AUSTRALIA'S NATIONAL DIOXINS PROGRAM

Pamela Harris, Andrew Ivory and Chris Mobbs

Environment Australia, GPO Box 787, CANBERRA, ACT, 2602 Australia, email dioxins@ea.gov.au

Introduction

Environment Australia published the first national inventory of dioxin and furan emissions[1] in Australia in 1998. As there were few Australian data on dioxins, the preparation of the inventory relied heavily on overseas data, using estimation methodology. The National Dioxins Program was subsequently established in 2001 to improve the knowledge on the ambient levels of dioxins in Australia and to develop measures to reduce, and where feasible, eliminate dioxins.

Discussion

Development of an inventory

As international discussions focussed more intensely on dioxins and similar unwanted POPs by-products, in the lead up to the Stockholm Convention, in 1998 the Australian Government sought to establish a better scientific understanding of the situation on dioxins in Australia. Better information was needed on:

- which activities actually produced dioxins in Australia;
- what emission factors could be derived for these sources;
- what the activity levels were for these sources; and
- what amounts of dioxins were released in total to the environment each year in Australia.

The general expectation was that dioxin releases and levels in Australia would probably be less significant than in many other developed countries because of its relatively lower industrial profile.

Environment Australia commissioned a desktop study that relied on using available existing data and, where data was unavailable, applied estimation techniques, with a heavy reliance on emission factors derived from other countries' data. In determining the emission factors that could be applied to Australian sources, three reports [2-4] in particular were drawn on.

The limited funding meant that the study was restricted to emissions to air. Twenty-seven activities were examined, with estimates being derived for 19 activities as likely sources of dioxins. The total annual releases of dioxins from these 19 sources were calculated to be between 150 and 2300 grams I-TEQ/yr. The activities were ranked according to the upper bounds (or worst case scenario) for each range. The six top sources in the inventory accounted for around 90% of total emissions (Table 1).

Table 1. Six Highest Emissions of dioxins

Source	Range g/year
Fires – controlled burning	65 - 1300
Bushfires	7 – 400
Residential Wood Combustion	15 – 98
Coal Combustion	4.5 – 73
Sinter Production	10.3 - 77.4
Industrial Wood Combustion	10 – 65
TOTAL	150 - 2300

FORMATION AND SOURCES

In general, the estimates of total emissions reported in the Australian dioxins inventory were consistent with expectations although one or two results were surprising. For example, the results for controlled burning or bushfires were not expected to be as high, particularly at the upper bound level. However, the estimates for these sources were heavily qualified by the authors of the study and clearly needed further investigation.

Despite such reservations, the inventory provided an indicative overview of the sources likely to emit dioxins in Australia, the total releases that could come from these sources and where further attention could be given to improve our knowledge.

Implementing a National Dioxins Program

The Australian Government announced funding in May 2001 of a National Dioxins Program[5] (NDP) with AUS$5 million over four years (June 2001 to June 2005). The objectives are to:

- ensure protection of the health of the Australian population and environment from exposure to dioxins;
- ensure that international obligations concerning dioxins are met; and
- complement work of other government agencies in protecting the integrity of Australia's food.

The NDP will be implemented over three phases:

Phase One - gather as much data as possible about levels of dioxins in Australia;
Phase Two - assess the impact of dioxins on human health and the environment; and
Phase Three - in light of these assessed impacts, to reduce and where feasible, eliminate releases of dioxins in Australia.

If Australia ratifies the Stockholm Convention on Persistent Organic Pollutants, the NDP will contribute to meeting our obligations in relation to dioxins, including development of national action plans.

Phase One data gathering

Under Phase One, about AUS$2.5 million has been allocated to carry out studies to determine the levels of dioxins in humans and the environment in Australia and to assess the relative importance of sources of dioxin emissions. These studies will considerably enhance our knowledge and understanding of dioxin levels and impacts in Australia. For the purpose of the NDP the term "dioxins" is used in the broader sense and is also taken to include the closely related polychlorinated dibenzofurans (PCDFs or furans) and co-planar polychlorinated biphenyls (PCBs). The analysis will determine the levels of 29 compounds considered by the World Health Organisation to have significant toxicity. Results of studies on dioxins by other Australian Government programs will also contribute to an overall picture about dioxins in Australia. Phase One will run from mid 2002 through to mid 2003.

The studies and data gathering cover human body burden (breast milk and blood serum), levels in food and the environment, and emissions from bushfires and motor vehicles. The breast milk study will pool milk taken from first time mothers from 18 cohorts in urban and rural areas. The blood serum study will pool serum from up to 10,000 donors taken from similar areas in five age groups (<15, 15-30, 30-45, 45-60, >60 years).

Although not funded from the NDP, the Australia New Zealand Food Authority is analyzing the levels of dioxins in a variety of food (eggs, meat and dairy products) samples taken from all State and Territory capitals in 2000. The samples are those foods that are consumed in significant amounts in the

Australian diet and have been prepared to a 'table-ready' state (eg. cooked) from retail outlets.

A range of environmental media will be assessed to determine the level of dioxins including air, aquatic environments, soils and terrestrial fauna. Where possible, these studies will take samples from three broad areas: metropolitan, agricultural and remote sites. Studies on ambient air will done over a 12 month period with samples being taken monthly from nine monitoring sites. This study aims to capture and characterise seasonally dependent factors including bushfire smoke and residential woodsmoke in areas where these sources impact strongly on air quality.

Studies of dioxins in soils, aquatic sediments and fauna and a limited range of terrestrial fauna are also being undertaken and where possible, the samples for analysis will be taken close to the monitoring sites for the ambient air study.

The 1998 inventory estimated that bushfires may contribute up to 50 % of the total dioxins emissions to air in Australia. As this estimate was based on overseas studies, research will be done to characterise dioxin emissions from bushfires in Australia. This will be achieved by sampling smoke from bushfires and from laboratory controlled fires. A broad variety of vegetation categories are being examined including native forests and woodlands and agricultural crops such as sugar cane.

Overseas studies show that motor vehicles may contribute less than 3 % of the total annual dioxins emissions in a country. Nevertheless, a study will be undertaken to determine the probable contribution to the dioxin emissions from this source in Australia. The initial study will involve examining studies of motor vehicle emissions carried out in other countries and comparing these with the Australian motor vehicle fleet. Factors such as the composition of the Australian fleet, types of fuels used and their additives, emission controls standards and driving patterns, including distances traveled, will be taken into consideration when extrapolating the overseas data to Australia. If necessary, air sampling in high volume inner city tunnel traffic may then be carried out to confirm the findings of the initial study.

Phase two - risk assessment

The data gathered from the Phase One studies and other programs, will be used to prepare a new inventory of dioxins in Australia. This data will be used to undertake a risk assessment of the environmental and human health impacts of dioxins. The risk assessment phase will begin in late 2002 and be completed by late 2003. It will evaluate the potential risk to human health and the environment in Australia that may result from exposure to dioxins either directly from the environment or through the ingestion of foodstuffs contaminated with dioxins.

Phase Three - policy development

The outcome of the risk assessment phase will be used to inform the policy development phase which could consider a range of management measures, consistent with the Stockholm Convention, aimed at reducing, and where feasible, eliminating releases of dioxins including:

- emission standards or guidelines for industrial and non-industrial sources;
- development of guidelines for acceptable levels of dioxins in air, soil, and sediment;
- promotion of measures for the reduction of dioxins emissions;
- identification of remediation technologies and development of clean-up guidelines;
- investigation of appropriate waste disposal and recycling measures;
- research grants for acquiring new knowledge; and
- economic instruments to effect reductions.

Acknowledgements

The authors would like to acknowledge the following staff of Environment Australia who have

contributed to the development of the National Dioxins Program: David Atkinson, Peter Burnett, Andrew Chalklen and Lesley Dowling.

References

1. Environment Australia. (1998) Sources of Dioxins and Furans in Australia: Air Emissions, *Commonwealth of Australia.*
2. Bremmer, Troost, Kuipers, de Koning and Sein (1994). *Emissions of Dioxins in the Netherlands.*
3. Her Majesty's Inspectorate of Pollution (1995). *A Review of Dioxin Emissions in the UK.*
4. USEPA, The Science Advisory Board (1995). *Dioxin Reassessment Review.*
5. Internet address - National Dioxins Program http://www.ea.gov.au/industry/chemicals/dioxins/index.html