

## DIOXIN BODY BURDEN OF POPULATIONS LIVING IN THE VICINITY OF TWO MUNICIPAL SOLID WASTE INCINERATORS (MSWI) IN BELGIUM

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### Introduction

Over the past few years, there has been some concern in Belgium about the potential health risks of dioxins emitted by municipal solid waste incinerators (MSWI), which was recently reinforced by the Belgian PCB incident in which dioxins were introduced in the food chain<sup>1</sup>. With the exception of the data on human milk published by the WHO in 92/93, no epidemiological study has so far been conducted to assess the dioxin body burden of the Belgian population and to evaluate the possible impact of emission sources such as MSWI<sup>2</sup>. In this study, we compared the dioxin (PCDD/Fs and coplanar PCBs) body burden of subjects living near two MSWI in Wallonia (Belgium) with that of controls living in an unpolluted rural area.

### Methods and Materials

This study was approved by the local ethics Committee. Blood samples were obtained from subjects living near two MSWI in Belgium, one localized in a rural area (Thumaide) and the other in an industrial area (Pont-de-Loup). These two MSWI have been in activity for more than 20 years and their emissions have been more than 100 times above the current norm (0.1 ng TEQ/Nm<sup>3</sup>) until the mid-90s. A total of 85 subjects were recruited around the two MSWI, 52 from Thumaide (26 women and 26 men, aged 21 to 80 years) and 33 from Pont-de-Loup (20 women and 13 men, aged 33 to 65 years). These subjects were compared with 27 control subjects (11 women and 16 men, aged 33 to 66 years) living in the Ardenne (Belgium). These three groups were not significantly different with respect to age, sex, smoking habits and health status. Having given their informed consent, the volunteers provided approximately 200 ml of blood after fasting for 12 hours. In order to evaluate dioxin body burdens, dioxins (17 PCDD/Fs congeners) and coplanar PCBs (IUPAC n o 77, 81, 126 and 169) were quantified by GCMS on the lipid fraction of 50 ml of serum. The results were expressed per gram fat as equivalents of TCDD using the WHO-TEFs (1998). The statistical analysis was done using the SAS software version 8.0.

### Results and Discussion

The dioxin body burden of residents near the Thumaide MSWI was significantly higher than that of the control subjects living in the Ardenne (geometric mean, 36.7 vs. 27.2 pg TEQ/g fat,  $p = 0.01$ ). By contrast, the dioxin body burden of subjects living near the Pont-de-Loup MSWI (24.3 pg TEQ/g fat) was slightly (but not significantly) lower than that of controls. This difference between Thumaide and Pont-de-Loup is most probably due to the lower proportions of residents regularly consuming locally produced foods in Pont-de-Loup (27%) compared to Thumaide (50%).

## HUMAN EXPOSURE II - POSITIVE

After adjustment for age which was the only other factor influencing the accumulation of dioxins, the increase of dioxin body burden attributable to the emissions of the Thumaide MSWI was estimated to average 34 % (Fig. 1). The analysis of the congeners patterns showed that this increase was mainly due to the 1,2,3,7,8-PeCDD and 2,3,4,7,8-PeCDF congeners, which were precisely those responsible for the contamination of cow's milk around this incinerator (Fig. 2, results not shown for cow's milk).

These results were thus reassuring for the residents of the incinerator of Pont-de-Loup and even for those of Thumaide, as their dioxin body burden remains despite the increase within the range of background values recently reported in Europe for populations of the same age living in unpolluted areas : Finland, 33 pg TEQ/g fat (12 to 81) (control subjects, age: 40 to 70 years) <sup>3</sup>; Germany, 40.8 pg TEQ/g fat (11 to 112) (rural zone, mean age: 44.7 years) <sup>4</sup>; Germany, 21.9 pg TEQ/g fat (general population, mean age: 49.1 years) <sup>5</sup>. It is also interesting to note that dioxin concentrations in the blood of subjects living near these two incinerators were also within the range of values reported by the WHO for human milk collected in two areas of Belgium in 1992/1993 : 20.8 (Walloon Brabant) and 34.4 (Flanders) pg TEQ/g fat <sup>2</sup>. Taking into account the fact that the population examined in our study was much older than the young women examined by the WHO, our results suggest that exposure of the general population to dioxins continues to decrease in Belgium.

After adjustment for other determinants (age, BMI and fish consumption), the coplanar PCB body burden was found to be similar between residents of the Thumaide MSWI and controls from the unpolluted area (8.7 vs. 7.7 pg TEQ/g fat). Subjects living in Pont-de-Loup even had lower concentrations of coplanar PCBs in their blood (5.1 pg TEQ/g fat) compared to controls.

The increase of dioxin body burden observed in Thumaide (34 %) enables us to estimate the safety margin offered by the emission norm imposed to incinerators in Belgium (0.1 ng TEQ/Nm<sup>3</sup>). If one assumes that dioxin emissions of this incinerator have exceeded 50 ng TEQ/Nm<sup>3</sup> during approximately 20 years, this norm thus represents a safety margin by a factor of 50 to 100 for an increase in dioxin body burden greater than 5 % in people regularly consuming local products.

### Acknowledgments

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### References

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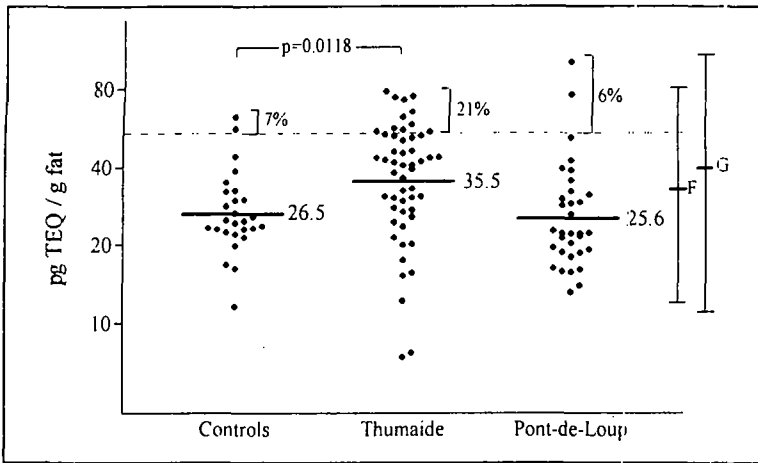


Figure 1. Concentrations of dioxins in the blood of subjects living in the vicinity of two MSWI in Belgium (values adjusted for an age of 50 years). The dotted horizontal line represents the upper limit of normal as calculated in the control group (geometric mean + 2 SD). The two vertical bars represent the medians and extreme values reported recently in Europe for populations living in unpopulated areas (F, Finnish controls; G, rural population in Germany).

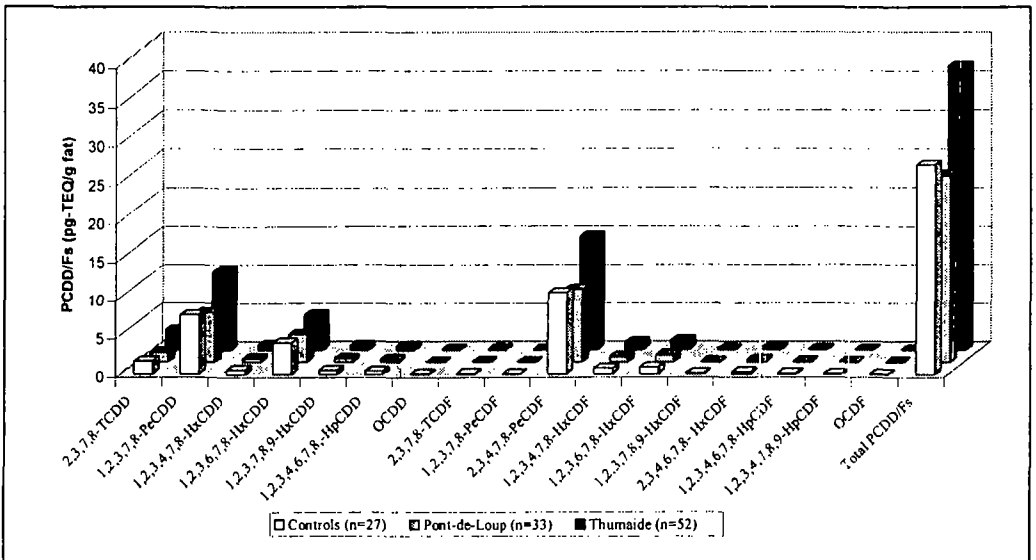


Figure 2. Patterns of the PCDD/Fs in the blood of subjects living near two MSWI and in a control area in Belgium.