STATUTORY AND RESEARCH ACTION IN AUSTRIA

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ABSTRACT

In Austria an emission limiting value for PCDD/F of 0,1 ng toxic equivalents/m³ (I-TEF) for steam boiler plants, which incinerate municipal waste, waste oil or biomass material was established in 1989. The major results of an estimation of PCDD/F amounts emitted from various sources are 20 - 150 g TE per year. The most important environmental investigations dealing with PCDD/F, mainly carried out around a copper reclamation plant, are described.

1. LEGAL SITUATION

In Austria the "Clean Air Act for Steam Boiler Plants" (Luftreinhaltegesetz für Kesselanlagen, LRG-K [1]) came into effect on 1 January 1989. This law sets an emission limiting value of 0,1 ng toxic equivalents (TE)/m³ for the new steam boiler plants which incinerate municipal waste, waste oil or biomass material. Old installations must either be rebuilt or closed down to the end of 1994. In a supplementary clause of the regulation for this law, which has been effective since 9 March 1990, it is prescribed that TE are to be calculated according to the I-TEF method [2].

For plants other than those mentioned above there is no limiting value for PCDD/F emissions. The future will show to what extent the LRG-K limiting value will be introduced for other industrial plants as a measure in the officially approved procedures. So, for example, a new steel production plant (using predominantly scrap metal) was not put into operation because dioxin emissions were substantially higher than 0,1 ng/m³.

Until now no new plants have been effected by the Clean Air Act.

2. ESTIMATION OF EMISSIONS

A prerequisite for reducing the entry of PCDD/F into the environment is an estimation of emissions. A number of evaluations for the separate emission sources are available for some countries [3,4,5,6,7].

A work of this nature will shortly be available for Austria [8]. The major results of this undertaking are briefly presented here. PCDD/F which have recently entered the ecosphere, i.e. the "primary sources", will be considered. It must be remarked, however, that the quality of the data often only allows a very rough estimation of the emission load.

As "secondary sources", PCDD/F which have been introduced in the last thirty years through the use of chlorinated compounds can probably be named as the most significant sources with several kg TE.

Municipal Waste Incinerators

In Austria there are three large municipal waste incinerators (MWI) which operate with very different technical standards. The MWI I in Vienna emits between 0,5 and 2,5 ng TE/m³ via the flue gas, which results in 0,3 - 1,5 g TE/a (average value 0,9 g). After the installation of a new flue gas cleaning system and a DeNOx unit (for nitrogen removal), which reduces the PCDD/F emission by a factor of about 10, the MWI II in Vienna achieved a flue gas concentration of 0,05 to 0,3 ng TE/m³. That results in an annual load of 0,1 - 0,5 g TE (average value 0,3 g). At the smaller and older MWI in Wels it was calculated that 20 - 50 ng TE/m³ are emitted, which constitutes a load of 2 - 5 g TE/a (average value 3,5 g).

In total it emerges that municipal waste incinerators emit 2,4 - 7 g (average value 5 g) per year.

Hazardous Waste Incinerators

Due to great variations in processed materials at Vienna's hazardous waste incinerator one can calculate an emission concentration of between 0,5 and 40 ng TE/m³, which results in an annual load of between 0,3 and 24 g TE (average value 9 g). The planned installation of activated carbon filters at these plant could lower emissions to below 0,1 g/a.

Incineration Plants for Industrial Waste

Approximately 1.000.000 t of waste are disposed of each year by thermal treatment in industrial plants. It is thus possible to assume emission values over a very wide range from 0,1 to 10 ng TE/m³, which would give an annual load between 5 and 20 g TE.

Hospital Furnaces

Given the quantity of hospital waste (30.000 t/a) and around 100 operational furnaces, and taking as a basis for calculation the information of the literature (1 - 30 ng TE/m³), one can estimate an annual load of 2 - 8 g TE (average value 5 g).

Sewage Sludge Incinerators

Measurements indicate an emission concentration below 0,5 ng TE/m³, which results in an overall load of < 0,5 g TE/a.

Power Plants

The literature and measurements of coal-fired power plants confirm very low concentrations, so that the entire emission would lie below 1 g TE/a.

Combustion of Wood

Measurements from Austria show that emission concentrations are strongly influenced by the operational conditions of the plant. The concentrations lie between < 0,01 and > 1 ng TE/m³. The intermixture with waste products appears problematic. Ignorance of the plant technologies makes an evaluation uncertain. 1 - 5 g TE/a could be assumed.

Domestic Combustion

In the absence of measurements an evaluation is not possible, but domestic combustion could prove to be a major emission source. The combustion of fuels together with waste products appears to be problematical.

Incineration of Waste Oil

The incineration of waste oil from automobiles in modern plants and in cement rotary kilns leads to an emission below 0,1 ng TE/m³, which results in a mass flow of < 0,5 g/a. In any case, the incineration of waste oil with PCB as an impurity proves that emissions up to 10 ng TE/m³ can occur, depending on the quality of the plant.

Car Exhausts

85 % of Austrian petrol contains 1,2-dibromoethane as a scavenger, which results in no PCDD/F emissions. The annual emission of the remaining 15 % containing both 1,2-dichloroethane and 1,2-dibromoethane can be estimated to around 0,05 - 0,4 g TE. The emissions of brominated dioxins and furans will be considerably higher.

Metallurgical Industry

Emissions from aluminium reclamation processes are estimated to be in the range of between 1 and 10 g TE/a. Measurements at the Brixlegg copper reclamation plant prior to the installation of an afterburner suggest an emission of 30 g TE/a. No statements concerning its efficiency can be made at this time. According to the present state of knowledge, one can reckon with a discharge of between 5 and 40 g TE/a from all copper reclamation processes. The contribution of scrap iron smelting is estimated at 1 - 5 g TE/a. Emissions from zinc reclamation processes and lead smelting are presently estimated at 1 - 6 g TE/a. At present the emission potential of aluminium foundries can not yet be calculated.

Thus, with an overall emission of 8 - 61 g TE/a, the metal producing and processing industry is classified as a significant source of PCDD/F compounds.

Pulp Production

In Austria ca. 200.000 t of bleached sulphate pulp (17 % of the entire production) are produced each year. The formation of PCDD/F is, to a large extent, dependent on the technology used. Consequently, due to insufficient data, emissions can only be assumed to lie within a wide range of 1 - 10 g TE/a.

Overall Emissions from Sources Amenable to Evaluation

From the sources described in this paper, it is possible to fix a yearly overall PCDD/F input of 20 - 150 g TE in Austria. An overview of the estimated emissions is given in the following table.

PRIMARY SOURCES	TE in g/year (I-TEF)
Municipal Waste Incinerators	2,4 - 7
Hazardous Waste Incinerators	0,3 - 24
Incineration Plants for Industrial Waste	5 - 20
Hospital Furnaces	2 - 8
Sewage Sludge Incinerators	< 0,5
Power Plants	< 1
Combustion of Wood	1 - 5
Domestic Combustion	?
Incineration of Waste Oil	< 0,5
Car Exhausts	0,1 - 0,4
Metallurgical Industry	
Aluminium	1 - 10
Copper	5 - 40
Iron	1 - 5
Zinc and Lead	1 - 6
Pulp Production	1 - 10
Total Emission	20 - 150

3. IMPORTANT INVESTIGATIONS IN THE SCOPE OF TECHNOLOGY

Activated carbon filters in pilot plants were tested at the hazardous waste incineration plant (Vienna) and at the MWI I (Vienna). At the MWI II (Vienna) measurements of the influence of the DeNOx unit on dioxin emissions were carried out.

With reference to PCDD/F emissions, test runs were carried out at the high temperature gasification (HTG) plant in Linz, a newly designed installation for the thermal treatment of hazardous waste.

4. ENVIRONMENTAL RESEARCH

Investigations in the Vicinity of a Copper Reclamation Plant

Practical experience of the behaviour of the PCDD/F in the environment exists in the vicinity of a copper reclamation plant in Brixlegg/Tyrol, where ca. 30 g TE were emitted each year. Soil analyses recorded values of up to 332 ppt (I-TEF). At a distance of 250 m from the emission source, air pollution in the vicinity was fixed between 0,8 and 1,6 pg TE/m^3 (I-TEF). In 1987 concentrations in hay reached 33 ppt TE (I-TEF) in the dry weight. Similarly, investigations of grass (May 1988) yielded values of between 13 and 21 ppt TE (I-TEF) in the dry weight. A number of farms in the vicinity of Brixlegg have a greater proportion of their pasture land (i.e. meadow cultivated for fodder) in the area which is influenced by emissions. Analyses of milk samples taken from these farms produced concentrations between 20 and 70 ppt TE (I-TEF) in the milk fat.

Relations between fodder and cow milk contamination were investigated at a farm in the area. On the basis of the I-TEF model, a bioaccumulation factor of 1.7 (concentration in milk fat/concentration in the dry fodder) was calculated under the described immission and concentration conditions.

Furthermore, a few analyses of blood taken from farmers and their families living and working at this site were carried out. In three cases no rise in the PCDD/F concentration was established. However, a four-fold increase compared to the normal value was recorded for one farm worker, while another individual was found to have a twenty-fold increase. Similarly, analyses of breast milk taken from women living in the area were undertaken. However, no conspicuous results were obtained.

As a first emission-reducing measure at the reclamation plant the use of PVC-containing materials was discontinued. This step achieved a modest, but not satisfactory, reduction of PCDD/F emissions. An afterburner has, until now, not had the desired effect.

The effectiveness of these and other emission reducing measures is to be continually checked by analysing samples of grass, cow milk and spruce needles from trees exposed in containers.

Further PCDD/F Investigations from Austria

In addition to the 5 breast milk analyses from the Brixlegg area, only two samples have been analysed for the WHO study. The PCDD/F concentrations of these samples are comparable to those of other industrialized countries.

At the present time investigations of cow milk are being undertaken by the federal ministry which is responsible for monitoring foodstuffs.

Soil studies have been carried out in Linz, a heavily populated urban area with heavy and chemical industries. The results indicate slightly enhanced concentrations. Likewise, in Vienna a few soil samples were analysed. Here, the PCDD/F concentrations lay within the expected range for a large town.

Similarly, some soil samples taken in the vicinity of a chemical plant in Kärnten were analysed. The samples were found to contain up to 26 ppt TE (I-TEF).

Until now only a few Austrian studies of PCDD/F contamination of the environment have been made. In future more research work concerning its occurrence, behavior and effects will be necessary.

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