CHARACTERIZATION OF INDIVIDUAL PARTICLES IN DUST SAMPLES

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A comprehensive understanding of the risk associated with metal-bearing dust includes identification of the solid phases hosting the metals. Synchrotron microanalysis can provide information on elemental concentrations, crystal structure and oxidation state of individual particles, and distinguish anthropogenic from geogenic sources. At abandoned gold mines in Nova Scotia, windblown and vehicle-raised dust was collected in seven aerodynamically fractionated size ranges (0.5 to 16 μm) using a cascade impactor deployed at three tailings fields. All three sites are used for recreational activities and off-road vehicles were racing on the tailings at two mines during sample collection. MicroXRD of individual particles was used to identify Fe-As5+ weathering products including scorodite ($FeAsO_4 \cdot 2H_2O$) and amorphous hydrous ferric arsenate. Microanalysis was applied to house dust and garden soil from a single urban home in Ottawa, Canada with the purpose of distinguishing metal associated with soil particles from metal associated with indoor consumer products. Element correlations (via XRF mapping) and microXRD prove to be the most valuable tools. In the living room, Pb is associated with Mn and Fe hydroxide and phosphate minerals, similar to particles identified in the garden soil. However, in the bedrooms, Pb-based and non-Pb paint pigments as well as gypsum, bassanite and portland cement indicate in-home renovation. Zinc is present as zincite and wurtzite, constituents of the pigment lithophone, and also in metallic form. A principal advantage of synchrotron-based microanalysis is that little or no sample preparation is needed and thus there is little risk of post-sampling modification.

Keywords: tailings dust, house dust, synchrotron microanalysis