DIOXIN EMISSIONS AND DEPOSITIONS AT A BELGIAN INDUSTRIAL SITE

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Introduction

From July 1998 till December 2001 deposition measurements were made in the near surroundings of two sintering plants of Sidmar N.V. in Gent, Belgium. In parallel, dioxin concentrations in flue gas of both sintering plants were recorded in the course of 8-16 single measurements per month.

The presented paper is to highlight several aspects of the measurement programme which will also be continued throughout 2002; in detail:

- Deposition evolution at the sites in the vicinity of the sintering plants
- PCDD/F emissions situation during the measurement period
- Comparable data from rural or urban sites in Germany
- Discussion in view of the present debate of the limit value regarding PCDD/F depositions in Belgium

Methods and Materials

Deposition measurements. The dust deposit collection was done by means of the Bergerhoff procedure acc. to VDI guideline 2119, Sheet 2. For sampling purposes 6 Bergerhoff vessels were placed at each measurement location; one for the determination of the dust deposit and 5 for the determination of dioxin deposits (combined samples).

The Bergerhoff vessels, prepurified in two cleaning courses, were hermetically locked with cleaned glass covers. At the sampling place the glasses were opened and exposed on 1.5 m high a rack. For the analysis the filtrate of the combined samples was extracted with toluene, 10 % acetone was added to the toluene phases and used for the soxhlet extraction of the appropriate glass-fibre filters.

The extracts won by further processing were column-chromatographically cleaned and ^{13}C-labelled standards were added and analysed by capillary-gas chromatographic separation and high resolution mass-spectrometric detection of the PCDD/F by means of HP 5890A/VG AutoSpec.

Emissions measurements. The flue gas samplings reported here were carried out according to the European standard EN 1948 („cooled probe method“).

The extraction of the samples was performed via toluene in a separation funnel (condensate) and in a soxhlet extractor (particle filter and XAD resin) respectively, followed by a clean-up via liquid chromatography using silica and alumina columns.

All analyses were conducted by HRGC/HRMS on HP 5890A/VG AutoSpec systems.

Results and Discussion

The reduction of dioxin emissions in the region of Flanders was pushed ahead by the Ministry of the Flemish Community by means of the so-called ‚Vlarem‘ programmes.[1]

LEVELS IN ABIOTIC COMPARTMENTS

For sintering process emissions in case of existing plants a specific limit value of 2.5 ng I-TEQ/m^3 as well as a target value of 0.4 ng I-TEQ/m^3 was established; for new plants a limit value of 0.5 ng I-TEQ/m^3 has to be met and a target was set at 0.1 ng I-TEQ/m^3.

From July 1998 to December 2001 the GfA performed more than 600 PCDD/F emissions measurements at the sintering plants 1 and 2 of the SIDMAR N.V. in Gent. These measurements were accompanied by deposition measurements within a radius of up to 5 km to the emission sources (pls. vide Fig. 1 for locations).

Table 1 shows a quarterly split of the data on PCDD/F depositions measured at 4 selected locations in the vicinity of the SIDMAR factory premises as well as for the emissions of the sintering plants from 1998 to 2001.

The emission-reduction measures taken by Sidmar since 1998 starting with process integrated measures and ending with the use of adsorbents on the basis of activated carbon indicate a significant impact on the PCDD/F emissions of both sintering plants. During the measurement period the average concentration per annum was decreased from about 6.6 ng I-TEQ/m^3 in 1998 to a tenth in 2001 which means that an average output (weighed on the basis of the different mass flows of both plants) of 69 g I-TEQ/a in 1998 (Calculation basis: hrs/a x m^3/h x I-TEQ/m^3) was reduced to 4.9 g I-TEQ/a in 2001.

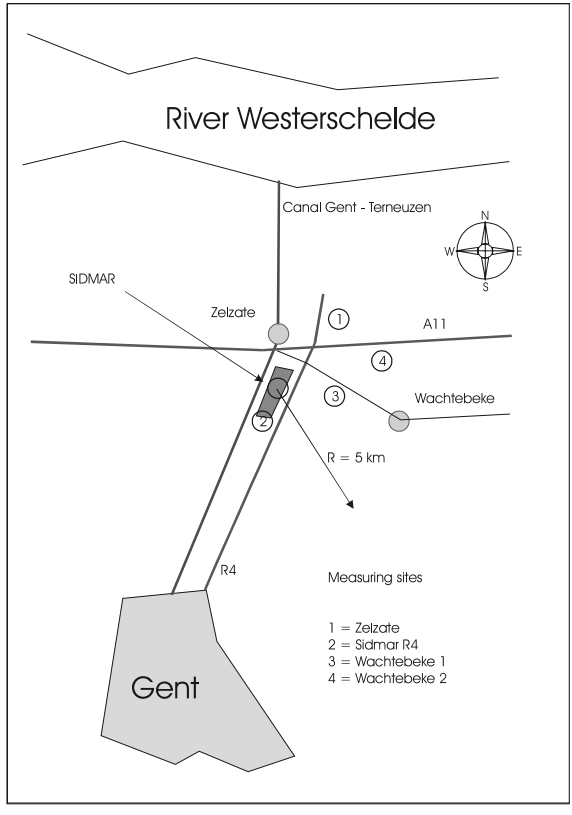

Figure 1. Locations of the PCDD/F deposition measurements in the vicinity of the sintering plants

Table 1. Quarterly mean values of PCDD/F emissions and depositions in the vicinity of two sintering plants of SIDMAR N.V., Gent

Matrix:	PCDD/F in emissions			PCDD/F in depositions				
Site:	sintering plant 1*	sintering plant 2*	ø sintering plant 1 +2/a[a]	ø all locations	Zelzate	Sidmar R4	Wachte-beke 1	Wachte-beke 2
Month/year	ng I-TEQ/m^3			pg I-TEQ/[m^2*d]				
7-9/1998	5.9	8.5	6.6 (1998)	16 (1998)	7	b	b	b
10-12/1998	5.5	5.5			21	21	b	b
1-3/1999	2.8	2.6	2.1 (1999)	10 (1999)	11	15	b	b
4-6/1999	2.4	1.1			6	8	9	9
7-9/1999	2.2	3.5			7	6	11	8
10-12/1999	0.9	1.3			11	11	22	10
1-3/2000	1.0	0.6	0.62 (2000)	13 (2000)	26	9	32	12
4-6/2000	0.5	0.7			8	10	19	10
7-9/2000	0.4	0.7			4	6	9	8
10-12/2000	0.6	0.6			9	10	19	10
1-3/2001	0.4	0.5	0.57 (2001)	9 (2001)	9	20	20	9
4-6/2001	0.5	0.8			4	6	8	5
7-9/2001	0.6	1.0			7	5	16	7
10-12/2001	0.2	0.2			6	8	14	5

* mean values from 8-16 single measurements per month
a weighed acc. to average running time and mass flow b no data determined

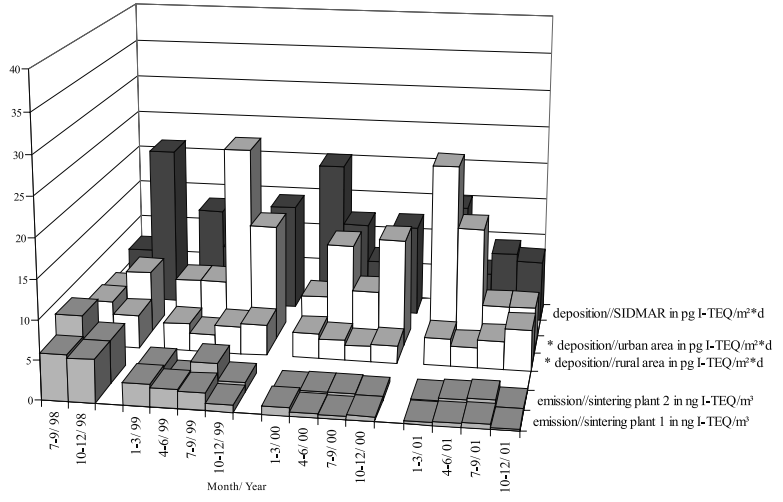

Figure 2. Development of the emissions situation and comparison between SIDMAR PCDD/F depositions and background pollution in a German federal state (marked with an asterisk*) within the years 1998 to 2001

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Figure 2 shows an exemplary comparison of PCDD/F depositions at locations near the sintering plants with average values reflecting the background pollution (urban and rural areas) in a German federal state (basis: 230 values at 5 locations).[2] The PCDD/F deposition in the near surroundings of the sintering plants shows comparable data to German depositions in urban areas and no impact from the emissions situation is observed.

On the other hand it is questionable whether the proposed Flemish limit and guide values of 10 pg I-TEQ/(m^2*d) (limit value) and 3.4 pg I-TEQ/(m^2*d) (guide value) resp. are realistic[3,4] -here the deposition mapping data from German federal states can serve as an orientation.

Examinations from North Rhine-Westphalia[5,6] revealed mean values for rural areas of 5 – 20 pg I-TEQ/(m^2*d) and 10 – 90 pg I-TEQ/(m^2*d) for urban areas and a background deposition of 10 – 15 pg I-TEQ/(m^2*d). GfA measurements in another federal state (vide Fig. 2) show mean values per month of 2-12 pg I-TEQ/(m^2*d) in rural areas and 5-50 pg I-TEQ/(m^2*d) in urban areas.

In view of the fact that dust deposits are naturally subject to high, coincidental fluctuations, limit values, especially on the proposed scale, do not seem to be a sensible alternative for the elaboration of meaningful collectives of data and their comparison to reference values. And at the end of the day this matrix particularly raises the question: „What should be done in case of exceeding the limit value ?“

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