Systematic monitoring of PCDD and PCDF emissions of industrial installations

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Introduction:

A prerequesite for an effective reduction of the PCDD/F input into the environment is the exact knowledge of all relevant sources, having either high emissions > 1 ng TE/m^3 from low outlets and/or high emission fluxes. Whereas the emissions into the air from sources such as incinerators are well known, comprehensive emission data from other industrial installations are widely missing. Consequently, estimates of total annual emissions into the air by primary sources in Germany are highly uncertain, ranging from 760 to 882 g/a[1-4]. A comprehensive monitoring program of industrial emissions has therefore been started in North Rhine-Westfalia (Germany) in order to detect relevant sources and to have a sound basis for further abatement germany measures. First results of this program, which started in 1992, will be presented.

Scope:

In a first step, 76 out of several hundred industrial installations were selected, which could from theory be regarded to possess relevant emission potentials for PCDD/F. This group included, e.g., installations for wood combustion, smelters and foundries for non ferrous metals, sintering installations, for ferrous and non ferrous metals, chemical processes (with chlorine input) or destillation of used oil. 45 installations out of this relevant group were chosen for emission measurements, because the emissions of the remaining facilities could be assessed by analogy.
In this paper results from 32 sources (with 3 measurements each) are presented.

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Experimental:
The emission measurements were predominantly performed under normal operating conditions. At some installations, however different operating conditions were also measured as well as PCDD/F contents in raw and clean gas, to gain insight into the efficiency of filters and other equipment of flue gas cleaning.Sampling time varied between 3 and 23 hours. Each measurement was performed twice, holding operating conditions as constant as possible. The following measurement methods were used: dilution method[5], condensation method[6] and a simplified procedure[7]. Characteristic flue gas components such as CO, TOC, NO_x, SO_2 and HCl were measured parallel to PCDD/F sampling.

In addition to stack emissions of PCDD/F under normal operating conditions, also diffuse emissions from halls were measured in some cases.

First results:

Table 1 contains measurement results from those installations having PCDD/F emissions > 1 ng TE/m^3. The installations in Table 1 represent an hourly total emission of more than 50 mg TE or, assuming 8.000 annual operating hours, an annual emission of nearly 0,5 kg TE. These figures clearly show, that PCDD/F emissions from some industrial source categories other than incinerators as well as total annual emissions in Germany have been grossly underestimated so far.

First results from measurements of diffuse emissions are presented in Table 2.

An important finding is that at some sources emission fluxes by diffuse emissions from low outlets were higher than stack emissions.

First results from measurements of the efficiency of filters can be summarized as follows:

The replacement of an electrostatic precipitator by a fabric filter in a sintering installation resulted in a reduction of only 35% - 75% (TE). On the other hand, the combination of a fabric filter with the input of lime, 5% open hearth coke and NH_3 containing flue gases from the salt conditioning yielded very low emissions from 0,004 ng TE/m^3 for a secondary aluminium smelter.

The use of a biofilter had an efficiency of >95% in the flue gases of a crematorium.

References

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Table 1: Installations with PCDD/F emissions > 1 ng/m

installation	concentration (ng TE/m^3)	emission flux (mg TE/h)
hot briquetting inst. for recycling material	70	3,7
Sintering inst. (recycling material)	47	13
sintering inst. (iron ore)	43	29
sintering inst. (iron ore)	12	5,8
Sn-secondary smelter	5,9	0,09
sintering inst. (iron ore)	1,9	2,0

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Table 2: Emissions from diffuse sources		
installation	concentration (ng TE/m^3)	emission flux (mg TE/h)
workhall exhaust system, sintering inst. 1	0,62	0,272
workhall exhaust system, sintering inst. 2	0,01	0,002
Al-secondary smelter, hall emissions	0,01	0,003
Zn-secondary smelter, hall emissions	0,05	0,002

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