipids,
- indicators PCB > 1 115 ng/g lipids,

26 participants were above at least one of these thresholds. Only four participants were above all these thresholds simultaneously, three of them living in Fécamp (coastal area) and one living in Maubeuge (industrial area). Only one of these 26 people lived in an area exposed to the emissions of the incinerator for total TEQ and two for PCDD/Fs, the others coming from non exposed areas (far from incinerators). Most of these people lived in the non exposed areas of Fécamp and Maubeuge, which presented a distribution of concentrations above the results found in the other locations (Figure 1).

The usual risk factors are consistent among this population, since age and body mass index are major contributors (Table 1). Eight of the 11 participants above the threshold for PCDD/Fs + DL-PCBs are 57 years old or older. Most of them are overweighted. Similar profiles were found among the people with elevated DL-PCBs and PCBs indicators levels. Men are over-represented in this sub-population, while the population study includes more women, and the mean concentration was higher among women. No consistency was found in the occupational exposure of these high serum levels participants. They represent different working or retreating categories: offices employees, farmers, teachers...

For all these people, fish and seafood consumption was superior to the mean consumption of the participants (61g/day).

### Conclusion

A descriptive analysis of the profile of participants with elevated serum levels underlines the usual risk factors: age and overweight. Location is also common point among most of these participants, Fécamp (a coastal area) being over-represented. However, only one of the 26 persons of the total TEQ and two people of the PCDD/Fs lived in an area directly exposed to the incinerator. This is consistent with the results from the whole study, which did not show a correlation between the serum levels and the exposure or non-exposure to emissions of an incinerator. Fish and sea-food consumption seems to be the only common characteristic to the elevated concentrations.

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### References

- [1] Fréry N, Volatier JL, Zeghnoun A, Falq G, Mouajjah S, Thébault A, Pascal M, Bérat B, Grange D, De Crouy-Chanel P, Sarter H, Eppe G, Heyman C, Guillois-Becel Y, Lucas N, Mathieu A, Noury U, Pouey J, Schmitt M, Salines G. *Organohalogen compounds* 2007, submitted
- [2] Focant JF, Eppe G, Massart AC, Scholl G, Pirard C, De Pauw E *Journal of Chromatography A* 2006; 1130: 97

[3] Zeghnoun A, Pascal M, Fréry N, Sarter H, Falq G, Eppe G, Focant JF, *Organohalogen compounds* 2007, submitted

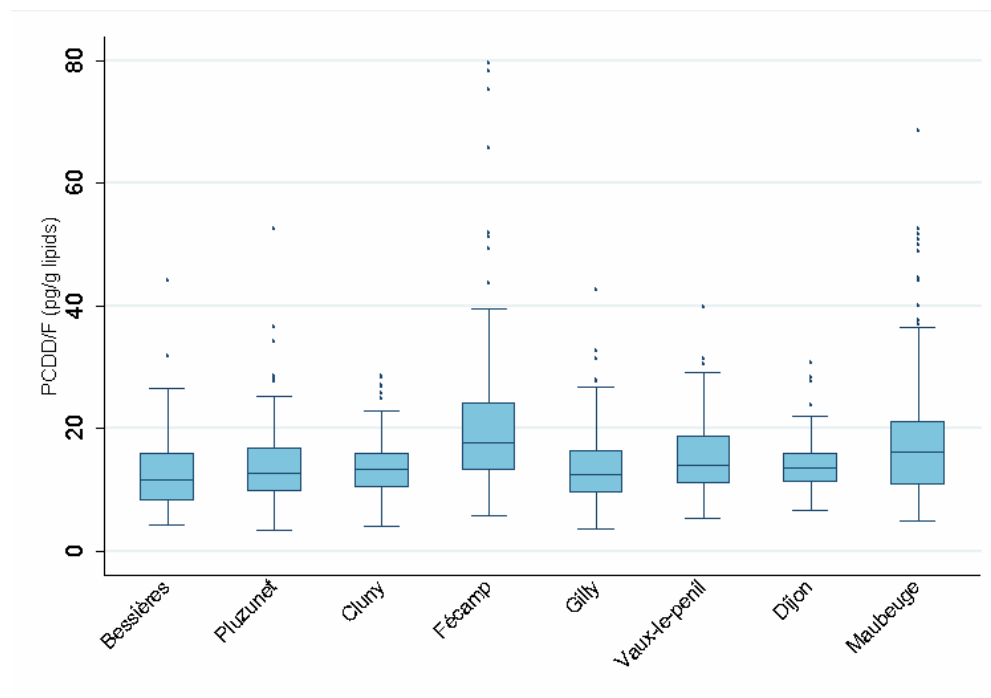


Figure 1 – Distribution of the serum levels of PCDD/Fs by location

Table 1 – Description of the participants with high serum levels

	PCDD/Fs + DL-PCBs	PCDD/Fs	DL-PCBs	PCB indicators
99th percentiles	> 100 pg TEQ <sub>98</sub> /g lipids	> 50 pg TEQ <sub>98</sub> /g lipids	> 58 pg TEQ <sub>98</sub> /g lipids	> 1 115.152 ng/g lipids
<b>Total number</b>	11	12	13	11
<b>Living in the area of Fécamp (coastal area)</b>	7	7	8	6
<b>Living in area of Maubeuge (industrial area)</b>	1	4	2	2
<b>Age &gt; 57 yrs</b>	8	8	11	9
<b>Men</b>	8	7	7	9
<b>Overweight (Body Mass Index &gt; 25)</b>	10	8	11	10
<b>Recent weight loss (&lt;10% of the total weight)</b>	3	4	4	4
<b>Consumption of fish and sea food &gt; 61 g/day</b>	7	4	5	6
<b>Exposed to incinerator emissions</b>	1	2	3	3