Geochemical Options for Immobilizing Lead (PB) Contamination in Soil.

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GEOCHEMICAL OPTIONS FOR IMMOBILIZING LEAD (PB) CONTAMINATION IN SOIL

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Childhood ingestion of Pb contaminated soil can result in cognitive deficits. The problem posed by Pb in soil is that it is relatively abundant in older urban yard soils, and is an exposure threat to under-served communities. To affect risk reduction, the preferred intervention technique is “excavation and removal”. However, this option is hardly a “cost-effect” methodology that can be used widely. Here, we examine the use of low cost soil amendments that alter the form of the Pb in soil and render it less toxic. Our goal has been to add phosphate products to high Pb soils to convert the Pb to a less bioaccessible form (the Pb-mineral pyromorphite).

In the Contaminated Urban-yard Restoration: Testing Apatite II Immobilization of Lead in Soil (CURTAILS) - A New Orleans Field Trial, we have been assessing the possibility of reducing the amount of bioaccessible Pb in residential soils using a biogenic phosphate product (Apatite II) obtained from fish bones (Ca10-xNa_x(PO4)6-x(CO3)x(OH)2 where x < 1). We have evaluated how effective Apatite II might prove in a series of plot trials with a variety of other phosphate products. Namely: Triple Super Phosphate (Ca(H2PO4)2•H2O), rock phosphate (Ca5(PO4)3F), hydroxyapatite Ca10(PO4)6(OH)2, bone-char, [Ca10(PO4)6OH2], bone-meal fertilizer and phosphoric acid (H3PO4). Trials in New Orleans are underway at 3 residential sites.

Here we present results of solubility tests performed on soils collected 6-months after phosphate addition. Solubility testing used an in vitro bioaccessibility assay that employed a simulated gastric fluid. Initial tests of soil Pb showed levels of >1,000 mg/kg. Each study yard was divided into 8, 10’x10’ plots, 6 of which were amended with the phosphate products and the other 2 left as controls. The pre-amendment soils did not exhibit 100% Pb bioaccessibility. Microscopic analysis of the pre-amendment soil revealed Pb in the form of Pb-paint particles, and a fraction of the Pb in the also associated with phosphorus. This suggested that a transformation of the soil Pb to a Pb-phosphate form was occurring in the soils prior to the project. Tests of the soils at 6-months post addition showed that all the phosphate products had some effect, but in one soil the effect was less; we posit this was because there had already been long term change to a Pb-phosphate at this location.