THE CONCENTRATIONS OF PCBS IN DUST-FALL COLLECTED IN IRON AND STEEL INDUSTRIAL COMPLEX, KOREA

In-Ho Kim[1], Young-Min Kim[1], Min-Kyun Kim[2] and Byoung-Eog Kim[2]

[1]Air Quality Preservation Team, Environment&Energy Department, POSCO, Pohang, Korea
[2]Environment&Energy Research Center, Research Institute of Industrial Science & Technology, Korea

Introduction

Polychlorinated biphenyls (PCBs) are well known as persistent, complex mixtures of isormers and congeners which have been detected in air, water, wildlife and human beings all over the world. The individual PCBs differ in persistence in the environment and in their toxicological mechanism and potency depending on the chlorine number and the substitution pattern of the biphenyl rings (1). Hence, the complicated analytical methodologies for PCBs have hampered the study for PCB distributions. The aim of this study is to investigate the concentrations of Polychlorinated biphenyls (PCBs) in dust-fall collected in Iron and steel industrial complex where studies monitoring PCB concentrations are sparse.

Materials and Methods

Sampling of Dust-fall: Dust-fall samples were collected at 9sites in Iron and Steel industrial complex, every month from December, 2000 to November, 2001. Figure 1 shows each 9 monitoring site.

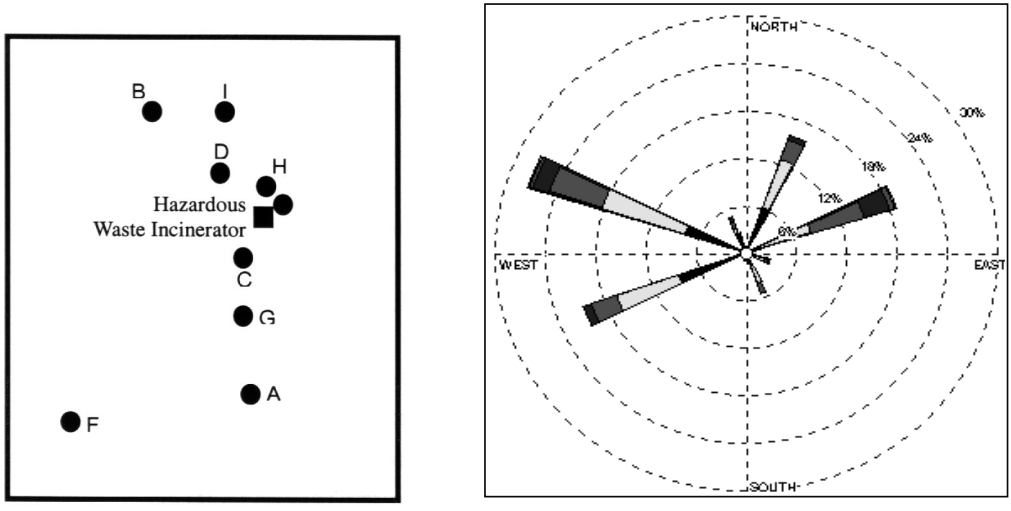

Figure 1. Sampling sites and wind rose diagram

FORMATION AND SOURCES: FIELD CASES

The Iron and Steel industrial complex consists of ca 200 companies with 1 hazardous waste incinerator. Each sampling site from "A" to "I" described in figure 1 was located at 10, 7, 3, 2.5, 0.3, 13, 5, 0.5, 5 km distance from an incinerator, respectively. As shown in wind rose diagram in figure 1, the main direction of annual wind was NWW, NEE, SWW and NNE.

Chemicals

^{13}C-labled PCB compounds were purchased from Cambridge Isotope Laboratories, MA, USA. Silica gel(100-200mesh) was purchased from Alltech, IL, USA and Aldrich, WI, USA. All solvents were used after purification by reflux.

Analytical Method

Filtration

Dust-fall samples collected were filtered using pore size 0.45 ? of a micrro-membrane filter, and then insoluble portion over pore size was kept in a desiccator under consistent temperature and humidity for weighing. The final samples treated through procedures described above were stored in a refrigerator below 5?.

Pre-Preparation

The pre-preparation procedure of dust-fall samples weighed, consists of the extraction and the concentration prior to analysis. The extraction of dust-fall was carried out using an accelerated solvent extractor (Dionex ASE200, USA) with toluene and the extracts were concentrated by nitrogen gas . EC-4977, -4978 and –4979 were used for the internal standard during pre-preparation procedure.

Analysis

Gas Chromatograph (HP6890, USA) with High Resolution Mass Spectrometry (Micromass Autospec Ultima, UK) were employed for the analysis of PCBs. The separation was completed by 60m of a DB-5 capillary column (ID 0.32 mm, film thickness 0.25 ?, J&W Scientific, USA).

Results and Discussions

Table 1 shows the concentrations of 27 PCBs in dust-fall collected in Iron and Steel complex. Sampling site H located in the vicinity of a Hazardous waste incinerator shows the highest concentration of PCBs, 9730.7 pg/g. However, the incinerator, itself can not fully explain PCB distributions in Iron and Steel industrial complex, since the distance of sampling sites from an incinerator was not propotional to the concentrations of PCBs shown in Table 1. It may be conceivable that there are other factors such as PCB sources and climate factors and all possible factors related with PCB distributions are being investigated.

References

1. Bernhopt, A., Hektoen, H., Skaare, J.U., Ingebrigtsen, K., 1994, Tissue distribution and effects on hepatic xenobiotic metabolizing enzymes of 2,3,3,4,4-pentachlorobiphenyl (PCB-105) in cod (*Gadus morhua*) and Rainbow trout *(Oncorhynchus mykiss*). Evnironmental Pollution 85, 351-359.

Table 1. The concentrations of PCBs in dust-fall at nine sampling sites.

	A	B	C	D	E	F	G	H	I
1L	100.72	190.36	27.89	N.D.	77.67	60.42	23.56	123.77	23.78
3L	235.90	249.15	94.91	N.D.	232.30	211.02	87.81	314.37	32.97
4L	162.28	N.D.	58.87	N.D.	N.D.	N.D.	50.82	1153.81	N.D.
15L	446.59	65.73	227.56	533.43	201.19	192.89	194.61	2144.42	36.19
19L	26.51	7.15	12.22	20.30	19.82	13.20	8.43	185.94	3.13
37L	515.34	68.69	299.11	480.27	204.53	296.02	255.18	2576.71	41.01
54L	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.68	N.D.
77L	175.59	12.84	61.99	160.93	219.31	86.54	56.93	351.64	5.97
81L	16.08	N.D.	3.55	15.11	N.D.	5.46	3.49	15.74	0.43
104L	3.57	0.78	0.13	N.D.	N.D.	1.14	0.25	0.31	N.D.
105L	1009.95	26.84	179.19	202.52	226.20	274.49	119.23	846.73	12.39
114L	69.84	5.59	13.58	24.78	17.43	21.96	9.65	61.73	1.60
118L	2092.61	79.23	349.73	434.47	489.40	571.76	229.23	1533.70	42.65
123L	209.87	10.98	33.15	72.29	56.11	66.47	29.08	141.30	6.29
126L	46.91	5.53	6.13	19.67	13.28	19.43	5.83	6.59	1.38
155L	11.69	0.56	0.85	2.97	5.40	3.27	0.86	1.43	1.10
156L	465.91	5.12	41.49	44.26	79.09	108.47	35.17	134.04	1.90
157L	85.15	1.16	8.97	9.67	13.30	19.67	6.45	29.09	0.38
167L	163.01	2.75	15.59	17.61	34.47	41.74	13.47	48.95	2.21
169L	17.20	1.78	1.07	3.35	2.63	3.98	0.64	0.83	0.47
188L	N.D.	N.D.	N.D.	0.51	N.D.	N.D.	N.D.	N.D.	N.D.
189L	107.27	4.27	7.31	16.03	20.53	40.01	12.01	21.16	2.03
202L	40.31	0.64	2.41	5.82	4.42	10.34	8.15	7.50	N.D.
205L	34.21	0.06	2.34	5.71	4.94	7.61	4.63	5.28	N.D.
206L	96.20	5.39	8.49	18.64	17.23	32.55	20.79	15.22	1.52
208L	28.87	1.01	1.90	5.54	4.06	7.67	5.35	3.08	0.17
209L	102.41	6.17	4.93	21.19	25.08	27.02	5.89	5.71	2.01
Total	6263.99	751.78	1463.35	2115.07	1968.39	2123.10	1187.50	9730.71	219.57