Reduction of Dioxin Emissions and Regulatory Measures in Austria

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ABSTRACT

Based on estimations of dioxin emissions for the years 1987/88, assuming an average value of 80 g International Toxic Equivalents (I–TE) per year from primary sources, a projection for the year 1993 is given. Dioxin emissions from primary sources for 1993 are supposed to be less than 40 g I–TE. The reduction to less than 50 % within 5 years is mainly attributed to technical measures and the closing down of some important industrial emitters.

Rules and regulations referring to dioxins and their precursors from emission control measures, production and use of some chloroaromatic compounds and from hazardous waste treatment are described.

DIOXIN EMISSION INVENTORIES

For the years 1987 and 1988 two estimations about overall dioxin emissions were carried out by the "Österreichisches Forschungszentrum Seibersdorf" (ÖFZS) and the "Forschungsgesellschaft Technischer Umweltschutz" (FTU) (1, 2, 3). The results are given in table 1.

Tab. 1: Estimated dioxin emissions in Austria for 1987/88 (g I–TE/a)

	Data from ÖFZS (1)	FTU (2, 3)
Primary sources		
Municipal waste incineration	3 (1 – 14)	2.4 – 7
Hazardous waste incineration	6 (2 – 10)	0.3 – 24
Incineration plants for industrial waste	–	5 – 20
Hospital furnances	4 (1 – 11)	2 – 8
Sewage sludge incineration	<1	<0.5
Incineration of waste oil	–	<0.5
Coal fired power plants	<<	<1
Wood fired power plants	–	1 – 5
Domestic combustion	70 (40 – 230)	?
Outdoor burning of straw	10 (4 – 16)	–
Car exhausts	<1	0.1 – 0.4
Metallurgical industry	19 (<1 – 38)	
Aluminium		1 – 10
Copper		5 – 40
Iron		1 – 5
Zinc and lead		1 – 6
Pulp production	4	1 – 10
Sum Primary sources	112 (50 – 320)	20 – 140
Secondary sources		
Chlorinated aromatic compounds (accumulated over 30 years)	12 000	–

The two studies mentioned yielded similar results. The ÖFZS estimated the mean annual dioxin emissions at 112 g I–TE for 1987/88, including domestic combustion and outdoor burning of straw at 70 g and 10 g TE, respectively. The values were projected on the basis of chimney soot concentrations from Germany. New emission measurements indicate that the contribution of both domestic combustion and the burning of straw out in the fields have been over–estimated in the ÖFZS study. The contribution of the use of chloroaromatic compounds accumulated in the course of the last 30 years was estimated to amount to 12 kg I–TE, a fact which shows the specific importance of secondary sources.

For their study the FTU partly relied on a bigger set of data. For the time prior to 1988 they estimated the average PCDD/F emissions from primary sources (not including domestic combustions) at about 80 g I–TE.

This value includes about 25 g of the copper reclamation plant in Brixlegg, and the emissions from three larger waste incineration plants and the one and only Austrian hazardous waste incineration plant located in Vienna.

In the meantime the copper reclamation plant has been retrofitted with an afterburner, a waste incineration plant (Wels) closed down, the two Vienna waste incineration plants equipped with catalytic denox units, and the hazardous waste incineration plant equipped with activated carbon filters. A large aluminium electrolysis unit and a few incinerators for hospital waste have been closed down. Petrol does no longer contain halogenated scavengers. For the sintering plant of the steel industry in Linz measures aiming at dust separation are being prepared. Further technological improvements and the closing down of existing plants will play a role, too.

According to a rough estimation these measures led to a reduction of the assumed PCDD/F emissions from primary sources of about 80 g in 1987 to less than 40 g in 1993.

But one must also bear in mind that this estimation does not take into account diffuse sources like f.e. domestic combustion or other sources up to now unknown. Neither the contribution of remobilized PCDD/Fs from secondary sources (e.g. the former use of chloroaromatic compounds or contaminated sites) nor their introduction into the food chain nor the importance of transboundary long–range transport can be properly assessed. Thus no statements can be made on in how far reduced PCDD/F emissions contribute to a reduction of air pollution, thus also reducing the load of foods and for humans.

REGULATORY MEASURES

Air pollution control

In Austria the "Clean Air Act for Steam Boiler Plants" (competent authority is the Federal Ministry for Economic Affairs) came into effect on 1 January 1989. This law sets an emission standard of 0.1 ng TE/Nm^3 for new steam boiler plants which incinerate municipal waste, waste oil, or biomass. Until the end of 1994 old installations must either be rebuilt or closed down. In an amendment to the ordinance for this law, which has been effective since 9 March 1990, it is stipulated that TE are to be calculated according to the I–TEF–method.

The trade regulations which are also determined by the Federal Ministry for Economic Affairs set general standards for emissions from industrial and commercial plants. At present emission standards for air pollutants from various industrial branches are being established by the Federal Ministry for Economic Affairs and laid down in ordinances amended to the trade regulations. The ordinance for the cement industry, which does not contain a limit value for dioxin emissions, has already entered into force. At the moment

limit values and their introduction are being discussed within the framework of draft ordinances for foundries, iron and steel producing plants, non–ferrous metals and the chipboard industry.

Chemicals

The Federal Ministry for the Environment, Youth and Family Affairs implemented a number of efficient measures to avoid the generation of dioxins. There are especially two ordinances, the "Ban on Pentachlorophenol" and the "Ban on Halogenated Biphenyls, Terphenyls, Naphthalenes and Diphenylmethanes" both based on the Chemicals Act.

The ban on pentachlorophenol (PCP) prohibits the manufacturing, placing on the market and the use of pentachlorophenol and its salts. Furthermore, and this is a very important provision, the manufacturing, placing on the market and use of finished products which contain pentachlorophenol or its salts is prohibited. Exemptions will only be provided for scientific purposes and research applications. This regulation with all its provisions became effective at the beginning of 1993.

The second ordinance prohibits the manufacturing, placing on the market and use of polychlorinated biphenyls and other halogenated biphenyls, of polychlorinated terphenyls and other halogenated terphenyls, halogenated naphthalins and monomethyl–tetrachloro–diphenylmethane, monomethyl–dichloro–phenylmethane, monomethyl–dibromo–phenylmethane and other halogenated diphenylmethanes.

The ban also includes the manufacturing and placing on the market of finished products that contain the substances or preparations mentioned above.

Another provision stipulates that hydraulic fluids must not contain more than 30 ppm of these substances. Electric equipments which contain PCBs at concentrations of more than 30 ppm have to be labelled with the following words – "Contains PCB – Harmful to the Environment" and have to be equipped with the symbol "harmful" in accordance with the labelling requirements of the Chemicals Ordinance of 1989. All users of electric equipments requiring labelling as mentioned above must notify the name of the company, location, and the type of the equipment to the Federal Ministry for the Environment, Youth and Family Affairs.

The refilling of transformers is only allowed if the refilling operation does not exceed a maximum value of 30 ppm of banned substances in the transformer, not even six months after the refilling operation.

Electric equipments and transformers which contain PCB or one of the other substances in a concentration of more than 500 ppm must be put out of operation by the end of December 1999.

The use of transformers that contain PCBs in concentrations of less than 500 ppb is allowed until they are put out of operation.

The only exemption provided is for research and analysis purposes and for intermediate products in synthetic processes.

Waste

Within the framework of the Waste Management Act an ordinance was enacted which defines hazardous wastes. At present this ordinance is being reviewed. There will be criteria for the classification of hazardous waste and the introduction of a limit value of 2000 ng I–TE/kg is being considered as well. Wastes classified as hazardous have to be subjected to specific measures in terms of both treatment and disposal.

Foods and fodder

Determination of limit values for hazardous substances in foodstuffs and fodder lies within the competence of the Federal Ministry for Health and Consumer Protection and the Federal Ministry for Agriculture and Forestry. At the moment there are no legally binding limit values for dioxins and related substances.

On account of a contamination case in the vicinity of the copper reclamation plant in Brixlegg (see 4) a group of experts from the Federal Ministry for Health and Consumer Protection determined a maximum value for PCDD/F in cow's milk which was confirmed in 1991. It is 1.4 ng TE/l milk, which corresponds to 35 ng TE/kg milk fat. In view of this case the Federal Environmental Agency (which is part of the Federal Ministry for the Environment, Youth and Family Affairs) recommended the Dutch limit values (6 ng I–TE/kg milk fat). In Germany a similar orientation value (i.e. 5 ng I–TE/kg fat) is used (5).

The Federal Environmental Agency furthermore recommended to refrain from feeding dairy cows with fodder containing more than 3 ng I–TE/kg. This recommendation was made on the basis of investigations on PCDD/F transfer from fodder into cow's milk, carried out in the vicinity of the copper reclamation plant Brixlegg. The results of these investigations are in line with those obtained in other countries.

Soil

In Austria there are no orientation or limit values for the contamination of soils with PCDD/Fs. In accordance with the German limit values (5) PCDD/F loads are assessed from case to case by the Federal Environmental Agency.

CONCLUSIONS

Measures leading to a reduction of dioxin emissions aim at reducing the population's load by these undesired substances. In the course of the last five years the assumed PCDD/PCDF emissions from primary sources (not including domestic combustion) were reduced from about 80 g I–TE from the time prior to 1988 to less than 40 g in 1993. This is mainly due to the retrofitting or closing down of larger emission sources, the contribution of which could be properly assessed. On other emittents, especially on smaller sources, there is only little information available, a fact which renders their inclusion into emission evaluations difficult or even impossible. The implementation of emission reduction measures like legal regulations is therefore difficult. The contribution of secondary sources and of the transboundary transport of airborne dioxins cannot be evaluated either. Therefore it must be assumed that reductions in emissions do not necessarily immediately nor to the same extent influence ambient concentrations and, as a consequence, reduce the load of foods and the population.

REFERENCES

1 ORTHOFER, R., VESELY, A. (1990), Abschätzung von toxischen Emissionen (PCDD, PCDF, PAH, BaP) aus Verbrennungsprozessen in Österreich. Österreichisches Forschungszentrum Seibersdorf (ÖFZS). Commissioned by the Federal Ministry for the Environment, Youth and Family Affairs.

2 SCHEIDL, K. et al. (in preparation), Emissionen von polychlorierten Dibenzo–p–Dioxinen und Dibenzofuranen in Österreich. Forschungsgesellschaft Technischer Umweltschutz, Wien (FTU). Commissioned by the Federal Environmental Agency Vienna. Summarized in (3).

3 RISS, A., SCHEIDL, K. (1990), Statuatory and Research Action in Austria. In: HUTZINGER, O., FIEDLER, H. (ed.): Organohalogen Compounds, Vol 4, Dioxin '90 – EPRI–SEMINAR, Bayreuth, 51–56.

4 RISS, A. (1993), Impact of PCDD/PCDFS Emissions of a Copper Reclamation Plant: Five Years of Experience with Environmental Monitoring. In this Volume.

5 SCHULZ, D. (1993), Measures to Reduce PCDD/PCDF–Impact on Man and the Environment in the Federal Republic of Germany. In this Volume.