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# Fate and transport of lead in urban stormwater catchment ponds

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The Minneapolis-St. Paul Metro Area has multiple sources of lead emissions from the downtown garbage burner, regional airports, smelters, lead paint, and the legacy of leaded gasoline. The accumulation of sediment and pavement runoff creates the potential for stormwater catchment areas to capture lead and other metals alongside high phosphorus loadings. The geochemical transformations that lead undergoes within the chemically stratified ponds determine the concentration, chemical speciation, and bioavailability of lead, which control the toxic effects of lead on pond ecology and the potential for remobilization of lead from pond sediments. In this study, we examined the lead geochemistry of three well-studied urban stormwater ponds and nearby soil within the Minneapolis-St. Paul Long Term Ecological Research program (MSP-LTER). Concentrations of lead and other heavy metals were determined using X-ray fluorescence (XRF) and mass spectrometry (ICP-MS) for the soils, surface water, bottom water, porewater, and sediment. XRF data shows lead concentrations in urban soils range from 20 to 2,000 ppm. The EPA's action level for lead in soils is 200 ppm. Sediments at the bottom of the three stormwater ponds range from 23 to 300 ppm lead. Sediment lead concentrations in two out of the three ponds exceed 200 ppm, with lead levels generally higher at greater sediment depths in these two ponds. ICP-MS data shows dissolved chromium, nickel, and copper are concentrated by a factor of 10 within stormwater sediment porewater as opposed to pond surface and bottom waters. However, dissolved (<0.15 micron filtered fraction) lead concentrations in porewater range from 0 and 0.002 ppm, which is not significantly different from surface or bottom waters. Synchrotron-based X-ray absorption spectroscopy (XAS) will be used to determine lead speciation of the soils and sediments. XAS spectra will identify the possibility of lead phosphate minerals forming in stormwater pond sediments, the proportions of lead adsorbed onto iron and humic substances, and any other prevalent forms of lead. The form of lead within sediments and nearby soils offers insight into the types of sources, processes that affect lead fate and transport, and potential remobilization of metals in urban ponds.