

Characterization of Lead Particles in Contaminated, Urban Soils as an Assessment of Public Health Risk

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Lead (Pb) contamination continues to persist in the environment, despite banning the use of lead-based paints and leaded-gasoline, two products that increased exposure of the neurotoxin to the wider public. In urban environments, the risk of exposure to Pb from the use of leaded-gasoline is increased due to higher vehicular traffic and the shortened distance between typical urban homes and the road, as compared to suburban and rural areas. The city of Philadelphia, PA experiences relatively high incidences of Pb poisoning in children, even compared to other major cities in the US. At the turn of the 20th century, Philadelphia was the home to a large number of lead smelters in an industrial neighborhood within the city's limits. This neighborhood is now residential and has been subjected to numerous studies that have all concluded that its soil is dangerously contaminated with Pb. To further complicate the issue, Philadelphia, like other older cities in the US, contains homes that are still covered in lead-based paint, which is extremely vulnerable to weathering, as these paints are now at least 40 years old, consistent with the 1978 ban on lead-based paints. The objective of this study is to characterize the Pb particles from soils that have been collected from various locations in Philadelphia and to distinguish the 3 main sources of Pb contamination (gasoline, paint, and smelters) based on the results of this characterization. Pb is a known neurotoxin and its uptake and effect in the human body is influenced by particle size, associations with mineral phases, speciation, oxidation state, as well as other factors. Various methods, including X-Ray Fluorescence, X-Ray Diffraction, Scanning Electron Microscopy, and Transmission Electron Microscopy, have been utilized in tandem to obtain a more complete characterization of Pb contamination to assess and compare the risk associated with exposure from the 3 main sources. These results can be used for community outreach efforts that are ongoing in these high-risk neighborhoods of Philadelphia and should also be extrapolated to similar urban centers across the US that face potential public health crises due to Pb poisoning of its youth.