California Arsenic Bioaccessibility Method: Bench-Top Prediction of Relative Bioavailability in Contaminated Soils

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Background/Objectives. The California Department of Toxic Substances Control (DTSC) Human and Ecological Risk Office (HERO) recently released guidance on evaluating arsenic bioavailability in contaminated soils. Human Health Risk Assessment (HHRA) Note 6 recommends using the recently published California Arsenic Bioaccessibility (CAB) in vitro method to predict in vivo relative bioavailability (RBA). Traditional HHRAs assume that arsenic in soils is 100% bioavailable. However, it is well known that this is not typically the case; US EPA recommends a default RBA of 60% in the absence of site-specific data. Until very recently this meant using an established in vivo animal study, which, while widely accepted, are both expensive and time consuming. CAB is a quick and inexpensive method, which allows for a more efficient use of the resources available for the cleanup while maintaining a high level of health protectiveness.

Approach/Activities. DTSC's HHRA Note 6 provides guidance on when and where it is most advantageous to conduct a bioavailability study using CAB and how the results of such a study should be incorporated into a risk assessment. Important considerations include the site-specific naturally occurring background concentrations of arsenic, the range of arsenic due to contamination, the planned future land use of the site, and community acceptance. Risk-based concentrations for arsenic are typically lower than naturally occurring background levels in soils. As such the background concentration is often used as a clean-up goal; in those cases it is also necessary to determine the bioavailability of arsenic background soils. HHRA Note 6 provides guidance on how to determine clean-up values under multiple outcome scenarios. HHRA Note 6 is currently being updated to include additional guidance on how to determine site-specific arsenic background concentrations in addition to expanding the section on determination of remediation goals. DTSC HERO toxicologists are available for consultation on applying this guidance on a site-specific basis and have a long-term goal of creating a database of all sites in the State that have used CAB in their decision making process. This database would be publically accessible with the goal of helping to inform future site evaluations.

Results/Lessons Learned. CAB is highly predictive of arsenic RBAs for a wide variety of soil types when the total arsenic concentrations are less than 1,500 mg/kg, but tends to over-predict in soils with higher levels of arsenic. Consequently, DTSC is recommending the use of CAB to predict site-specific RBAs of arsenic in soil at most sites under its jurisdiction.