TOTAL DIOXIN EXPOSURE ASSESSMENT: A JAPANESE CASE STUDY IN TWO AREAS CONDUCTED BY JAPAN ENVIRONMENT AGENCY

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Introduction

In Japan, dioxins (polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), and coplanar-polychlorinated biphenyls (co-PCBs)) emitted from waste incinerators have recently been a focus of social concern. Especially, Nose town in Osaka prefecture and southeastern part of Saitama prefecture get special concern among other cases. In Nose town, highly contaminated soil which has a maximum TEQ concentration of 8,500 pg/g was found around the municipal solid waste incinerators located in the town. In southeastern part of Saitama prefecture, several small industrial waste incinerators are located within a radius of about 2 km, and possible dioxin contamination around the incinerators area are suspected.

Japan Environment Agency conducted a comprehensive dioxin exposure study in the above two areas of serious concern. The final goal of this study is (1) to identify the contribution of the special local sources among total exposure, (2) to establish the relationship between exposure and human body burden. Dioxin levels in ambient and indoor air, deposition, surface soil, fallout particle on soil surface, groundwater, house dust, diet and blood samples were collected from volunteers in the residents of the surrounded areas. Control samples were also collected to investigate potential impacts from direct and indirect local atmospheric contamination.

In this presentation, dioxin concentrations in the analyzed samples and the results from preliminary exposure assessment are discussed.

Materials and methods

Study areas and volunteers

The two studied areas are Nose town in Osaka prefecture and the southeastern part of Saitama prefecture. Both of the areas are mainly residential and agricultural area, in which several vegetable plants are grown on the farms.

About 15 volunteers were selected from the neighboring zone and the control zone of the two areas, respectively. Neighboring zone was the area around the suspected local point source(s), roughly within 2km radius from the suspected local source(s). Control zone was selected near each neighboring zone but further from the suspected local point source(s) (Table 1). Volunteers preferably meet the following criterion were selected: (1) age ranged from 40 to 65, (2) residence period longer than 1 year in the target zone, (3) longer residence time in the target zone during the day.

Environmental samples and CMB analysis

Ambient air, deposition, surface soil, fallout particle on soil surface, groundwater, indoor air, and house dust samples were collected from the residences or nearby sites of the all or selected volunteers (Table 2). Newly developed techniques were used for dust deposition sampling and *in situ* water sampling[1,2].

Ambient air at the elevation of 1.5m and 3m height from ground level were sampled using high-volume and/or middle-volume air samplers[3]. Indoor air were sampled during 1 week in the volunteer's residence. Information on the ventilation of the rooms, cooking and heating activities were obtained through questionnaire. House dust samples were taken at the residence of the selected volunteers.

Soil samples of 5cm depth were taken at the residence of the selected volunteers. Deposition of dioxins were sampled at the residence of the selected volunteers over one-month period. Fallout particle on surface soil samples were taken at the soil sampling site. Part of these samples were fractionated according to the particle diameter range. Chemical mass balance (CMB) analysis for the origin estimation of the soil/particle/dust samples were performed by the fractionated samples, using the analyzed data of Al, Na, Mn, V, K and some other parameters.

Diet and blood samples

Diet samples were prepared by duplicate plate sampling from three days diets of each volunteer. Precise information on dietary and smoking habit were obtained through questionnaire. A 100ml blood samples were taken from each volunteer. Dioxins and general physiological parameters were analyzed from the blood samples.

Dioxin analysis

The samples were analyzed for 2,3,7,8-substituted PCDDs and PCDFs, and co-PCBs. Determination of these compounds generally followed the protocol by Environment Agency[4]. Briefly, all samples were extracted with organic solvents. Then analytes in purified extracts were separated and quantitated by high-resolution gas chromatography/high-resolution mass spectrometry.

Results and Discussion

The distribution of PCDDs and PCDFs concentrations in the soil and blood samples are shown in Figure 1. TEQ was calculated using I-TEF[5]. The soil concentrations in the neighboring zones were higher than those in the control zones in both cases. However, no discernable difference in the distribution of blood concentrations was observed in both cases.

TEQs from co-PCBs[5] exhibited similar trend between the zones. The average concentrations in soil were higher in the neighboring zone than in the control zone in both cases, whereas the average concentrations in blood were comparable between the neighboring and control zone in both cases. Co-PCBs comprise 0.02%-18% and 9%-56% of total TEQs in soil and blood, respectively.

Total exposure assessment based on the concentrations in other matrices will be presented and discussed.

REFERENCES

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Table 1. Statistics of the volunteers

	Nose		Saitama	
	neighboring zone	control zone	neighboring zone	control zone
Total number	15	17	16	15
male	7	10	4	6
female	8	7	12	9
Mean age	47	53	51	48
Mean residence period (yr)	20	35	24	27

Table 2. Number of samples collected

	Nose		Saitama	
	neighboring zone	control zone	neighboring zone	control zone
Ambient air	7	9	11	6
Deposition	1	1	1	1
Surface soil	7	10	9	6
Fallout particle	7	10	9	6
Ground water	Total 8		—	
Indoor air	11	14	16	15
House dust	1	1	1	1
Diet	13	15	16	15
Blood	15	17	16	15

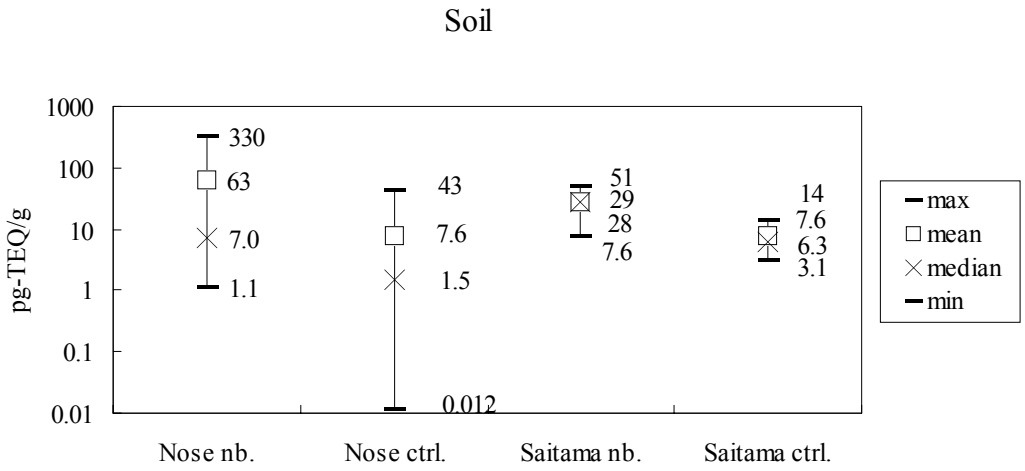

Figure 1. I-TEQ concentration distribution of PCDDs and PCDFs in soil (upper) and blood (lower) samples for the neighboring (nb.) and the control (ctrl.) zones in Nose and Saitama. Note that the I-TEQ axis is logarithmic.