Since the early 1980s, Australia has experienced an almost exponential growth in the use of insecticides, herbicides, fungicides and defoliants for crop protection. Much of this chemical use is concentrated in the Murray-Darling Basin, where the growing needs of intensive agriculture are further served with reservoirs, weirs and river diversions.

Increased research into the effects of these practices is vital to the safety and security of Australia's inland water supplies, and consequently to agricultural sustainability in the region, according to a report presented in September 1996 to the Prime Minister's Science and Engineering Council.

The report, Agricultural Chemicals and Algal Toxins

– Emerging Water Quality Issues, was prepared by

Bruce Cooper from the NSW Department of Land
and Water Conservation, Dr Gary Jones and Dr
Richard Davis from CSIRO's Division of Water
Resources, and Dr Michael Burch from the CRC for
Water Quality and Treatment in Adelaide. It warns
that Australia's surface and groundwater resources
increasingly are at risk from agricultural chemical
residues and toxins produced by blue-green algae, and
that many of the processes leading to this
contamination are poorly understood.

Research is needed on the core problems of how agricultural chemicals and algal toxins persist in the environment, to what extent they can be passed through the food chain, and how they affect human health, the report says. Cost-effective technologies to help manage the emerging problems, and improved guidelines and best-management practices aimed at preventing contamination also are needed.

The report warns that while the effects of individual pesticides are generally well known, the 'synergistic' combinations may alter or multiply the effects of the original chemicals many times. For example, the pesticides dieldrin and endosulfan are individually weak environmental oestrogens, but in combination can be up to 1000 times more potent. Combinations of other commonly used chemicals may have similar synergistic effects, but the mechanics leading to these synergies, and which combinations are most potent, are not understood.

Another subject requiring investigation is the impact on in-stream ecology of the accumulation of pesticides in sediments, the report says. Adsorption to suspended particulates followed by deposition to river sediments is a process that concentrates some pesticides in the environment. The effects of this process on the biota living in the sediments are little known, except where gross incidents of contamination have occurred. While sedimentation can concentrate some pesticides, the actual binding of pesticides to sediments may reduce their bioavailability in the short term. Later, physical or chemical disturbance may remobilise bound pesticides.

Also recommended is increased work on the chronic impacts of 'new generation' pesticides and veterinary chemicals. A number of pesticides mimic some properties of the female sex hormone oestrogen and there is potential for such chemicals to have chronic impacts on aquatic biota, according to the report. Of similar concern are metabolic blocking agents and novel biological compounds being developed for agricultural use through genetic manipulation.

## **Blooming blue-greens**

Human activities can stimulate algal blooms by changing river flows and enriching water with nutrients – especially phosphorus and nitrogen – from soil erosion, urban run-off, irrigation drainage and sewage treatment plants. Although blue-green algal blooms are often poisonous, there are no nationally or internationally ratified standards for these toxic compounds in drinking water. The report suggests that health and water resource agencies should be assisted to formulate national drinking water guidelines for algal toxins.

The report also identifies an urgent need for research to determine from irrigation water whether algal toxin residues are present in Australian agricultural and aquacultural produce, and whether residues pose risks to human health and aquatic biota. Algae are consumed by micro-crustaceans which in turn are eaten by fish. Filter feeding animals such as freshwater mussels also consume algae, and then are eaten by animals such as native water rats. In this way, algal toxins may accumulate in the aquatic environment, causing major changes in the aquatic food chain structure.

Some blue-green algae in Australia appear to produce toxic compounds not known elsewhere. One example is Anabaena circinalis, the major bloomforming alga in rivers of the Murray-Darling Basin. This produces nerve toxins known as Paralytic Shellfish Poisons, which could accumulate in the food chain, affecting human health, rural industries, and native plants and animals.

Simple techniques are needed for monitoring, measuring and treating blue-green algal toxins, the report says. Most measuring is done by expensive equipment in sophisticated chemistry laboratories. Cheap, reliable measuring techniques for use in remote locations are needed to ensure day-to-day safety of domestic water supplies. Low-cost methods of treating algal blooms are also needed by rural communities.

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