

Environmental XRF and PIXE Applications with Public Health Implications

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The Notre Dame Lead Innovation Team has been studying the pervasive problem of lead poisoning in children – which while greatly reduced nationally in the last 40 years due to environmental regulation of leaded gasoline and residential paint – still occurs in many metropolitan areas in the US. For example, elevated blood lead levels in children exceeded the CDC limits for more than 30% of the children tested in one census district in downtown South Bend, IN between 2004-2014. While the national average is less than 1% now, these urban hotspots have been identified nationally, and we report on our preliminary findings in one midwestern city.

While XRF technology is now widely used to address this issue by county health departments across the US, the current model requires an elevated blood lead level in a child, before the lead source is investigated and remediated or abated. Using primarily XRF technology, we propose a “citizen science” model for sample collection to expand the capacity of our testing equipment and we reverse the paradigm for testing for lead poisoning. We are aiming to develop a robust method that can screen tens of thousands of residential units for the presence of lead, and then ask if children are present that they be tested for lead exposure. Preliminary data comparing our lead testing kit and its use in South Bend, IN will be compared to the more extensive in home XRF testing and ICP testing.

As part of this study, we have discovered an elemental co-factor measurable with XRF and PIXE that helps identify the source of the legacy lead contamination. This observation can allow leaded gasoline residue in soils to be distinguished from leaded paint sources and other industrial sources of lead in soils without lead stable isotope analysis.