

Reducing lead contamination in urban soils

By Marisa Naujokas

Most people are aware of the hazards of lead paint, but environmental health experts are now looking at lead contamination in urban soils, with increasing concern. Superfund Research Program (SRP) Health Science Administrator Heather Henry, Ph.D., organized a session at the American Chemical Society (ACS) Meeting Sept. 8-12 in Indianapolis, where scientists and U.S. Environmental Protection Agency (EPA) experts discussed challenges in cleaning up these soils.

Stricter standards increase need for urban soil remediation

Ingestion of lead from soil and surface dust is a major exposure pathway in children. Lead is a neurotoxin, and studies have shown that early life exposure to high levels results in reduced IQ. Due to these findings, in 2012, the U.S. Centers for Disease Control and Prevention (CDC) recommended lowering the definition of elevated blood lead in children from 10 micrograms per deciliter to 5 micrograms per deciliter. According to EPA toxicologist Mark Maddaloni, Dr.P.H., the more stringent standard increases pressure on cities to find ways to remove lead in soils.

"We may not be able to dig our way down to these new ambitious CDC recommendations," Maddaloni noted. He added, digging up backyards and hauling away contaminated soil is not feasible in many urban settings, so alternative cleanup approaches are needed, such as adding amendments to soil to reduce lead bioavailability.

No one-size-fits-all answer

There is no one-size-fits-all approach, because soil characteristics determine effectiveness of different soil amendments. Amending soil involves mixing chemicals or other products into the soil to change the chemical composition and immobilize, or bind, the lead. A variety of phosphate amendments, such as compost, fish bone meal, and phosphate fertilizers are under investigation. Fish bone meal garnered publicity as a fix-all approach, but the presenters agreed that it does not work under all circumstances.

Ganga Hettiarachchi, Ph.D., from Kansas State University, showed that plant uptake of lead can be minimized, and soil quality can influence amendment effectiveness. Zhongqi (Joshua) Cheng, Ph.D., from Brooklyn College noted that the presence of other contaminants, such as arsenic, can also complicate cleanup efforts. For example, phosphate can mobilize arsenic, creating other problems. Christopher Schadt, Ph.D., of Oak Ridge National Laboratory, observed that microbial communities, including fungi, present in the soil, can be players in mobilizing soil lead.

Lead bioavailability as a key parameter

Presenters also emphasized that lead bioavailability is a key measurement of soil lead risk. If soil lead is stabilized, so that it can no longer be absorbed into the body, exposure risks are greatly reduced. But, measuring bioavailability itself is a challenge, according to Kirk Scheckel, Ph.D., from the EPA, and Nick Basta, Ph.D., of Ohio State University. Their research suggests that the current laboratory *in vitro* method to predict lead bioavailability - known as the relative bioavailable leaching procedure, developed by John Drexler, Ph.D., of the University of Colorado Boulder and William Brattin of the Syracuse Research Corporation, Denver, Colo. - is not accurate for amended urban soils.

According to Basta, "Research is needed to evaluate other *in vitro* lab methods, and develop a new laboratory method to accurately evaluate the ability of soil amendments to reduce bioavailable lead."

Research to Risk Assessment

Henry and co-chairs Maddaloni and Scheckel organized this ACS session, as part of the SRP Research to Risk Assessment Initiative. The initiative brings together risk assessment experts and researchers, to exchange information and define research needs.



Henry oversees the NIEHS SRP grants. (Photo courtesy of Steve McCaw)



Scheckel presented "Challenges of lead immobilization and risk assessment" at the ACS session on biogeochemistry interactions that affect bioavailability and remediation of lead in soils. (Photo courtesy of Heather Henry)

Henry said, "As a result of this ACS session, we are better positioned to communicate the state of science and potential shortcomings of using phosphate for lead soil remediation."

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