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Metal Distribution and Bioaccessibility in Ash-Impacted Urban Soils from the 2025 LA Wildland-Urban Interface Fires

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Large-scale wildfires at wildland-urban interfaces (WUI) have increased in frequency over time, most recently demonstrated by the January 2025 Los Angeles WUI fires in the Eaton and Palisades regions in Southern California which burned over 11,000 residences. WUI wildfires result in the combustion of buildings, large appliances, and vehicles, which can produce metal-enriched debris and release metal(loid)s including Pb, As, Cd, Hg, and Cr as airborne ash particulates that then deposit onto downwind regions. These metals may differ in extent and speciation in comparison to those generated by natural wildland fires due to the incineration of human-caused materials and structures, potentially forming novel contaminant complexes with distinct bioaccessibilities. The immediate and short-medium term dynamics of these metals in debris and ash-impacted soils is poorly understood.

Soils were collected from burned residences (n=10) within the central burn zone of the Eaton Fire and unburned residences (n=10) located in the downwind ash plume, 0.5-2.5 km from the burn zone boundary. At each residence, a portable X-ray fluorescence (XRF) spectrometer measured the concentrations of a suite of metals in surface soils and at 5 cm depth below the surface. Soil samples were collected from each residence at depths of 0-1 cm, 0-5 cm, and 5-10 cm; samples of ash and dust were also collected from potential point sources (e.g., burned household appliances, vehicles, water heaters). All samples were air-dried in a fume hood, sieved to ≤250 µm (the potentially ingestible size fraction), and exposed to *in vitro* lab-based extractions to measure solubility in water and bioaccessibility in simulated gastric fluid (SGF) of lead (Pb) and arsenic (As).

XRF measurements show elevated concentrations of metals at the burn sites relative to those downwind in the ash/smoke plume (**Figure 1**), with the highest levels observed in fine-grained dust and ash associated with point sources. Water and SGF extractions allowed comparisons in metal mobility as a function of spatial location, depth in the soil column, and time as sampling continues over a 12-month period. Characterizing how these metals integrate into urban soils is critical for informing potential public health interventions and soil remediation strategies.

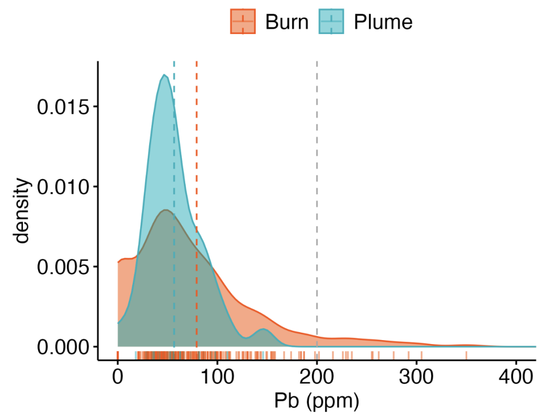

Figure 1. *Density plot of field XRF soil measurements of Pb at sites inside (red) and outside (blue) of the Eaton Fire burn zone; data from 2/4, 2/10, 2/20/25; n=317. Colored dashed lines are the group mean; grey dashed line is the EPA limit of 200 ppm. Non-soil point source ash measurements within burned structures are not included in this figure.*