Alloy LLC
Bringing good things together
Health • Environment • Policy

Webinar overview
BIOAVAILABILITY TOOLS FOR HUMAN HEALTH
RISK ASSESSMENT OF METALS IN SOIL

Background

Human health risk assessment (HHRA) of contaminated soils assumes that humans are exposed to soil via ingestion, inhalation, and dermal contact with the soils. For sites contaminated with metals, the potential human health risks (toxicity) from exposure to contaminated soils is primarily associated with possible ingestion of soils, especially by young children; potential exposures via inhalation or dermal absorption of metals in soil result in much lower exposures.

Generally, the toxicity of ingested chemicals depends on the extent to which they are absorbed from the gastrointestinal tract and into systemic circulation. Standard practice in HHRA is to assume that metals in ingested soil are absorbed to the same extent as metals in the form used in toxicity studies (such as those that characterize the non-cancer or carcinogenic toxicity). However, research shows that metals can bind to soils, and that this binding can lead to reduced absorption following human exposure. The factors that affect this binding of metals to soil include both chemical and physical considerations, and are influenced by the source of the metals and characteristics of the soil, and include:

- The chemical form and mineralogy of the metal. For example, the bioavailability of oxides may be significantly different than sulphide mineral forms.
- The nature of the source of metals. Metals from smelter sources may have different bioavailability that metals that are consolidated in the quartz matrix of mineral ores.
- The particle size. Smaller particles have larger relative surface area, and so metals can dissolve from the soil more readily and therefore can have higher bioavailability.

The amount absorbed is referred to as the bioavailable fraction. Understanding more about the bioavailable fraction of metals in soils provides information that can be used to develop more accurate estimations of chemical exposures and associated risk. This information can also be used to develop health-based soil screening values that reflect site-specific conditions.

Accounting for bioavailability in soils using user-friendly tools

The bioavailability of some metals in soil has been well studied, particularly lead and arsenic. Many of the studies have been done using animal research that can be expensive, time consuming, and raise ethical concerns in some jurisdictions. In order to provide broader use of bioavailability considerations in risk assessment, simple chemical extraction methods have been developed that provide an inexpensive and efficient tool for generating estimates of bioavailability for specific sites .

The technical basis for understanding the bioavailability of metals in soil to humans will be described, and the use of bioavailability adjustments in risk assessment will be demonstrated. The presentation will also describe the use of animal research and the simpler chemical testing methods that can be used to provide data on bioavailability.

After this webinar, you should be able to assess whether bioavailability may be an important consideration in assessing potential human health risks for a particular contaminated site. You will also know strategies for developing useful data, and how to incorporate those data into the risk assessment process. This will include how to fit the bioavailability data into pharmacokinetic models for understanding human health risks from exposure to lead in soil. There will be an opportunity to ask questions and seek clarifications at the end of this webinar.