PCDDs and PCDFs in snow coat of an industrial city as a result of oil incineration at accident place

Kruglov E.A., Amirova Z.K., Loshkina E.A.

The Regional Ecological Centre of the Republic Bashkortostan
147 October Av., Ufa 450075, Bashkortostan, Russia

1.Introduction

In regions with a stable snow coat during some months the snow as a matrix can be applied in determining the contamination by way of PCDD/Fs precipitation with dust and aerosol particles from the atmosphere [1,2].

In the Republic Bashkortostan (the South Urals region) the stable snow coat is preserved for 5 months, the average depth of it attains about 60-90 cm, and the thaws do not practically result in its destruction.

This climate special feature is successfully used during many years in performing the background monitoring of polyaromatix hydrocarbons (PAH), acid precipitates by Russian Federal Service on Hydrometeorology and Environment Monitoring [3].

The snow sampling was carried out a year in a period of a maximum moisture accumulation with registrating the snow density, the date of establishing the stable snow coat, the total amount of precipitates, the height of snow bed etc.

So the exposition of atmospheric contamination during 4-5 months has been evaluated as a region dependence.

2. Materials and Methods

The snow sampling was performed according to the method, applied for PAH [3] : five snow cores in a square 1 m x 1 m were taken from the whole bed depth with a standard sampling device (S=5 cm^2), and the average sample was formed. The snow was melted and filtered (2 L) through the polyurethane foam filter. The filter precipitate was estimated gravimetrically. The filter was labelled with 15 ^{13}C12-2,3,7,8-PCDD/PCDFs. The futher sample processing consisted in extracting with benzene in Soxhlet apparatus (24 hours), in concentrating and cleaning the extract on multilayer silica, graphitized carbon and alumina columns.

To the final extract in 5 µl of dodecane the ^{13}C12-1,2,3,4-TCDD and ^{13}C12-1,2,3,7,8,9-HxCDD as internal standards were added. All the criteria of US EPA Method 1613 were fullfilled.

The measuring system included: VG Autospec-Ultima HRMS-Carlo Erba 8035 GC (MS: SIR, 10000, EI, 36 ev, reg.2 ions; GC: J & W Scientific DB-5, 60 m, 0,25 mm, injectin volume 1 µl).

3. Results and Discussions

The snow was sampled in industrial area of Ufa with large-scale oil-processing and herbicide producing facilities with incinerator of organic chlorine residues (sample 1); in urban area in the vicinity of a large heat power-station functioning on the mazout as a feedstock (sample 2) and in rural locality (sample 3).

The PCDD/PCDFs content are snow in the Table 1. The isomeric pattern (Fig.1) demonstrates the source dependence and the complex transfer behavior (sample 3), which is noted in [1].

In winter 1996 the snow and air were sampled from the pipeline breakdown place on the frozen river, where the large crude oil flood occured. A part of crude oil, collected from the ice surfase, was burned. The air samples were taken in residential areas in 100 m from the accident place in the directions down (A) and against the wind (B). The snow was collected from the surfase in close vicinity to the incineration of crude oil (Table2).

4.References

1) Marklund S., Tyslind M., Andersson P., Ljung K., Sodestrom G., Rappe C. (1991): Environmental deposition of PCDDs and PCDFs as determined by the analyses of snow samples from Northern Sweden. Chemosphere, vol. 23., nos. 8-10, 1359-1364.

2) Andersson P., Marklund S., Rappe C. (1992): Levels and profiles of PCDDs and PCDFs in environmental samples as determined in snow deposited in Northern Sweden. Dioxin-92 , Tampere, Finland, vol. 8., 307-310.

3) Guidance on the monitoring of atmosphere contamination (1991): R.D. 52.04.186-89, Moscow, Goskohydromet,508-520.

Table 1.

PCDD/Fs content in snow samples (pg/g dust)

PCDD/PCDFs, pg/g	Samples		
	1	2	3
2,3,7,8-Cl4DF	1,33	0,84	0,17
2,3,7,8-Cl4DD	0,33	0,51	0,1
1,2,3,7,8-Cl5DF	0,62	0,77	0,25
2,3,4,7,8-Cl5DF	1,32	1,65	0,23
1,2,3,7,8-Cl5DD	ND	ND	ND
1,2,3,4,7,8-Cl6DF	2,17	1,87	0,20
1,2,3,6,7,8-Cl6DF	2,08	2,12	0,25
1,2,3,7,8,9-Cl6DF	1,16	ND	0,37
2,3,4,6,7,8-Cl6DF	1,6	1,54	0,28
1,2,3,4,7,8,-Cl6DD	ND	ND	ND
1,2,3,6,7,8-Cl6DD	1,23	0,86	0,12
1,2,3,7,8,9-Cl6DD	0,72	ND	ND
1,2,3,4,6,7,8-Cl7DD	8,88	14,75	0,51
1,2,3,4,7,8,9-Cl7DF	1,3	1,83	0,13
1,2,3,4,6,7,8-Cl7DF	6,36	6,64	0,43
Cl 8DF	9,28	27,07	2,7
Cl8DD	21,5	38,92	1,33
I-TEQ, pg/g	2,52	2,39	1,7
I-TEQ, pg/m^2	100,8	95,6	68,0
I-TEQ, pg/m^2 · day	0,9	0,8	0,5

Fig. 1.

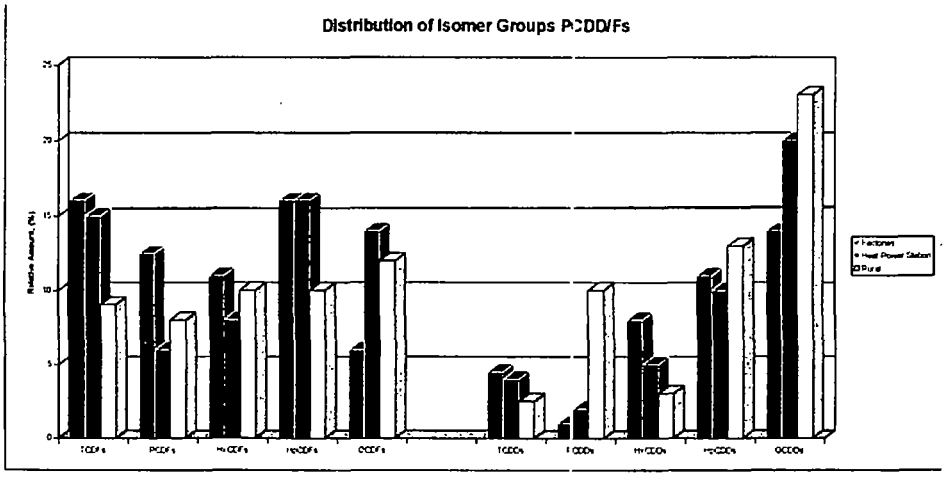

Table2.

PCDD/Fs content in air and snow on the incineration of oil place

PCDD/PCDFs	Air, pg/m³		Snow from incineration place, Pg/g (dust).
	A	B	
2,3,7,8-Cl 4DD	0,56	0,17	32
Total Cl 4DD	3,37	0,31	154,7
1,2,3,7,8-Cl 5DD	0,85	0,12	119,8
Total Cl 5DD	0,44	0,08	186,77
1,2,3,4,7,8-Cl 6DD	0,32	0,09	36,24
1,2,3,6,7,8-Cl 6DD	1,84	0,12	70,69
1,2,3,7,8,9-Cl 6DD	0,52	0,08	35,98
Total Cl 6DD	0,56	0,37	264,8
1,2,3,4,6,7,8-Cl 7DD	7,77	4,26	278,3
Total Cl 7DD	5,00	3,16	343,4
Cl8DD	62,45	39,3	2556,4
2,3,7,8-Cl 4DF	0,65	0,42	124,07
Total Cl 4DF	1,20	1,00	427
1,2,3,7,8-Cl 5DF	0,19	0,13	263
2,3,4,7,8-Cl 5DF	0,24	0,16	286,7
Total Cl 5DF	0,38	0,38	1575,5
1,2,3,4,7,8-Cl 6DF	0,28	0,12	385,7
1,2,3,6,7,8-Cl 6DF	0,26	0,10	326,45
1,2,3,7,8,9-Cl 6DF	0,30	0,05	88,36
2,3,4,6,7,8-Cl 6DF	0,37	0,08	210,32
Total Cl 6DF	0,17	0,15	1298,68
1,2,3,4,6,7,8-Cl 7DF	0,67	0,21	879,36
1,2,3,4,7,8,9-Cl 7DF	0,44	0,05	129,37
Total Cl 7DF	0,22	0,17	1735,45
Cl8DF	2,00	0,22	882,92
Total PCDD	172,73	48,06	3230
Total PCDF	7,37	3,24	8614,2
I-TEQ-PCDD	1,39	0,241	112,31
I-TEQ-PCDF	0,33	0,26	280,98
I-TEQ PCDD/PCDFs	1,72	0,5	392,3