



Uptake and potential toxicity of chemical elements, including heavy metals, into almond trees planted over waste trenches

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In the early to mid-1900s, waste of all descriptions, including automobile parts, lead-acid batteries, and appliances, was accumulated in numerous sites throughout California. Such waste deposits were often incinerated and closed in later years followed by covering with a layer of soil. In almost all locations, such waste sites remain fenced without plant cover. However, almond trees were planted over such a waste site in Central California. To assess possible toxicity we conducted a study to measure the concentrations of selected chemical elements in specific plant parts of almond trees, including portions edible by humans or livestock. Concentrations of more than 20 elements were measured during the 2003 and 2004 growing seasons in leaves, wood, hulls, and nuts of the almond trees. These included metallic and nonmetallic elements, and included elements that function as plant nutrients as well as elements that do not. Some elements were not found in any sample above their respective detection limits, including Be, Cd, Cr, Hg, and Tl. Where elements were detected, we compare concentrations and statistical significance between trees planted over waste trenches and trees outside of the waste site. For the elements detected in kernels (Al, Cu and Ba the only ones with potential toxicological significance), we discuss the amounts of kernels which would need to be ingested to reach the permissible tolerable weekly intake. We also calculated potential toxicity for adults and children for As, Cd, Pb, and Se in kernels if these elements were present just below their detection limits. We also discuss potential toxicity of almond hulls to livestock, based on concentrations measured in this study.