

Is urban gardening safe? Trace element concentrations and exposure risk measured from over 15,000 soils from 3,000 Australian gardens

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Urban vegetable gardening is increasing in popularity worldwide but this is often occurring in contaminated soils. Home owners typically have limited knowledge of potential contamination and do not have access to affordable soil trace element analysis. To address this gap, we devised the public science initiative ‘*VegeSafe*’ in 2013 to empower the Australian community to better understand contaminants in their home gardens, address any potential health risks and promote safe gardening practices.

This study presents data on trace element concentrations (As, Cd, Cr, Cu, Mn, Ni, Pb and Zn) from 15,313 soil samples from 3,196 Australian homes. Participants provided samples and associated metadata via post to Macquarie University. Soil samples were analysed using portable X-Ray fluorescence spectrometry. Geospatial techniques were used to ascertain where soil contamination exceeded Australian residential guidelines. Uptake of potentially toxic trace elements into vegetables was calculated using literature values. Potential carcinogenic and non-carcinogenic health risks associated with soil As, Cu, Mn, Ni, Pb and Zn concentrations were determined using US EPA modelling.

Lead was the element that most frequently exceeded Australian guidelines for residential gardens (300 mg/kg) in the inner city areas of Sydney, Melbourne and Brisbane. Mean soil Pb concentrations were 221.5 (95 % CI: 213.6-229.6) with 20.4 % of all samples > 300 mg/kg. For other trace elements, less than 4 % of samples exceeded Australian guideline values. Non-carcinogenic risk for children exposed to soil Pb and Mn exceeded tolerable limits in nine regions of Sydney, Melbourne and Brisbane, while excessive carcinogenic risk was rare. Uptake of Pb by garden produce is of concern with 20 % of vegetable gardens estimated to be producing food that exceeds Australian and World Health Organization criteria for Pb content (typically 0.1 mg/kg).

Although trace element concentrations from 80 % of Australian gardens are unlikely to pose a health risk, the prevalence of Pb in inner city gardens suggests that specific populations are at a greater risk.