DIOXINS AND RELATED COMPOUNDS - REGULATORY ASPECTS IN THE NETHERLANDS

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The government of the Netherlands has intensively sponsored dioxin research during the past five years. The research programme was initiated in 1989 by the detection of relatively high levels of PCDD/PCDF in cow's milk in the surroundings of several municipal solid waste (MSW) incinerators. This programme has now almost been finalized. The main items of the programme were:

- detection of sources and quantification of their emissions
- environmental concentrations
- concentrations in dietary components
- toxicity and toxicokinetics
- environmental modelling
- analysis, quality assurance/quality control

The results of these studies, as far as available at that moment, have been summarized in an 'Integrated criteria document dioxins' [1] which was published in December 1993 by the National Institute of Public Health and Environmental Protection (RIVM) in Bilthoven. Besides, regulations were developed and the finding of international consensus on hazard assessment was promoted.

LEGAL ASPECTS

Emission

In August 1989 a guideline on incineration of MSW and related processes like incineration of chemical waste, hospital waste and sludge, was published [2]. In this guideline an emission standard for dioxins of 0.1 ng I-TEQ/m^3 was set for new incinerators. Existing incinerators had to meet this standard the first of December 1993. In February 1993 the guideline was transformed into law [3] and because of problems with the accommodation of the existing incinerators the date of enforcement was delayed to the first of January 1995. The dioxin emission of MSW incinerators has to be monitored at least twice a year. As the result of a round robin study an instruction for sampling, sample treatment and analysis was published in 1993 [4], in which also detection limits for the different congeners were dictated. The emission standard of 0.1 ng I-TEQ/m^3 has no relation to health related standards like e.g. the TDI or the standard for milk, but was based on "best technical means" in 1989. The choice for such a strict standard could be justified because of the relatively high background in the Dutch population and the need to reduce this background because of the high exposure of breastfed babies.

Six old MSW incinerators have been closed of which one, after retrofitting, was taken into operation again and one was replaced by a new incinerator.
Actions are taken to reduce the amount of waste which has to be incinerated.
Separation of wastes upon collection and composting of the organic fraction of municipal waste now is widely introduced. Standards will be developed for the dioxin content of compost and other organic fertilizers.
The results of the study on sources and emissions [5] indicated that for the Netherlands MSW incineration is by far the most important source (ca. 80%) of dioxin emissions into the air. For other dioxin emitting processes no standards have been set until now. Licence providing authorities however have been instructed to ask for maximum acceptable emission reduction. If necessary for certain sources, emission maxima will be presented in the National Emission Guideline.
The emission to surface waters in the Netherlands is low and totally estimated at 3 g I-TEQ/year. In principle emission to the water compartment is not allowed and maximum emission preventing measures (best technical means) are required.

Products

The use of the pesticides 2,4,5-T and pentachlorophenol, which are contaminated with dioxins, is prohibited.
Products with PCB-concentrations >0.5 mg/kg for the individual congeners 28, 52, 101, 118, 138, 153 and 180 are prohibited.
The use of chlorinated methyl diphenylmethanes (UGILECs) as PCB substitutes is not allowed.
In fuel a concentration limit of 500 mg/kg for chlorinated organic compounds has been set. A tightening up to 50 mg/kg is considered now with exceptions for car and airplane fuel.
A preliminary decision prohibiting the use of the flame retardants polybrominated biphenyls (PBBs) and diphenyloxides (PBDOs) has been published in 1993, but is not yet in force.

Food

Food is the main route of exposure to dioxins, contributing for 90-95%. In 1982 a tolerable daily intake (TDI) of 4 pg 2,3,7,8-TCDD/kg b.w. was proposed by the RIVM in Bilthoven and accepted by the authorities. Afterwards this TDI was used for total dioxin exposure expressed in toxic equivalents. Based on this TDI and on the Inventory of Food Consumption a standard for milk and milk products was derived in 1989. This standard of 6 pg I-TEQ/g fat was reevaluated in 1991 after a thorough study of the concentrations of dioxins and dioxin related PCBs in food components [6-7] and after the reevaluation of the TDI. This did not lead to a change in the standard for milk.
At this moment a small area still exists in which the standard for milk is exceeded. Milk from this area is collected and destroyed and from animals out of the area which are brought to the slaughterhouse fat and organs have to be destroyed. To follow the situation in the area, milk of selected dairy farms is incorporated in a monitoring programme in which for individual farms mixed samples over periods of one month are analyzed. It is expected that this situation will soon be normalized since the accomodation programme of the nearby incinerator has just been finished and emissions are now below the standard of 0.1 ng I-TEQ/m^3.
A chain model for dioxins has been developed and validated from which concentrations in cow's milk can be predicted from emissions into the air [8].
The median dietary intake of PCDD/F for adults in the Netherlands amounts to 1 pg I-

TEQ/kg b.w. (95 percentile: 1.8 pg I-TEQ/kg b.w.). If coplanar PCBs are included, this median comes to 2.4 pg TEQ/kg b.w. (95 percentile: 4.3 pg TEQ/kg b.w.). In these calculations, TEFs of 0.01, 0.1 and 0.005 have been used for PCBs 77, 126 and 169, respectively. From the food study, milk and milk products, fish oil and to a less extent meat and meat products appeared to prevail the exposure[7]. The contribution of fish oil has to be studied in more detail. By extrapolation of the results of a study on dioxin levels in curly kale the daily intake by vegetables and fruit was estimated at about 8 pg I-TEQ/person.day for adults and therefore to be of less concern[9]. Besides for milk and milk products, no standards have been set for dietary components.
To identify possible population groups at risk a food consumption survey was carried out for the main islamitic group in the Netherlands, which is of Turkish origin. Although there is a clear difference with the consumption pattern of the general Dutch population, the daily intakes of dioxins and planar PCBs are similar. Butter, mutton and beef contributed most to the daily intake of Dutch Turks.

Soil

Background levels in top soil in the Netherlands are between 1-20 ng I-TEQ/kg dry soil. No legal standards have been set for the concentration in soil, but in 1987 the following guidance levels have been proposed for soil:

- 1000 ng I-TEQ/kg dry matter for residential areas and for agricultural purpose,
- 100 ng I-TEQ/kg dry matter for aquatic sediments
- 10 ng I-TEQ/kg dry matter for dairy farming.

Based on the information presented in the "integrated criteria document dioxins" [1] these figures will be reevaluated.
Elevated concentrations have been detected in the soil of several haughs of the river Rhine and tributaries. Concentrations in milk of cattle grazing there however were within the background range, indicating that soil contamination has relatively little influence on dioxin intake by cattle. Deposition from the air on grass is the most important reason for the presence of dioxins in milk.
Rehabilitation of dioxin contaminated areas, like production sites, waste disposal sites and harbour sediments, is a hot issue in the Netherlands. Not only because it is very expensive but even more because it is a politically sensitive issue. As a maximum level in reclaimed areas 50 ng I-TEQ/kg dry soil has been proposed.

Air

Concentrations in air and deposition of dioxins have been calculated with use of a model[11]. For 1990 the calculated average concentration and deposition were 24 fg I-TEQ/m^3 and 8 ng I-TEQ/m^2.year respectively. Measurements to validate the model have been started. Preliminary results correspond well to the calculations[12].

Water

In sediments of the Rhine concentrations up to 220 ng I-TEQ/kg dry matter have been detected. In other waters even higher levels have been found near old sources. From sediment cores it can be concluded that suspended sludge from the Rhine shows a downward trend over the last decades.

PCBs

Because of existing impression that PCB levels in the Dutch environment are not declining at a rate that could be expected as a result of PCB regulations, a study has been started which aims to detect the reason for this phenomenon.

INTERNATIONAL ASPECTS

Because of differences in the TDIs used in each country the government of the Netherlands has asked the World Health Organization (WHO) to organize an expert meeting on this subject in order to obtain international consensus. In December 1990 this expert meeting was hosted by the RIVM in Bilthoven. As a result of this meeting a TDI of 10 pg 2,3,7,8-TCDD/kg body weight was proposed[13]. In 1991 this proposal was adopted by the Dutch government.

For hazard assessment of PCDD/PCDF the international TEFs (NATO CCMS) are used since 1988 and standards are expressed in toxic equivalents calculated with these TEFs. No official decision has yet been taken to incorporate dioxin like PCBs in the standards, but in hazard assessement procedures this usually is the case. Because of international comparability WHO was asked to give an opinion on this subject. An expert meeting organized by WHO/EURO in December 1993 has proposed a TEF-scheme for PCBs [14]. It is hoped that this will lead to international consensus in this field.

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