Using *In Vitro* Gastrointestinal And Sequential Extraction Methods To Characterize Site-Specific Arsenic Bioavailability

N. T. BASTA[1]*, S. D. WHITACRE[1], P. MEYERS[2], V. L. MITCHELL[2], C. N. ALPERS[3], A. L. FOSTER[4], S. W. CASTEEL[5] AND C. S. KIM[6]

[1]The Ohio State Univ., Columbus, OH, 43210, USA (basta.4@osu.edu, whitacre.39@osu.edu)
[2]DTSC, Sacramento, CA, 95826, USA (perry.myers@dtsc.ca.gov, valerie.mitchell@dtsc.ca.gov)
[3]USGS, Sacramento, CA, 95819, USA (cnalpers@usgs.gov)
[4]USGS, Menlo Park, CA, 94025, USA (afoster@usgs.gov)
[5]Univ. of Missouri, Columbia, MO, 65205, USA (casteels@missouri.edu)
[6]Chapman Univ., Orange, CA, 92866 USA (cskim@chapman.edu)

Often the most important risk pathway associated with human exposure to arsenic- (As-) contaminated soils and geomedia is incidental soil ingestion. Using total As content typically overestimates exposure because physiochemical properties of the soil or geomedia matrix can sequester As and reduce its bioavailability. The predominant As mineralogy in the soils and wastes was As(V)-ferrihydrite, As(V and III) associated with Al oxyhydroxide, gibbsite with lesser amounts of arsenopyrite. We determined the ability of several in vitro gastrointestinal (IVG) methods, including two versions of the OSU IVG method and the Relative Bioavailability Leaching Procedure, to predict relative bioavailable (RBA) As determined from juvenile swine (in vivo) dosing trials for soils and mine wastes.

Soil As was fractionated into 5 pools using a sequential extraction procedure (SEP): F1, non-specifically sorbed; F2, specifically sorbed; F3, amorphous and poorly crystalline oxides of Fe and Al; F4, well-crystallized oxides of Fe and Al; and F5, residual. RBA As ranged from 4 to 24%, below the USEPA default value of 60%. Most As was associated with reactive Fe and Al oxide fractions followed the tend F1 < F2 < F3, F4, F5. Strong linear relationships were found between bioaccessible As (IVG) and RBA As (in vivo). However, all except one in vitro method under-predicted RBA As for several high-Fe soils. Comparison of in vivo RBA As and SEP results show F1 + F2 < RBA As < F3. The sum of SEP F1+F2+F3 provided a conservative estimate of RBA As.