DIOXINS AND CO-PLANER PCBS IN AMBIENT AIR –COMPARISON OF HIGH VOLUME AND LOW VOLUME AIR SAMPLING-

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Introduction

To clarify the behavior/environmental fate, and/or the risk for organisms, obtaining accurate data regarding the concentration of dioxins and co-planer PCBs in ambient air is indispensable. In general, dioxin and co-plane PCB concentrations in air are determined using high volume sampling methods. However, it seems that concentration and congener/isomer distribution patterns of dioxins and PCBs in air vary widely from day to day. None the less, there are few studies available to researchers that provide long term sampling data. In this study, two air sampling methods ("high volume air sampler" and "low volume air sampler") were compared.

Field Operation

Two field studies were carried out.

(1) Air Sampling (Location-A)

High volume air sampling (sampling rate : 700L/min, sampling time : 24hrs(1day), total sample size : 1000m^3) was carried out for 7 days. Quart Air Filter and polyurethane form plug (PUFP) were changed daily. At the same sampling location, low volume air sampling (sampling rate : 30L/min, sampling time : 168hrs(7days), total sample size : 300m^3) was carried out.

(2) Air Sampling (Location-B)

Low volume air sampling (sampling rate : 30L/min, sampling time : 168hrs(7days), total sample size : 300m^3) was carried out continuously from Nov.,1998-Mar.,1999. Sampling for 7 days was done once per month.

Analysis

Quart Air Filters and PUFPs were dried in a desiccator. After spiking with internal standard ^{13}C compounds, PCDDs/PCDFs and co-PCBs were extracted using soxhlet extractor. Multi layer silica

gel and activated carbon column chromatography techniques were employed for sample clean up. Concentration of PCDDs, PCDFs and co-PCBs were determined by isotope dilution HRGC/HRMS method. All ^{13}C 2,3,7,8- substituted isomers and twelve ^{13}C co-PCBs congeners (IUPAC #77, #81, #126, #169, #105, #114, #118, #123, #156, #157, #167, #189) were used for internal standard surrogates for PCDDs/PCDFs and PCB's respectively. Organic solvents used for analysis were purified by non-boiling distillations. All procedures were carried out in a chemical hazard clean room (class<10000).

Results and Discussion

The results of comparing "high volume" and "low volume" air sampling method are shown in *Figure-1*. Total TEQ of PCDDs/PCDFs for each day differed widely in concentration from 0.1-0.9 pg-TEQ/m^3. For example, concentration and congener distribution of the "1st day's" and the "2nd day's" are shown in *Figure-2*. Atmospheric concentration of PCDDs/PCDFs is varies depending on meteorological conditions and emission rates.

There are significant concentration and congener profile differences between these two samples. However, results obtained using the low volume air sampling method were in good agreement with the average 7-day observation value (see *Figure-1*). Congener distributions of the two sampling methods are shown in *Figure-2*. There is no significant difference in the distribution pattern between the "average of high volume sampling" and the "low volume sampling".

Long term monitoring was carried out. Concentration and congener distributions are shown in *Figure-4*. There are slight differences regarding congener profiles, but concentrations observed were stable during the monitoring period. The range of TEQ's was 0.38-0.51pg-TEQ/m^3 (n=5, average=0.45pg-TEQ/m^3, SD=10%).

Results obtained show low volume air sampling methods are suitable to investigate the middle-long term average value of dioxin concentration in ambient air. This may be especially important for exposure assessment from inhalation.

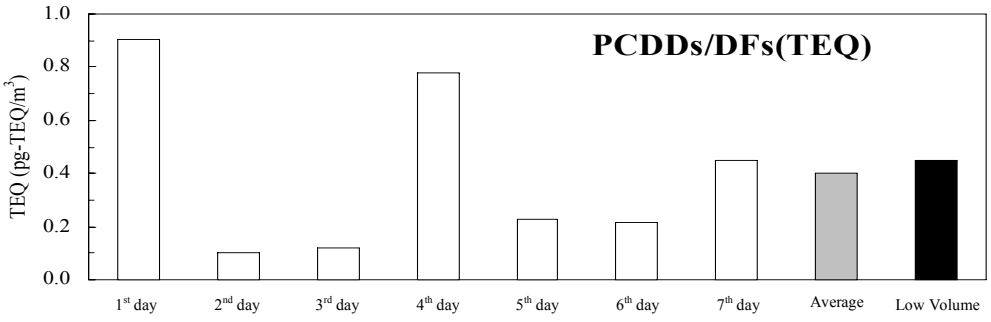

Figure-1. Comparison between high volume air sampling and low volume air sampling methods.

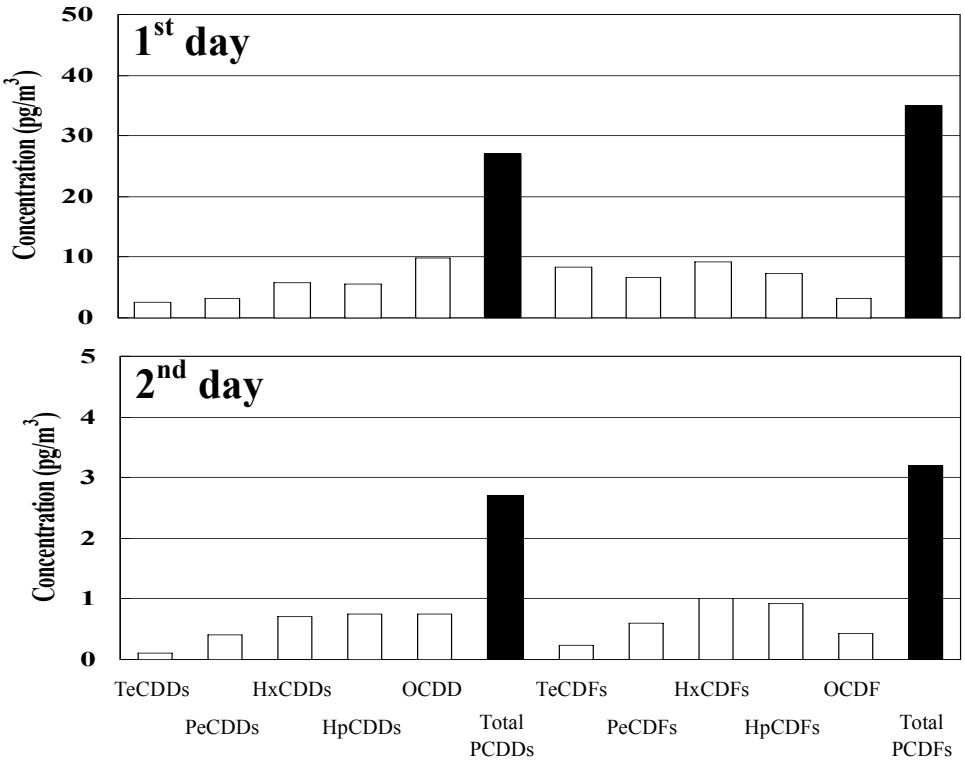

Figure-2. Comparison of congener distribution for the "1st day" and the "2nd day" samples.

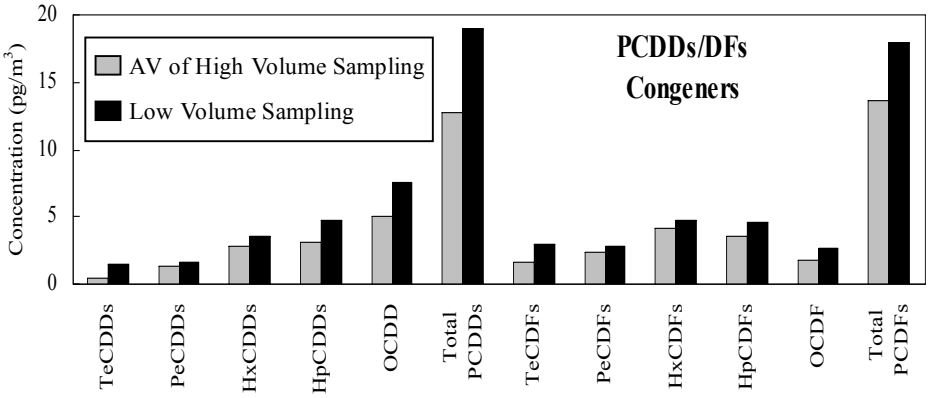

Figure-3. Comparison of congener distribution for the high volume" and the "low volume" samples.

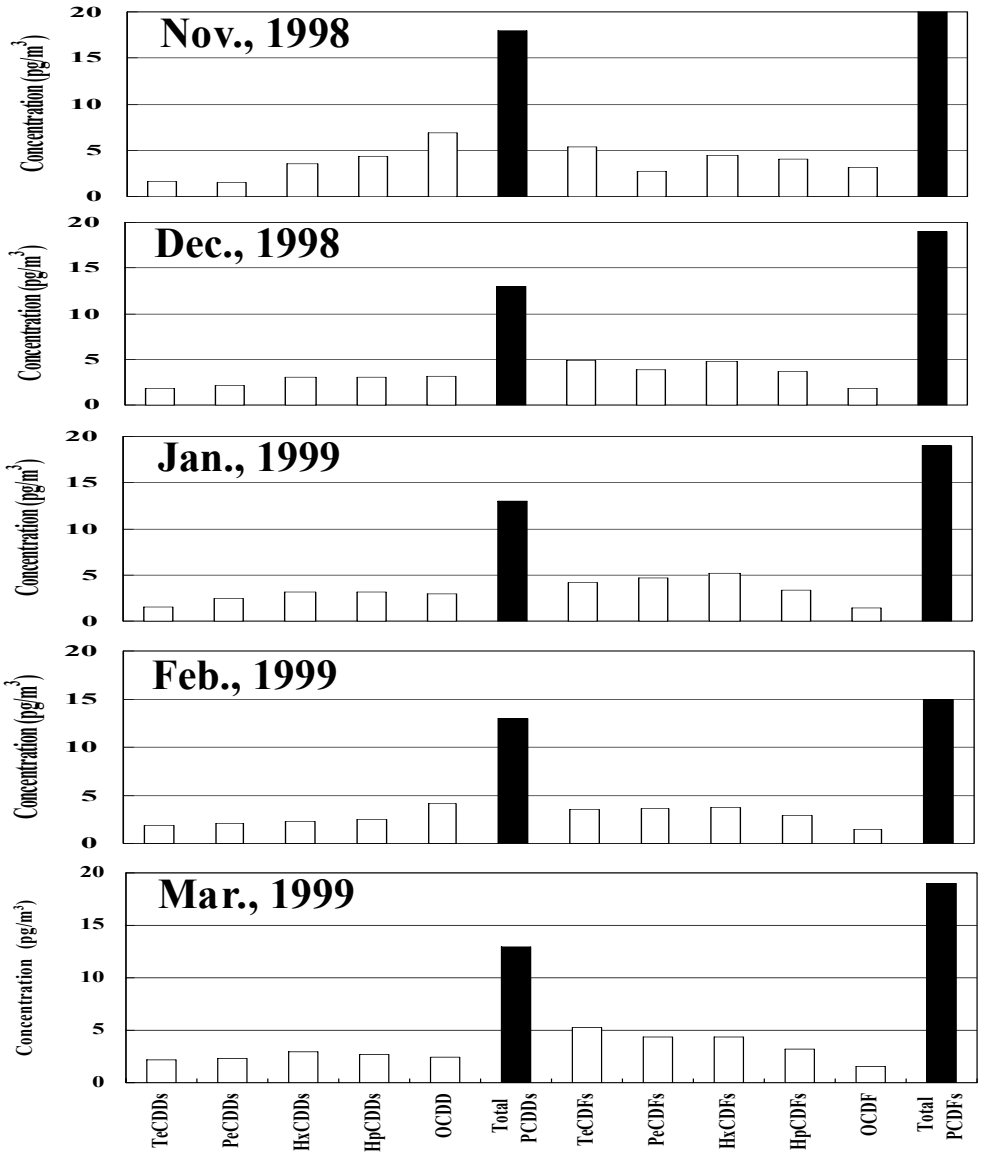

Figure-4. 5-month monitoring using low volume air sampling method.