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Legacy to Present: Residential Lead Burdens and Exposure Inequities in Massachusetts

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Lead (Pb) exposure remains a critical public health concern, particularly for children under five years of age, for whom low-level exposure to Pb can result in neurodevelopmental, behavioral, and cognitive impairments [1]. Although previous research and regulatory efforts have addressed Pb poisoning in the United States, the presence of lead in housing disproportionately affects vulnerable populations. Previous studies have underscored household environments such as lead-based paint, contaminated dust, and soil as primary exposure pathways for young children, highlighting the need for environmental assessments to better understand ongoing risks associated with Pb pollution.

This ongoing project evaluates residential lead exposure in the Commonwealth of Massachusetts, United States, by combining environmental sampling, advanced analytical techniques, and environmental justice (EJ) considerations. Dust, soil, and paint samples are being collected from residential homes to quantify lead concentrations and assess potential exposure to occupants, using high-precision measurements from inductively coupled plasma mass spectrometry. The data will allow for a detailed characterization of lead sources and distribution in both indoor and outdoor residential environments.

To address potential socioeconomic disparities, EJ factors are integrated into the analysis to evaluate the exposure risks of vulnerable populations. State-reported blood lead level data will be cross-referenced with environmental and EJ datasets to explore relationships between social vulnerability, residential lead contamination, and childhood lead poisoning outcomes. Additionally, Pb isotopic composition ($^{208}Pb/^{206}Pb$ and $^{207}Pb/^{206}Pb$) from paint and dust samples will be used to differentiate among potential sources of environmental lead. These isotopic signatures can help distinguish contamination linked to deteriorating lead-based paint (often associated with older housing) from other legacy sources such as historical industrial emissions, proximity to contaminated sites or major roadways, and urban soil pollution.

The expected outcomes of this ongoing research compile improved understanding of residential lead sources, exposure pathways, and social inequities influencing childhood lead poisoning. The findings aim to inform targeted mitigation strategies and policies designed to reduce lead exposure and advance environmental justice in affected communities.

References:

[1] U.S. Environmental Protection Agency. (2013). *Integrated Science Assessment for Lead* (EPA/600/R-10/075F). EPA Office of Research and Development. https://assessments.epa.gov/isa/document/&deid%3D255721