7.6 Using Bioavailability Methods to Evaluate Remedies (Bioavailability-Based Remediation)

Excavating and replacing contaminated soil is expensive and may be ecologically destructive. Therefore, an alternative remedial option that can be considered for sites is an in situ soil amendment that reduces contaminant bioavailability. This bioavailability-based remediation does not remove the soil contaminant, but instead reduces its bioavailability and potential exposure and risk. Extensive research has shown a variety of soil amendments can successfully reduce lead bioavailability (Chaney and Mahoney 2014; Scheckel et al. 2013; Hettiarachchi and Pierzynski 2004). However, phosphate-based treatments that reduce lead bioaccessibility increase arsenic bioaccessibility (Henry et al. 2015; Scheckel et al. 2013).

Compared to the available literature on lead, studies on the use of soil amendments to reduce arsenic bioavailability or bioaccessibility are limited. Although iron absorption of As(V) from water is well known, limited research is available on the on the ability of iron and other soil amendments to reduce bioavailable or bioaccessible arsenic in soil, especially over time. In the research available, Ferric chloride plus lime treatment of arsenic-contaminated soil reduces IVBA As 30 to 41% (Cutler et al. 2014). Using iron sulfate to treat soils contaminated with arsenical pesticides reduces arsenic bioaccessibility as much as 81% (Redwine et al. 2010). The measured reduction in arsenic bioaccessibility ranged from 20% to 81%, depending on the bioaccessibility method. Soil treatment with iron salts is inexpensive and shows potential for in situ remediation of arsenic contaminated soil (Redwine et al. 2010). Strong specific adsorption onto Fe oxides is the mechanism for the decreased bioaccessibility (Beak et al. 2006a).