COMPILATION OF EU DIOXIN EXPOSURE AND HEALTH DATA

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Introduction

Over the past two decades the European Commission has implemented wide ranging legislation aimed at directly or indirectly reducing or controlling the release of dioxins into the environment. However, following a recent re-evaluation of the toxicology of dioxins, WHO has revised downwards the recommended tolerable daily intake (TDI) from 10 pg 2,3,7,8 TCDD/kg/day[1] to 1-4 pg I-TEQ/kg/day[2,3] and, if this is accepted by EU Member States, it is possible that additional measures will have to be put in place to further reduce human exposure. Such action can only be formulated with detailed knowledge of the current situation within the EU, and the work described here has been undertaken in order to provide information and recommendations to establish a sound basis for the formulation of future policy to reduce exposure to dioxins. This paper summarises the main conclusions of the work.

In seeking to establish the current situation within the EU the scope of this work has been broad; encompassing current concentrations of dioxin in the environment, longevity and environmental transport; current levels of human exposure, concentrations of dioxin in the human body and observed trends; an analysis of acceptable levels of exposure for humans and the ecosystem. In addition, in considering future policy options, it has been necessary to establish what legislation and guidelines are already in place within Member States, which go beyond the requirements of existing EU Directives.

In view of the broad scope of the work it has been necessary to consider only PCDD/PCDFs and not to include PCBs, although conclusions relating to PCDD/PCDFs have been interpreted in the broader context of other dioxin-like compounds.

Methodology

Data have been compiled through contacts with Government Departments, Agencies, research organisations and individuals within all the EU Member States. As issues relating to dioxins fall across a range of disciplines this has involved contacts with Departments of the Environment, Health, Industry, Agriculture, Fisheries and Food and the exercise of data collection has been extensive. No new research has been undertaken as part of this project, rather the aim has been to assemble, compare and critically review the most recent data available from across the EU, in order to determine the current situation.

Results and Discussion

Legislation and Guidelines

In the past, the main focus of national regulatory activity to reduce or control dioxin releases to the environment has been stack emissions from waste incinerators, and most EU Member States have now set legal or guide concentrations of 0.1 ng I-TEQ/m^3 for existing and new MSWI, as well as for the incineration of hazardous waste. Belgium, Greece and Ireland have complied with the requirements of the EC Directives but, as Greece and Ireland have no MSWI capacity, they have no need to introduce further regulation in this sector. Finland and the United Kingdom have set a limit and guideline concentration, respectively, of 1 ng I-TEQ/m^3 for existing and new MSWI, although both have set an objective of achieving concentrations of 0.1 ng I-TEQ/m^3. It will, therefore, be a small step for most EU countries to implement the requirements of the proposed Waste Incineration Directive with respect to air emissions (which sets a limit of 0.1 ng I-TEQ/m^3). The focus of regulatory activity within Member States now appears to be moving towards industrial processes, as important sources of dioxin releases to both air and water, such as ferrous and non-ferrous metal production processes and other combustion sources.

Five Member States have introduced legislation completely prohibiting the production, marketing and use of PCP, thus going beyond the requirements of the EC Directive.

Another significant area of attention is direct human exposure. Nine Member States have recommended a maximum tolerable daily intake (TDI) of dioxin (four of which are more stringent than the previous WHO guideline of 10 pg 2,3,7,8 TCDD/kg/day), and five Member States have introduced regulations or guidelines for the maximum concentration of dioxin in milk and dairy products.

There is a wide range in the classification of 'soils'; whether agricultural (arable or pastoral), residential (urban or rural) or recreational. The dioxin concentration in soils is generally a result of historical accumulation, rather than current or recent releases and action is, therefore, more generally aimed at remediation, rather than prevention or control of releases. Austria, Finland, Germany, the Netherlands and Sweden have established guidelines concerning dioxin concentrations in soils, ranging from < 10 ng I-TEQ/kg d w to < 10,000 ng I-TEQ/kg d w, depending upon the classification of land use.

No Member State has introduced regulations beyond EC requirements controlling the release of dioxins into the aquatic environment. However, the proposed Waste Incineration Directive, if adopted in its present form, will require all Member States to set a legally enforced limit of 0.5 ng I-TEQ/l for effluent releases to water from municipal solid waste incinerators. No country has set ambient air quality standards or standards for deposition.

Environmental Levels, Fate and Transport

One of the main routes to human exposure to dioxins can be summarised as the 'air-grass-cow' route. Information drawn, primarily, from Germany and the UK suggests that concentrations of PCDD/PCDF in ambient air and grass samples decreased by around 10-20% per year during the 1980s and early 1990s. However, an essential component in the development of policy to control and reduce human exposure to dioxins is a thorough understanding of how these compounds behave in the environment. A critical assessment has been made of the current state of knowledge and understanding, and an evaluation of the feasibility of developing models to predict how

exposure might change into the future, as a consequence of reducing the amounts of dioxin released into the environment.

The average exposure of citizens in the EU Member States is already below the current recommended TDI (10 pg 2,3,7,8 TCDD/kg/day), and is gradually declining. However, it is essential to know whether the level of exposure is likely to continue declining at a rate sufficient to bring it below the new recommended TDI, within an acceptable timescale, or whether further policy measures will be required to achieve this.

This work has concluded that it is currently not possible to make reliable projections of future average levels of human exposure to dioxins, as vital information is lacking in a number of important areas: the mechanisms and rates of key environmental transfer and degradation processes; the role played by reservoir sources in determining future levels of exposure; the pathways for exposure of citizens in Southern European Member States; validation of the output of existing environmental models. In addition, a dynamic (non-equilibrium) integrated model system is required, that would cover the major routes to human exposure. The components for this model system may well already be available, although they may require validation, and the output should be probabilistic, in order to take account of the many uncertainties in the available input data and to avoid unrealistically extreme views of possible future levels of exposure.

Human Exposure, Tissue and Milk Levels

Data on human exposure to dioxins via the foodchain suggests that, over the past two decades, dietary exposure to dioxins has, on average, decreased by around 12% per year, depending upon the changing patterns of food consumption and the concentrations in foodstuffs. Estimates of the average daily dietary exposure to PCDD/PCDFs for a number of Member States range from 0.93 to 3.0 pg I-TEQ/kg/day, which are within the range of the recent WHO recommendation of 1-4 pg I-TEQ/kg/day. However, it has been estimated that PCBs can contribute around 50% of the total TEQ daily intake and total exposure could, thus, significantly exceed the recommended range.

Concentrations of dioxin in human tissue and body fluids are an indicator of the exposure history of the individual or group of individuals concerned. The only substantial source of comparable data relating to the majority of EU Member States is the WHO co-ordinated study of dioxin concentrations in human breast milk which, by definition, relates only to young women[4,5]. There is little comparable data relating to children, teenagers, men or older women.

Over the period 1988 to 1993 the average dioxin concentration in breast milk in EU Member States decreased by around 35% (8.3% per year), with a slightly higher decrease in rural areas and slightly lower in industrial areas. Measurements taken in Germany over the period 1988 to 1996[6-11] showed that the average concentration of dioxins in the blood of adult males decreased by around 64% (12% per year).

It is, therefore, clear that the actions taken to reduce human exposure to dioxins, whether by limiting and controlling the release of dioxins into the environment, restricting the movement of dioxins through the foodchain or establishing permissible concentrations in foodstuffs, have led to a reduction in the rate at which dioxins accumulate in the body of the 'average' citizen of the European Union.

However, there is a clear need for an EU-wide programme to monitor dioxin concentrations in the blood of males and females across all age groups, following similar procedures to the WHO co-ordinated assessment of human breast milk, in order to assess and monitor any changes in the age-related increase in dioxin concentrations as a result of the measures implemented to reduce exposure. In addition, measurements are required of the actual rates of accumulation of dioxin in the body tissue of breast-fed infants, both for the first born and subsequent children and, whilst recognising the wider benefits of breast-feeding infants, a better understanding is required of the importance of short periods of high exposure to dioxins on the neurological, immune system, reproductive system, endocrinological and intellectual development of infants.

Acknowledgements
This work is undertaken with financial support from the following:
- European Commission DG XI
- UK Department of the Environment, Transport and the Regions (DETR)

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