Regulatory measures in the Federal Republic of Germany to reduce the exposure of man and the environment to dioxins

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In 1990 the Minister for the Environment of the Federal Republic of Germany initiated the international symposium "Health Effects and Safety Assessments of Dioxins and Furans". In connection with the symposium, a hearing of experts on dioxins and furans was organised by the Federal Health Office (BGA) and the Federal Environmental Agency (UBA). The Federal Agencies evaluated the presentations and the hearing (1) and concluded that although a working group of the World Health Organisation considers a life-long daily exposure to 2,3,7,8-TCDD of to 10 pg per kg body weight to be the maximum tolerable value for man, reasons of precaution make it imperative to reduce the daily intake of 2 pg TE per kg b.w. to below 1 pg. It is a generally recognised fact that this can only be achieved in a long term perspective due to the persistence of dioxins and their ubiquitous distribution. There is no doubt that this objective requires a minimisation of new dioxin discharges into the environment. As a consequence, the Federal Ministry for the Environment has started a number of initiatives since the symposium in 1990 to reduce the dioxin emissions.

An essential step towards reducing the dioxin emissions was taken with the entry into force of the Ordinance on waste incinerators. Rough estimates show that in 1990 municipal incinerators in western Germany emitted a total of about 400 g I-TE per year. These dioxin emissions will be reduced in line with the provisions of the Ordinance on Combustion Plants (17th Ordinance on the Federal Immission Control Act of 23 November 1990) which prescribes a limit value for dioxins in exhaust gases of 0.1 ng I-TE/m^3 and will lead to a reduction in dioxin emissions by a factor of 100. At the moment, a working group is looking into whether a limit value of 0.1 ng I-TE/m^3 in exhaust gas can also be met by other plants (e.g. steel mills, metal recycling plants etc.) and not only by incineration plants for waste.

Another impact of dioxins was due to the so-called scavengers. In order to achieve a transformation of lead oxide to volatile lead halogenides, leaded petrol contained scavengers as additives (1,2-dichloroethane, 1,2-dibromoethane). During combustion, brominated and mixed-halogenated dibenzodioxins/-furans are produced, amounting to about 50 g I-TE/year in total. Another contribution towards the objective of reducing the dioxin emissions was the ban on the additive of scavengers to leaded petrol (19th Ordinance on the Federal Immission Contol Act of 17 January 1992).

The Ordinance on Sewage Sludge in its revised version of 15 April 1992 is another step helping reduce dioxin discharges into the environment. For the first time, it introduced a dioxin limit value for sewage sludges used as fertilizer in agriculture, horticulture or forestry. Accordingly, fertilization with sewage sludge containing more than 100 ng I-TE/kg of dried residue is prohibited. This measure - although it primarily serves the purpose of environmental protection - has far-reaching secondary repercussions. By limiting the dioxin content in sewage sludge, it also interrupts the path of dioxin transmission via the soil, plants, animals and food to the human body. Considering that > 90 % of the dioxin intake by humans orginates from food, the positive effects of the Seweage Sludge Ordinance are self-evident.

In addition to these regulations which are already legally binding, the Federal Health Office and the Federal Environmental Agency, in their report on present developments, have proposed a number of additional measures which, because of both their diversity and the implications which their implement action would entail require close cooperation between the Federal government and the governments of the "Länder" (federal states). This was also the position expressed by the Conference of Federal and Länder Ministers for the Environment at its annual meeting in 1990. It was decided to establish a Joint Working Group on DIOXINS which has been commissioned to initiate and coordinate nationwide measuring programmes, to document and evaluate the data collected up to now, to initiate research, and to deduce, on the basis of these data, preliminary, nationally applicable guidlines and/or limit values for different environmental media.

The first report, published in 1991 (3), contained reference values and recommended action for agriculture and horticultural land uses and soil reclamation. For preventive reasons, the group considers it a long term objective to reduce dioxin concentration to below 5 ng I-TE/kg of soil used for agricultural purposes. Limitations on the cultivation of certain feedstuffs and foodstuffs might be necessary if the dioxin contamination were to exceed 40 ng I-TE/kg soil. Guideline values were established for redevelopment measures for children playgrounds and for urban areas. The reference values and recommendations for action as proposed by the Joint Working Group were discussed at the Conference of Ministers for the Environment in November 1991. The recommendations have already been translated into governmental decrees in a number of Länder.

Table 1: Reference values and recommended action for land use and remediation of contaminated soil

PCDD/F contamination ng I-TE/kg soil dry matter	Recommended action
< 5	Target value
5 - 40	Unrestricted cultivation of foodstuffs; however, avoidance of critical land uses (e.g. grazing management) if increased dioxin levels are analysed in foodstuffs
> 40	Limitation to defined agricultural and horticultural land uses; unlimited cultivation only of plants with minimum dioxin transfer (e.g. corn)
> 100	Remediation of contaminated soil (sealing, decontamination or exchange) in playgrounds
> 1,000	Remediation of contaminated soil in urban areas
> 10,000	Remediation of contaminated soil also in industrial areas

At the end of 1993 the Working Group submitted its second report (4). The focal point of this report was a documentation on the contamination of food by dioxins and the deduction of guidelines and maximum values for milk and dairy products (Table 2) together with recommendations for action. Derivation of reference values and recommendations for action can be an effective instrument, provided its interference with the food chain is accompanied by its use as an indicator in the search for sources of contamination.

Table 2: Reference values and recommendations for action on contaminated milk and dairy products

pg I-TE/g milk fat	Proposed action
< 0.9	Desirable target; achievable in the long run only by measures to reduce the PCDD/PCDF impact to the environment
> 3.0	Verification of existence of PCDD/PCDF sources and initiation of measures to reduce impact. Change of land use pattern recommended in affected farms, if emission-reducing measures are not feasible in the foreseable future or would not result in reduced contamination Recommendation to stop direct supply of milk and dairy products to consumer
> 5.0	Ban on trade of contaminated milk and dairy products

In view of the public controversy on this issue and the large number of questions that are still unresolved, the Federal Minister for the Environment hosted a second international symposium in November 1992, again linked to a public hearing on dioxins and furans. At this hearing in Berlin, the reference values and recommendations for land use and soil reclamation and for contaminated milk and dairy products were discussed (2).

Most of these measures to protect man and environment reduce emissions at the "end of the pipe"; this is an approach which must gradually be changed. Therefore, the production of chemicals, preparations, products and the material flows are increasingly to be taken into account and included in the formulation of environmental protection measures. In the past, certain chemicals containing chlorine were an important source of dioxins. By banning the production and the use of pentachlorophenol, a source that has accounted for an input of dioxins into the environment of the western part of Germany of > 1 kg TE per year in the past, has been eliminated (Ordinance on the Ban on Pentachlorophenol of 12 December 1989). Environmental contamination of > 4 kg I-TE per year was caused by the use of polychlorinated biphenyls. The ban on PCBs (Ordinance on the Ban on PCBs of 18 July 1989) was another step in the protection from hazardous substances.

The Ordinance on the Prohibition of Certain Chemicals sets stringent limit values for 8 PCDD/PCDF in substances, preparations and articles placed on the market. This regulation is currently being amended (First Ordinance to amend the Ordinance of the Prohibition of Certain Chemicals of July 1994) in order to increase the number of controlled chlorinated dioxins from 8 to 17 and to reduce the limit values (Table 3). Furthermore, for the first time, limit values for polybrominated dibenzodioxins and dibenzofurans substituted in the 2,3,7,8-position are included in the list of the regulated compounds. Transition periods of three to five years were set inter alia for anthraquinone pigments, dyes and pigments which are produced with chloranil as an intermediate product, as well as for chloranil itself if it is used as a catalyst in the production of dyes and pigments. The Ordinance does not apply to certain products which are already regulated by other laws (e.g. drugs, pesticides, foodstuffs, marketing for a proper waste disposal) and for purposes of research or testing of properties or as a control substance for analytical investigations.

Table 3: Limit values for dioxins in substances, preparations and articles

1. a) 2,3,7,8-tetrachlorodibenzo-p-dioxin
   b) 1,2,3,7,8-pentachlorodibenzo-p-dioxin
   c) 2,3,7,8 -tetrachlorodibenzofuran
   d) 2,3,4,7,8-pentachlorodibenzofuran

2. a) 1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
   b) 1,2,3,7,8,9-hexachlorodibenzo-p-dioxin
   c) 1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
   d) 1,2,3,7,8-pentachlorodibenzofuran
   e) 1,2,3,4,7,8-hexachlorodibenzofuran
   f) 1,2,3,7,8,9-hexachlorodibenzofuran
   g) 1,2,3,6,7,8-hexachlorodibenzofuran
   h) 2,3,4,6,7,8-hexachlorodibenzofuran

3. a) 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
   b) 1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin
   c) 1,2,3,4,6,7,8-heptachlorodibenzofuran
   d) 1,2,3,4,7,8,9-heptachlorodibenzofuran
   e) 1,2,3,4,6,7,8,9-octachlorodibenzofuran

4. a) 2,3,7,8-tetrabromodibenzo-p-dioxin
   b) 1,2,3,7,8-pentabromodibenzo-p-dioxin
   c) 2,3,7,8-tetrabromodibenzofuran
   d) 2,3,4,7,8-pentabromodibenzofuran

5. a) 1,2,3,4,7,8-hexabromodibenzo-p-dioxin
   b) 1,2,3,7,8,9-hexabromodibenzo-p-dioxin
   c) 1,2,3,6,7,8-hexabromodibenzo-p-dioxin
   d) 1,2,3,7,8-pentabromodibenzofuran

Substances, as well as preparations and articles are not allowed to be placed on the market, if

1. the sum of the contents of the chemical compounds listed in columne 1 No. 1 exceeds a value of 1 µg/kg or
2. the sum of the contents of the chemical compounds listed in columne 1 No. 1 and 2 exceeds a value of 5 µg/kg or
3. the sum of the contents of the chemical compounds listed in columne 1 Nos. 1, 2 and 3 exceeds a value of 100 µg/kg or
4. the sum of the contents of the chemical compounds listed in columne 1 No. 4 exceeds a value of 1 µg/kg or
5. the sum of the contents of the chemical compounds listed in columne 1 No. 4 and 5 exceeds a value of 5 µg/kg.

The limiting values stated in numbers 2, 3 and 5 are regarded as observed only if the limiting values for the groups of congeners in the corresponding precedings numbers have not been exceeded.

All these legislative activities have reduced the dioxin impact on the environment. A considerable reduction of the dioxin concentration is already becoming apparent even in one of the final links in the food chain, namely the breast milk.

References

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