PCDD/PCDF BALANCE OF DIFFERENT MUNICIPAL WASTE MANAGEMENT METHODS
1. MUNICIPAL WASTE INCINERATORS (MWI)

Uwe Lahl
Umweltdezernat Stadt Bielefeld, Neues Rathaus, D - 4800 Bielefeld 1, FRG

and

Michael Wilken, Barbara Zeschmar-Lahl, Johannes Jager
ITU-Forschung, Ansbacher Str. 5, D - 1000 Berlin 30, FRG

Introduction

Municipal waste incinerators (MWI) emit PCDD and PCDF (1, 2). As sources a de - novo - synthesis is discussed (3) as well as a breakthrough of these compounds from the waste into the stream of flue gas and filter dust (4). Therefore, input - output - balances for PCDD/ PCDF in MWIs are necessary.

Exact balances of PCDD/PCDF in input and output of conventional MWIs faces the problem of collecting representative samples on the input side. Even if the sampling network is narrowed, the heterogenicity of municipal and especially of municipal-like trade waste is a more or less invincible barrier. This problem could be solved in the MWI Bielefeld - Herford, where the whole input stream is chopped, milled and mixed by a ball mill (5).

Experimental

The examination included two sample collection episodes, one in summer (A = 27.7.1989) and one in winter (B = 23.1.1990). Solid samples (sewage sludge, milled waste + sewage sludge (9 : 1), electrofilter dust) were taken every 30 min., gaseous samples (flue gas between electrofilter and gas washer, clean gas behind washer) were continuously collected over 8 hours.

Figure 1 shows the apparatus for sample collection.

Results

The results of both examination periods are given in **table 1**.

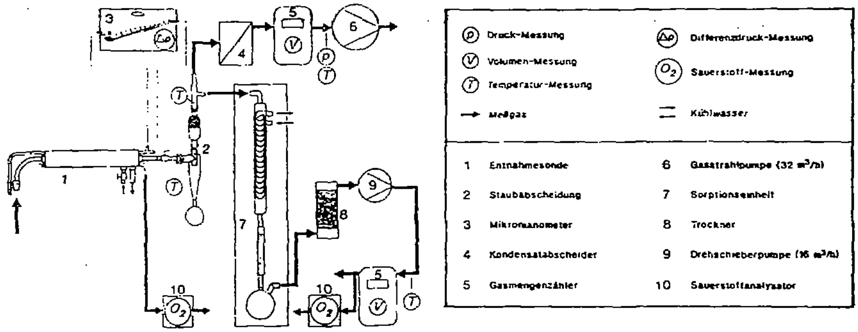
Our analyses show waste to contain, as expected, several PCDD/PCDF-precursors like PCB, chlorobenzenes and chlorophenols. In addition, about 20 ng/g of polybrominated biphenyl ethers, which are known as precursors for PBDD/PBDF, could be identified in the input (waste including sewage sludge).

Tab. 1: Results of sample collection period A and B at the MWI Bielefeld - Herford

PCDD/PCDF	sewage sludge [ng/g] A	sewage sludge [ng/g] B	milled waste [ng/g] A	milled waste [ng/g] B	electrofilter dust [ng/g] A	electrofilter dust [ng/g] B	semiclean gas [ng/m3] A	semiclean gas [ng/m3] B	clean gas [ng/m3] A	clean gas [ng/m3] B
2378-TCDD	<0,01	<0,002	<0,01	<0,002	0,05	0,02	0,18	0,11	0,15	0,17
12378-PentaCDD	<0,01	0,003	<0,01	<0,002	0,45	0,19	0,57	1,23	0,49	0,56
123478-HexaCDD	<0,01	0,006	0,01	0,028	0,72	0,39	0,37	0,56	0,36	0,27
123678-HexaCDD	<0,01	0,021	0,01	0,032	0,84	0,89	0,44	1,38	0,39	1,56
123789-HexaCDD	<0,01	0,008	<0,01	0,008	0,66	0,44	0,46	0,98	0,29	0,88
1234678-HeptaCDD	0,35	0,208	1,31	0,429	13,55	6,87	7,29	8,01	6,98	3,22
2378-TetraCDF	<0,01	0,005	0,01	<0,002	1,05	0,47	5,95	2,87	2,97	2,03
12378+12348-PentaCDF	<0,01	0,008	<0,01	0,013	1,25	0,59	6,28	5,56	3,57	2,92
23478-PentaCDF	<0,01	0,010	<0,01	0,008	1,15	0,70	5,12	5,57	3,24	3,10
123478+123479-HexaCDF	<0,01	0,013	<0,01	0,032	1,43	3,84	6,50	10,51	3,61	5,62
123678-HexaCDF	<0,01	0,006	<0,01	0,027	1,52	2,72	7,46	9,20	4,58	5,25
123789-HexaCDF	<0,01	0,003	<0,01	0,006	0,22	0,30	0,59	0,34	0,40	0,52
234678-HexaCDF	<0,01	0,008	<0,01	0,019	0,78	2,80	4,63	5,97	3,06	3,19
1234678-HeptaCDF	<0,01	0,067	<0,01	0,217	6,85	13,71	15,50	13,17	10,19	12,54
1234789-HeptaCDF	<0,01	0,006	<0,01	0,016	0,83	1,31	1,74	1,06	1,08	1,30
TetraCDD	<0,01	<0,002	<0,01	<0,002	2,75	1,73	6,84	7,55	6,38	5,86
PentaCDD	<0,01	0,097	<0,01	<0,002	10,37	4,23	10,64	10,32	9,92	8,08
HexaCDD	<0,01	0,140	0,21	0,374	18,34	9,95	11,89	13,48	10,41	8,99
HeptaCDD	0,60	0,370	2,43	0,823	25,99	13,17	15,93	16,07	12,25	9,41
OctaCDD	4,55	1,945	10,57	6,196	83,01	56,92	27,31	37,65	17,13	16,65
Sum PCDD	5,15	2,552	13,21	7,393	140,46	86,00	72,61	85,07	56,09	48,99
TetraCDF	<0,01	0,166	0,21	0,093	17,17	12,41	115,06	87,32	71,79	69,90
PentaCDF	<0,01	0,204	0,09	0,230	13,62	14,42	70,30	78,50	46,10	56,07
HexaCDF	<0,01	0,209	<0,01	0,470	12,46	18,32	54,70	59,13	34,41	33,53
HeptaCDF	<0,01	0,130	<0,01	0,314	9,47	19,99	20,76	19,98	15,09	19,22
OctaCDF	<0,01	0,049	<0,01	0,290	2,24	8,71	6,32	9,27	3,68	5,20
Sum PCDF	<0,01	0,757	0,30	1,397	54,97	73,85	267,14	254,20	171,07	183,92
PCDD + PCDF	5,15	3,309	13,51	8,790	195,43	159,85	339,74	339,27	227,16	232,91
TE (BGA)	0,01	0,021	0,03	0,041	2,14	2,13	7,03	6,93	4,46	4,53
TE of freights* (mg/h)	0,00	0,020	0,25	0,332	0,92	0,66	0,60	0,55	0,38	0,36
Sum PCB	139	47,0	514	527	4,4	11,1	9,6	24,9	4,7	17,1

* Input 14 Mg/h, 10 % sewage sludge (35,3 % dry matter), dry matter of input = 59,6 %, semiclean resp. clean vol.: 85.900 m^3/h each, electrofilter dust. 5 g/m^3

Fig. 1: Sample collection apparatus



Furthermore, the input showed a severe burden of PCDD/PCDF themselves. *In sum, the output of PCDD of* the MWI is not higher than the input. Regarding OCDD, the input is even much higher than the output. The input of PCDF on the other hand is neglectable in regard to the output. Here, a generation during combustion has to be considered, probably from chlorinated precursors mentioned above. Because *of bigger shares of less chlorinated PCDD/PCDF (see table 1) the TE of the output is higher than of* the input.

Tab. 2: Input/output - balance of the MWI BI - HF
A: samples from 27.7.1989 B: samples from 23.1.1990

		Input PCDD/PCDF (waste)	Output + Residues	Output vs. Input
PCDD	A:	98,57	66,57	0,68
(mg/h)	B:	64,89	29,37	0,45
PCDF	A:	2,15	46,56	21,66
(mg/h)	B:	12,30	31,72	2,58
Sum PCDD/F	A:	100,72	113,12	1,12
(mg/h)	B:	77,18	61,09	0,79
Sum PCDD/F	A:	0,25	1,52	6,08
(mg/h, TE)	B:	0,36	0,82	2,27

The results of sample collection period B are illustrated in figure 2.

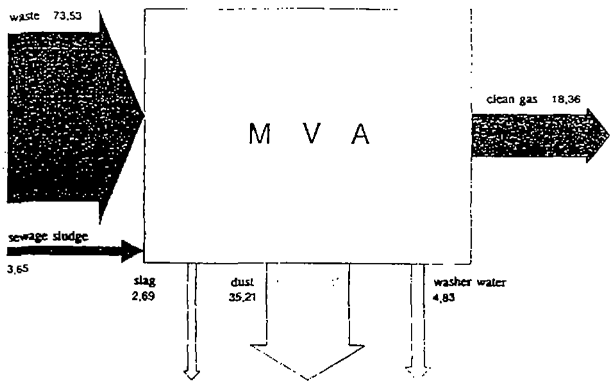
Discussion

The results presented in this paper are reliable because of a representative input sample collection and of the narrow sampling network within two sampling periods. Furthermore, it seems to us of special importance that the examinations conducted in two different seasons (summer, winter) show comparable results.

Fig. 2: Input/output - balance of the MWI BI - HF, samples B

Sum PCDD and PCDF

[mg/h]



The results of table 2 may give great delight to several operators of MWIs. But they also carry a series of implications.

1. The necessity of reducing dioxins - output especially via clean gas is still of great importance in regard to their toxicity. The input of dioxins in waste is no argument for spreading them in the environment by waste removal.

2. Further detailed analyses have to clear the question, which special waste fractions are responsible for the unexpectedly high dioxins input into MWIs.

3. The main matter in the dispute is still open: What proportional of the dioxin - output is the result of direct dioxin - input? This question is of special concern under the aspect of dioxin reduction due to the instructions of the 17th decree of the Federal Immission Protection Law, especially the new emission limit of 0,1 ng (TE)/m^3.

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