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Distribution and Bioacessibility of Lead in Fire-Impacted Soils Over Time

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An increase in the frequency and severity of wildfires poses an emerging threat to the environment and human health. Wildfires occurring at the wildland-urban interface (WUI) release toxic substances including heavy metals. Exposure to heavy metals such as lead (Pb) raises concern for both immediate and long-term threats to children especially.

Soil sampling was conducted approximately 1, 6, and 12 months post-containment of the 2025 Los Angeles wildfires, sampling ten burned sites directly affected by the fires and ten unburned properties. All sites were located either within the fire boundary (burned properties, n=10) or within 3.5 km of the ash plume (unburned properties, n=10). A handheld X-ray fluorescence (XRF) spectrometer was used to conduct *in situ* measurements of a range of metal concentrations at both the surface and subsurface (5 cm depth) layer. Soil samples were then collected from selected locations reporting the highest lead concentrations or other points of interest at each property at depths of 0–1 cm, 1–5 cm, and 5–10 cm. Samples were air-dried and sieved to recover potentially ingestible particle-size fractions (≤250 μm), then underwent *in vitro* lead bioaccessibility analysis using simulated gastric fluid (SGF) extractions to quantify the mass of lead dissolved due to SGF extraction, and the bioaccessibility of lead in each soil sample.

XRF measurements showed elevated Pb concentrations at burned sites at the surface level relative to those unburned. The highest levels of surface-enriched fine-grained dust and ash were associated with point sources. Continuous sampling over time suggests migration of lead from concentrated point sources to nearby surface soils, increasing the average concentration levels within a residential lot. SGF extractions revealed differences in lead bioaccessibility and mobility as a function of location, soil depth, and time; for example, lead bioaccessibility declined slightly with increasing depth at burned lots but was relatively constant at unburned lots. These findings provide critical insight into post-wildfire heavy metal behavior, informing future public health and soil remediation strategies.