Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30155

Wildfire influenced changes in metal nanoparticle size distributions in Tire Crumb Rubber

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It is well documented that wildfires alter both the form, mobility, and toxicity of trace metals in natural settings. Global wildfire activity at the Wildland-Urban Interface (WUI) is rapidly increasing, resulting in the burning of structures, vehicles, and other anthropogenic materials. Relatively little is known about the impacts on trace metal behavior of burning anthropogenic materials. These materials can be concentrated sources of trace metals. In this study, we leveraged the high sensitivity of single particle inductively coupled plasma mass spectrometry to examine how burning during WUI wildfires impacts the nanoparticle size distributions of metal-containing nanoparticles. Although we examined ash generated from a number of residential materials, that generated from Tire Crumb Rubber (TCR) was of particular interest. TCR is a common end-of-life tire byproduct used in a variety of residential and commercial applications. We examined nanoparticles generated by leaching TCR with water and with a simulated lung fluid and demonstrated that burned TCR is a source of potentially toxic trace metal-containing nanoparticles, including Cr, Ni, Zn, Pb, and Cu. Additionally, for the first time, we report an anomalous nanoparticle population of Cr containing nanoparticles that result from burning TCR, which has not been observed in other metals or generally in other burned materials. Nanoparticles are a potential vector for respiratory exposure to trace metals, with their small size (<100 nm) increasing their ability to penetrate into the lung.