



Science for Environment Policy

New method needed to estimate contamination in vegetables

The traditional method for estimating contamination levels of vegetables grown in contaminated soils may not be as reliable as previously thought, a new study finds. A new risk assessment technique showed that the daily intake of cadmium in lettuce grown in soils near Swedish glasswork sites was above the safety threshold for a fifth of the study population.

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Soils near industrial sites, such as power plants, oil refiners, [chemical](#) plants, and glasswork sites, often contain relatively high levels of contamination. Plants growing in these soils can take up these contaminants, such as cadmium, lead, and arsenic, into their tissues. As homegrown vegetables and [urban gardening](#) become increasingly popular, it is important to assess the [risks](#) associated with consuming vegetables grown in these soils.

However, routine risk assessments often do not look at concentrations of contaminants in site-specific vegetables, but only use soil contamination and a bioconcentration factor (BCF) – a value which predicts how much contamination a plant will take up from the soil – to assess the risk. Some scientists think the use of BCFs is insufficient to calculate the risk in a specific site, and can overlook areas which pose the highest risk.

Among other uncertainties, BCFs do not take into account the fact that different vegetables (leafy versus root vegetables, for example) take up different levels of contaminants. Furthermore, the type of soil affects how much contaminant a vegetable can take up.

The researchers investigated these uncertainties by testing the actual cadmium and lead concentrations of soil and vegetables grown within 250 metres of 22 of the most contaminated glasswork sites in southeastern Sweden. The study included 70 households and focused on potatoes (Bintje, *Solanum tuberosum*) and lettuce (Asparagus lettuce, *Lactuca sativa*) as representatives of root and leafy vegetables, respectively. Eighty-eight additional soil samples were collected from 18 of the glassworks sites and used to grow potatoes and lettuce in the lab.

Almost half of the soil samples had contamination levels above the Swedish Environmental Protection Agency guideline values, which are 50 milligrams per kilogramme for lead and 0.5 mg/kg for cadmium (dry weights). Levels in most vegetables were not as high and did not exceed the limit set for foodstuffs – 0.3 mg/kg in lettuce, 0.1 mg/kg in potatoes for lead, and 0.2 mg/kg in lettuce and 0.1 mg/kg for potatoes for cadmium (fresh weights).

However, 19% of the lettuce samples exceeded the safety standard for cadmium levels, and the authors found that 17% of the female population in the study area may be at risk of ingesting harmful amounts of cadmium from homegrown vegetables.

The scientists also calculated BCFs for the specific sites and vegetables to assess variation from measured data. They found high variation for cadmium levels in lettuce, which ranged from 0.07 to 17 mg/kg. The results also showed higher average BCFs than the generic factors generally used, indicating that these factors may underestimate the levels of contamination in lettuce – or that lettuce takes up more contaminants than other vegetables.

The researchers say their results show that the uncertainty associated with using generic BCFs must be addressed when assessing the health risks of ingesting contaminants through vegetables. They suggest that specific BCFs be prioritised for risk assessment in the future to allow for higher reliability.

