

What's in Port Pirie's vegetables?

Two years ago scientists from the Division of Soils investigated the effects that heavy-metal emissions from the Port Pirie lead smelter were having on the surrounding countryside. They found that the smelter had affected a large area, producing higher-than-normal levels of lead, cadmium, and zinc—both in the soils and in the vegetables and wheat grown in them. However, these abnormal levels were lower than the standards recommended by health authorities and did not constitute a health risk (see *Ecos* 7).

But what was the effect of the fall-out much nearer the smelter, in the many home gardens of the city? Were the soils and vegetables grown there contaminated to the same or to a greater extent? And did the gardeners and their families run any health risk?

A group led by Dr Kevin Tiller from the Division began an investigation involving a number of gardens within the city limits, comparing these findings with results from the previous survey. They also tested vegetables bought in Adelaide to see how their heavy-metal contents compared with those found in the home-grown produce at Port Pirie.

Their results did indeed reveal some cause for concern. Heavy-metal levels were much higher in the home gardens than in the surrounding areas and could, in some cases, lead to abnormally high intakes of the metals, particularly by some children.

Dr Tiller, with his colleagues Mr Paul de Vries, Ms Leonie Spouncer, Mr Lester Smith, and Mr Bernie Zarcinas, began the study by collecting soil and vegetable samples from 56 home gardens in different parts of Port Pirie. The group tested tomatoes, silver-beet, capsicums, rhubarb, beans, potatoes, carrots, cabbage, and cucumbers, and also asked the householders about the types of vegetables they grew, their soil conditions, and the sort of fertilizers and soil filling they used.

Scattered pockets

Examination of the soil samples showed that most contamination occurred to the

south and south-east, which ties in with prevailing wind patterns in the area. The fall-out decreased rapidly away from the smelter, but the group also found pockets of contamination in different areas, regardless of their distance or direction from the smelter. This they decided was due to applications of smelter slag several decades ago, when it was thought to be a useful fertilizer.

Within strongly contaminated areas, some plots turned out to be relatively free of heavy metals, due probably to the recent addition of clean garden fill such as dune sand. The south-western section of the city was the least contaminated, but, even so, one garden there had soil with a cadmium content of 13 p.p.m.—close to

the highest value detected. It was found that the heavy-metal fall-out in undisturbed gardens had remained in the top 2–5 cm of the soil.

As in the earlier study, analysis of the produce showed that both root and leaf vegetables accumulated cadmium and lead. Carrots had the highest cadmium concentrations and beans and cucumbers the lowest. Silver-beet had the highest lead concentrations, followed by carrots and beetroot, with cucumber again the lowest.

The ranges of all heavy-metal concentrations were much higher than those previously recorded in the countryside around Port Pirie, and very much higher than those found in a 'shopping basket survey' of Adelaide vegetables.

Comparing the vegetables

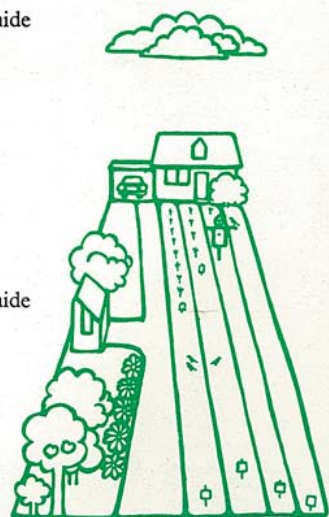
In the Adelaide survey, the group purchased eight types of vegetables from five different shops on two separate occasions. They examined the samples for lead, cadmium, copper, zinc, and manganese and found that practically all the vegetables had low levels of all the metals. Exceptions to this were some of the silver-beet samples, which exceeded the level for zinc laid down in the South Australian health regulations. And they found high cadmium concentrations in some potatoes.

However, the vegetables generally had very low levels of heavy metals—much lower than those from Port Pirie home gardens. For example, the lead concentrations in silver-beet bought in Adelaide ranged from 0.16 to 0.34 p.p.m. (fresh weight), while the Port Pirie samples ranged from 0.22 to 2.2 p.p.m.

Cadmium concentrations in carrots were even more striking. The Adelaide

Highest metal levels found in the vegetables surveyed

	Port Pirie	Adelaide
lead (p.p.m. fresh weight)		
silver beet	2.20	0.34
rhubarb	0.74	0.25
tomatoes	0.07	0.14
beetroot	1.90	0.13
carrots	1.60	0.03
lettuce	0.22	0.02
cadmium (p.p.m. fresh weight)		
silver beet	0.49	0.20
rhubarb	0.19	0.16
tomatoes	0.21	0.05
beetroot	0.35	0.09
carrots	2.60	0.01
lettuce	0.18	0.02



samples had an upper limit of 0.010 p.p.m., but the Port Pirie city samples had concentrations as high as 2.6 p.p.m. —very much greater.

The team also found quite high surface contamination on unwashed vegetables. They found high levels of zinc on unwashed cucurbit leaves and of lead on unwashed tomatoes. Appreciable amounts of the lead and zinc could be removed by washing, which highlights the need for thorough washing of vegetables from polluted areas.

Effect on health?

The heavy-metal levels in the home-grown produce from Port Pirie did not exceed the maximum permissible limits laid down by the National Health and Medical Research Council. However, Dr Tiller and Mr de Vries point out that they are far above what is normal elsewhere in everyday vegetable supplies.

In fact, from vegetables alone, a few householders could easily exceed the maximum daily intakes for lead and cadmium recommended by the joint FAO-WHO expert committee on food additives (assuming that a person eats 200 g of vegetables a day). And vegetables are not the only source of heavy metals. Other foods, and the air and water in an industrial city, contribute their share.

As many a parent knows, some young children eat soil, and the research team is particularly concerned about the possible lead intake resulting from this common habit. High levels of lead in the soil are a great potential risk. A child weighing 10 kg could consume four times the FAO-WHO's acceptable daily intake merely by eating one gram of soil

from a contaminated garden. About one-third of the gardens in Port Pirie are sufficiently contaminated to produce this effect.

The team points out that this raises the problem of recognizing the sub-clinical symptoms of lead poisoning from the soil. They believe that attention should also be paid to the possible effects that exposure to high levels of lead has on early development and health later in life.

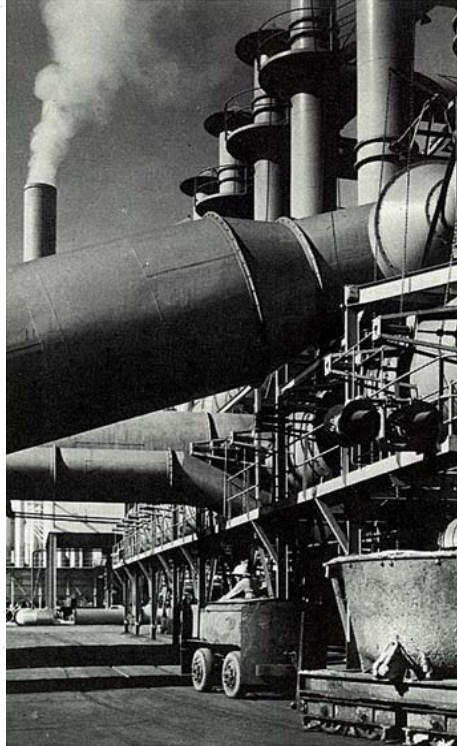
More about the topic

Environmental pollution of the Port Pirie region. 3. Metal contamination of home gardens in the city and their vegetable produce. K. G. Tiller, M. P. C. de Vries, L. R. Spouncer, L. Smith, and B. Zarcinas. *CSIRO Division of Soils Divisional Report No. 6, 1976.*

Some metals in selected vegetables purchased in the Adelaide metropolitan area. K. G. Tiller, M. C. P. de Vries, and L. R. Spouncer. *CSIRO Division of Soils Divisional Report No. 13, 1976.*

Toxic metals around Port Pirie. *Ecoss* No. 7, 1976, 27-31.

Contamination of soils and vegetables near the lead-zinc smelter, Port Pirie, by cadmium, lead and zinc. K. G. Tiller and M. P. C. de Vries. *Search*, 1977, 8 (in press).



Port Pirie's lead smelter.

