Predicting zones and potential sampling methods for elevated metal concentrations in urban soils, Halifax, Nova Scotia, Canada

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Canada lacks a uniform method for sampling metals in soils, posing challenges for comparing studies and hindering the recognition of trends. Although problematic, the absence of a standard methodology is not unfounded. Soil properties are extensively variable, making it difficult to evaluate a given area. This is particularly the case for urban precincts, where soils have been disturbed and soil horizons are not well developed. Developing a standard methodology holds substantial significance, both for urban soil sampling and for society, as this allows studies to be compared and may add to the effectiveness of environmental and health risk assessments. This study focuses on developing a protocol for urban soil sampling within the city of Halifax in Nova Scotia. One aspect of the study aims to predict where high metal concentrations may arise in a city, by identifying past land use activities that are strongly associated with a particular metal(s). A key prediction method includes the creation of Geographic Information System (GIS) map, illustrating potential zones of high metal concentration and type of metals present in these locations over historic time. A second aspect of the study involves evaluating the variability of metal concentrations with sample depth (0–5 and 0–15 cm sample depths) and particle size (un-sieved, <2 mm and <0.5 mm). Through the use of X-ray fluorescence (XRF), a total of 100 samples from Dalhousie University campus were analyzed, for metals with federal and provincial guidelines: Be, Ba, V, Fe, Co, Ni, Cu, Cr, Zn, Mo, Ag, Cd, Th, Sn, Pb, As, Sb, Se. Samples collected away from obvious point source contamination showed values consistently below Canadian Council of Ministers of the Environment (CCME) or Nova Scotia residential guidelines for Ba, V, Cu, Cr, Ni, Se, Mo, Ag, and Sn. Samples taken proximal to older buildings showed values below and above guidelines for Ba, V, Fe, Cu, Cr, Ni, Se, Zn, Mo, Ag, Th, Sn, Pb, As, and Sb. In some locations, metal concentrations for Fe, Th, Pb, As, and Sb were above both guidelines. Overall, a general trend was identified, with higher metal concentrations typically found within 0-15 cm sample depths. Preliminary conclusions contribute to establishing a possible background range for soils in the city of Halifax. Determining urban background will aid in the assessment of a standard protocol for the evaluation of metal content in city soils. Additional conclusions drawn from soil analysis may provide preliminary recommendations for policy makers.

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