

Toxicologist says urgent action needed on dioxins

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The environmental scientist whose work on dioxins last year prompted governments around the world to suspend the use of some pesticides says there is more to the problem and authorities need to act urgently.

Although dioxins have been banned from the ingredients of [pesticides](#) in [Australia](#) for more than a decade, many dioxins emerged in the [manufacturing process](#) and there was no end-stage monitoring to protect consumers and the public, said University of Queensland scientist Dr. Caroline Gaus.

Numerous environmental and [health issues](#) were associated with undeclared dioxin impurities, said Dr. Gaus, an environmental toxicologist with the National Research Institute for Environmental Toxicology (ENTOX).

Little information was available about the impurities because they were created during the production process so were not original ingredients.

“We estimate that the amount of these impurities is relatively high compared to other current dioxin sources, but this cannot be adequately quantified due to the commercial protection of data on pesticides use in Australia and internationally,” Dr. Gaus said.

She said pesticides with impurities used in high volumes represented a previously neglected but significant and concerning source of dioxins in the environment. They also posed a risk to the health of people handling

pesticides, and to consumers.

“Some of these pesticides contained high concentrations of dioxins, comparable to those known from pesticides which are banned or restricted for use in most countries since the 1980s and 90s,” she said.

Dioxins are linked to a range of cancers and are considered one of the most toxic man-made chemicals. They can cause adverse health effects in humans and wildlife including cancer, and act on development, reproduction and the endocrine system.

Research by Dr. Gaus and PhD student Eva Holt last year showed that a wide range of currently used and globally marketed pesticides contained dioxin impurities, despite the widespread belief that modern pesticides were no longer a significant dioxin source.

As a result of their work, a new wave of suspensions, recalls, restrictions and government reviews on pesticide formulations is under way worldwide, including in the United States, Canada, New Zealand and Australia.

The study analysed 23 different pesticide formulations, containing 15 different active ingredients currently used in Australia (plus four formulations that are no longer registered for use in Australia), including insecticides, herbicides and fungicides. Dioxins were detected in all samples, including some commonly used products. Researchers estimate approximately 200 pesticides have the potential to contain dioxins.

The pesticides are used on crops including cotton, potatoes, lettuce, tomatoes, beans and peanuts, as well as in parks and recreation areas, at turf farms and plant nurseries.

“In view of the global manufacturing, distribution and use of pesticides,

international regulation and monitoring strategies should be developed and implemented to identify, evaluate, and target pesticide dioxin sources at the manufacturing stage,” Dr. Gaus said.

Some Recent Restrictions

The Australian Pesticides and Veterinary Medicines Authority (APVMA) suspended all formulations containing quintozone (pentachloronitrobenzene) from use in April this year due to risk to workers applying the pesticide, which was commonly used on golf courses. The fungicide is under review in New Zealand where it is used on bulbs and turf. The manufacturer recently initiated a voluntary recall of product containing quintozone. The APVMA has recently suspended the pesticide PCNB from sale and a stop sale order has been issued by the US Environmental Protection Agency.

About Dioxins

- Dioxins are toxic compounds which have adverse health effects in humans and wildlife. They can elicit adverse health effects at low levels (cancer, immunotoxicity, reproduction, endocrine function, development).
- These toxicants are managed under the international Stockholm Convention treaty which aims to protect human health and the environment by reducing and eliminating dioxin release to the environment. More than 150 countries, including Australia, have ratified the Stockholm Convention treaty since 2004.
- Most chlorinated pesticides have the potential to contain dioxins if manufactured under certain conditions and processes (e.g. $> 150^{\circ}\text{C}$, alkaline conditions, process including chlorine) – the US EPA lists 161

chemicals (but it is not complete – PCNB for example is not listed). Thus, pesticides were considered historical sources of dioxins and contemporary monitoring data in most current-use pesticides are lacking.

- Dioxin impurities can vary between manufacturing facility, batch, year and country due to variations in production processes and conditions.

About the Research

- 23 different formulations containing 15 different active ingredients currently used in Australia (plus 4 formulations that are no longer registered for use in Australia), including insecticides, herbicides and fungicides, were analysed. Dioxins were detected in all samples. These include commonly used pesticides, such as PCNB, MCPA, 2,4-D, chlorothalonil and triclopyr/picloram. Others are Fluroxypyr, Mecoprop, Flumetsulam, Imazamox, Prochloraz, Fenamisphos, Chlorpyrifos, Lindane; 2,4-D; 2,4-DB; Chlorthal and Quintozene.
- Some of these pesticide formulations contained high concentrations of dioxins, comparable to those known from pesticides which are banned or restricted for use in most countries since the 1980/90s.
- Highest dioxin (1,100-2,000 mg/tonne AI) and TEQ (2,400-5,700 µg/tonne AI) concentrations were found in the fungicide quintozene (also known as pentachloronitrobenzene (PCNB)).
- Dioxin concentrations in PCNB are comparable to those known from the banned pesticides 2,4,5-T (trichlorophenoxyacetic acid; the key ingredient of Agent Orange). Note: TEQ concentrations in PCNB are at the lower end for those known for 2,4,5-T (approaching the 7,000 µg/tonne used under the Stockholm Convention to estimate historical dioxin releases via past use of 2,4,5-T).

- There are about 6000 pesticide products on the market in Australia (containing ~2000 different active ingredients) – the UQ/ENTOX scientists analysed only a small proportion (0.4 per cent) of these.
- Dioxin concentrations in other pesticides analysed ranged from 61-190 ug TEQ/tonne AI. Impurity concentrations may vary considerably depending on the conditions employed during pesticide production and should therefore be monitored regularly.
- As many pesticides are used in high volumes, they can represent previously neglected but important sources of dioxins to the environment and pose a risk to the health of people handling pesticides.
- Based on these findings, the APVMA have recently suspended the pesticide PCNB, due to dioxin contamination and the associated risks to pesticide applicators. Similarly, the US EPA have issued a stop sale order for PCNB.
- The estimated release of dioxins from the use of PCNB is 27 g TEQ/year (10-90th percentile range: 14-110 g TEQ/year). The dioxin release from this pesticide alone ranks among the top 5 dioxin sources to land in Australia (range 28-110 g TEQ/year).
- The greatest source of uncertainty with these estimates is the lack of information on pesticide use volumes in Australia, which is commercial in confidence and thus not publicly available. This is why the dioxin release associated with many of the pesticides analysed by the UQ/ENTOX scientists could not be estimated to date (has to be modelled)
- The cumulative dioxin release associated with high volume-use of different pesticides may be an important source of [dioxins](#), even if pesticides contain lower dioxin levels than PCNB, e.g. if all pesticide

products were contaminated at levels ranging from 100-10,000 μg TEQ/tonne AI and used at a total of 200,000 tonnes per year, then the annual dioxin release would be between 20 and 2000 g TEQ/year.

Note: data on the amount of pesticides used in Australia is not publicly available (commercial in confidence), total pesticide use may be considerably higher than 200,000 tonnes (approximately 2.25 million tonnes of pesticides a year are used in the USA, including 1.18 million tonnes per year of chlorine and hypochlorite pesticides).

Provided by University of Queensland

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