

**The Technical Review Workgroup for Metals and Asbestos (TRW)
Bioavailability Committee Annual Report:
Accomplishments and Activities for Calendar Year 2012**

Members

Region 2

Mark Maddaloni (co-chair)

ORD NERL – RTP

Karen Bradham

Region 4

Ofia Hodoh

ORD NHEERL – RTP

David Thomas

Region 6

Anna Milburn

ORD NRMRL – Cincinnati

Robert Ford

Fran Kremer

Bradley Miller

Kirk Scheckel (co-chair)

Region 7

Michael Beringer

Todd Philips

Region 8

Charles Partridge

OSRTI

Michele Burgess (co-chair)

Michele Mahoney

Region 9

Sophia Serda

Region 10

Katie Adams

Marc Stifelman

TRW Bioavailability Committee Accomplishments of CY 2012

Reports and Guidance on the Bioavailability of Metals in Soil

1. Completed Science Report: “Compilation and Review of Data on Relative Bioavailability of Arsenic in Soil”

In an effort to provide a more accurate default relative bioavailability (RBA) value for arsenic in soil, the TRW Bioavailability Committee compiled all available estimates of soil arsenic RBA. The resulting database included a total of 103 RBA estimates obtained from bioassays swine, monkeys and mice. The empirical distribution of RBA values in this data set suggests that values for arsenic RBA exceeding 60% are relatively uncommon (i.e., <5% of the RBA estimates exceed 60%). This report provides scientific support for a national default value for arsenic relative bioavailability on soil. This report has been signed by OSRTI management and posted to the TRW website (<http://www.epa.gov/superfund/bioavailability/guidance.htm>).

2. Completed Draft Policy Memorandum: “Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil”

The TRW Bioavailability Committee recommended a national default value for RBA of arsenic in soil based on an upper percentile from the data on soil arsenic RBAs reported in the Science Report, “Compilation and Review of Data on Relative Bioavailability of Arsenic in Soil”. An RBA value of 60% was selected as the default value and is supported by the analysis of soil arsenic RBA estimates which showed that less than 5% of the RBA estimates exceeded 60%. Where development of site-specific RBA estimates is not feasible (e.g., screening-level assessments), the default value of 60% can be used, recognizing that the default value is an estimate that is not likely to be exceeded at most sites and is preferable to the assumption of an RBA equal to 100%. The memorandum has been signed by OSRTI management and posted to the TRW website (<http://www.epa.gov/superfund/bioavailability/guidance.htm>).

3. Finalized Report: “Technical Review Workgroup for Metals and Asbestos: Bioavailability Committee. Mineralogical Report. XAS Data and Linear Combination Fitting Results”

The TRW Bioavailability Committee finalized a report assessing arsenic mineralogy of soils that were recently tested *in vivo* in swine and mouse bioassays. This mineralogical report contains results of X-ray absorption spectroscopy analyses of these soils. (<http://www.epa.gov/superfund/bioavailability/guidance.htm>)

4. Completed Manuscript: “Assessing Performance of a Mouse Assay for Determination of Arsenic Bioavailability in Contaminated Soils”

Members of the TRW Bioavailability Committee completed development of a manuscript on assessment of soil arsenic bioavailability using the ORD mouse model, including comparison of results from the mouse and swine models. The manuscript has been submitted for publication.

- 5. Continued Development of a New Soil Reference Material for Pb and As**
In collaboration with U.S. Geological Survey (USGS), the TRW Bioavailability Committee continued development of a new Soil Reference Material for Pb and As, using material collected from a Region 8 Superfund site in Montana. Product development is complete. Analysis of the new Reference Material is in progress. The new SRM is intended to replace depleted NIST SRMs used as Quality Control standards in analyses of arsenic and lead levels in soil and *in vitro* bioaccessibility assays.
- 6. Completed Round Robin Validation of New Soil Reference Material for Pb and As**
Conducted a multi-laboratory round robin analysis of the new Soil Reference Material to establish consensus values for Pb IVBA and for Pb and As concentrations analyzed using EPA Method 3051A (microwave extraction). The final report is in development.
- 7. Initiated Swine Bioassay on New Soil Reference Material**
Initiated a bioavailability assay in swine to assess Pb and As RBA of the new Soil Reference Material. Experimental phase is complete and data reduction is ongoing.
- 8. Initiated Manuscript Development: “Development and Analysis of a New Soil Reference Material for Lead and Arsenic ”**
Initiated development of a manuscript on the development and analysis of the new Soil Reference Material, reporting on the development process, consensus values for standard analyses, and results of additional *in vitro* and *in vivo* testing. Source for the soil is the Iron Mountain/Flat Creek (Montana) site in Region 8.
- 9. Completed Revision of the Pb IVBA SOP**
Completed revision of the Pb IVBA SOP to reflect changes in NIST reference materials, refine procedures, and develop a data reporting format. Available at:
http://epa.gov/superfund/bioavailability/pdfs/EPA_Pb_IVBA_SOP_040412_FINAL_SR_C.pdf
- 10. Continued New SW-846 Method Development**
Continued development of a new SW-846 method for *in vitro* bioaccessibility (IVBA) of Pb in soils.
- 11. Completed Development of Dioxin Bioavailability Framework**
Completed development of the Dioxin Bioavailability Framework. This report provides the basis for minimum requirements of assays intended to estimate RBA of PCDD/F in soils for applications to risk assessment. Currently, undergoing review by OSRTI’s Environmental Response Team.

12. Initiated Manuscript Development: “Effects of Phosphate Amendments on Bioavailability of Pb in Soils”

Initiated development of a manuscript that reviews of the state-of-the-science on the effects of phosphate amendments on bioavailability of Pb in soil, including review of arsenic and phosphate soil chemistry and studies on effects of amendments on soil arsenic bioaccessibility and bioavailability.

13. Initiated Development of Fact Sheet/Technical Memorandum on “Effects of Phosphate Amendments on Bioavailability of Pb in Soils”

Initiated development of a Fact Sheet/Technical Memorandum to be posted on the TRW Bioavailability website. This is a condensed version of the information reviewed in the phosphate amendments manuscript.

14. Initiated Development of Bioaccessibility Sampling QAPP

Initiated development of a generic Quality Assurance Project Plan (QAPP) for sampling soil for the purpose of site-specific Pb bioaccessibility assessments. The generic QAPP would be used as a model for developing QAPPs for specific sites.

15. Initiated Development Fact Sheet/Technical Memorandum on the Use of Animal Models for Evaluation Bioavailability

Initiated development of a Fact Sheet/Technical Memorandum outlining criteria for animal models for evaluating bioavailability and issues of model design.

Communication, Training, and Outreach

1. **Hotline.** The Bioavailability Committee responds to questions from inquiries made either by telephone to the Bioavailability Committee hotline (toll-free 1-866-282-8622) or via bahelp@epa.gov. The Bioavailability Committee responded to 4 requests for assistance in 2011. Of these calls, 2 were from state and federal agencies, 1 was from a consulting firm and 1 was from a university.
2. **Bioavailability Committee Annual Meeting.** Held on December 5-7, 2012, Atlanta, GA. Members of the Bioavailability Committee met to work on projects and plan activities for 2013.
3. **Presentations/Publications/Training:**
 - a. Bioavailability, Bioaccessibility, and Speciation of Arsenic Contaminated Soils. K.D. Bradham, K.G. Scheckel, B.W. Miller, D.J. Thomas. Annual Meeting of the Soil Science Society of America, Cincinnati, 2012.
 - b. Assessing Oral Human Bioavailability of Arsenic in Soil with in Vitro Gastrointestinal Methods. N. Basta, S. D. Whitacre, K.G. Scheckel, B. Miller and S. Casteel. Annual Meeting of the Soil Science Society of America, Cincinnati, 2012.

- c. Human Health Impacts of Toxic Elements and Deficient Nutrients in Plants. K.G. Scheckel and E. Lombi. NSLS/CFN Joint Users' Meeting, Upton, NY, 2012.
- d. USEPA West Oakland Residential Lead Assessment Study. S.M. Serda, S.A. Calanog, K.D. Bradham, K.G. Scheckel and B.W. Miller. Society of Toxicology Annual Meeting. San Francisco, CA, 2012.
- e. *In situ* Arsenic and Lead Stabilization and Remediation in Acidic Soils Using Green Chemistry and Nano Iron Welding Fumes. B.W. Miller, K.G. Scheckel and T.P. Luxton. Annual Meeting of the Soil Science Society of America, Cincinnati, OH, 2012.
- f. In-situ Stabilization of Pb and Zn Impact Sediments to Reduce Ecological Availability. K.G. Scheckel and A.G.B. Williams. 4th International Conference EuroSoil, Bari, Italy, 2012.
- g. Bioavailable and bioaccessible pools of soil bound Arsenic: Results from in vitro extraction, X-ray absorption spectroscopy, and in-vivo feeding studies. K.G. Scheckel, K.D. Bradham, B.W. Miller, D.J. Thomas. 4th International Conference EuroSoil, Bari, Italy, 2012.
- h. Bioavailability and Speciation of Arsenic in Contaminated Soils. 2012. B.W. Miller, K.D. Bradham, K.G. Scheckel, and D.J. Thomas. Invited Presentation: Natural Science Foundation of China. 2nd International Geobiology Conference; Critical Zone Observatories for Sustainable Soil Development and Beyond. Wuhan, China. 2012.
- i. Bioavailability and Bioaccessibility of Contaminants at United States Superfund Sites: Information and Recommendations of the U.S. EPA Technical Review Workgroup for Metals and Asbestos: Bioavailability Committee. Abstract. 2nd International Geobiology Conference; Critical Zone Observatories for Sustainable Soil Development and Beyond. Wuhan, China. 2012.
- j. High Fe Biosolids Compost Induced Changes in Pb and As Speciation and Bioaccessibility in Co-contaminated Soils. S.L. Brown, I. Clausen, M.A. Chappell, K.G. Scheckel, M. Newville, and G.M. Hettiarachchi. 2012. J. Environ. Qual. 41:1612-1622.
- k. A Multi-technique Investigation of Copper and Zinc Distribution, Speciation and Potential Bioavailability in Biosolids. E. Donner, C.G. Ryan, D.L. Howard, B. Zarcinas, K.G. Scheckel, S.P. McGrath, M.D. de Jonge, D. Paterson, R. Naidu, and E. Lombi. 2012. Environ. Pollut. 166: 57-64. Bradham KD, Scheckel KG, Nelson CM, Seales PE, Lee GE, Hughes MF, et al. 2011. Relative Bioavailability and Bioaccessibility and Speciation of Arsenic in Contaminated Soils. Environ Health Perspect 119:1629-1634.
- l. Karen Bradham and Michael Hughes co-chaired the workshop "Assessing the Bioavailability and Risk from Metal Contaminated Soils and Dusts" at the Annual Society of Toxicology conference in San Francisco March 11-16.
- m. Relative Bioavailability, Bioaccessibility, and Speciation of Arsenic Contaminated Soils. K.D. Bradham, K.G. Scheckel, B.W. Miller, D.J.

Thomas. 2012. Annual Society of Toxicology conference, San Francisco, March 11-16.

- n. Janice Ling-Chu Chien, Winston Dang, Halûk Özkaynak, Karen Bradham. 2012. Hand and Object to Mouth Contact Activities and Non-dietary Soil and Dust Ingestion Rates for Young Children in Taiwan. Society of Risk Analysis, San Francisco, December.

Coordination/Support with Regions, EPA Program Offices, and Other Federal Agencies

1. **USGS:** Completed development and continued analysis of a new Pb and As soil Reference Material, in collaboration with USGS.
2. **RCRA:** In collaboration with RCRA, continued development of a new SW-846 method for *in-vitro* bioaccessibility (IVBA) of lead in soils.
3. **TRW Pb Committee:** Collaborated with the TRW Pb Committee on several topics, including effect of phosphate amendments on bioavailability of soil Pb.
4. **Region 1:** Assisted Region 1 by providing comments and suggestions regarding site assessment (Wells G&H site) of bioavailability of arsenic in Aberjona river wetland sediments.
5. **EPA Region 6:** Reviewed and commented on a Region 6 draft investigational plan for bioavailability of PAHs at a former Air Force Base in Texas (“DRAFT: Investigation Plan – former foster Air force Base Skeet Range bioavailability Study Delineation of PAHs Victoria, Texas”).
6. **EPA Region 7:** Initiated investigations into potential differences between hotplate (EPA method 3050) vs microwave (EPA Method 3051A) digestion methods for measurement of Pb in soil.
7. **EPA Region 7:** Completed IVBA testing for samples from Southwest Jefferson County Mining Site to derive a preliminary remediation goal (PRG) for site.
8. **EPA Region 8:** At the request of Region 8, initiated a validation and regulatory acceptance assessment of an *in vitro* bioaccessibility (IVBA) assay for arsenic in soil.

13. **Metal Bioavailability Draft Scoping Reports.** Complete development of scoping reports on bioavailability of the Ni, Cd, and Mn bioavailability scoping reports
14. **Training Opportunities for 2012:** Identify training opportunities to support and update Regions on recent developments regarding application of bioavailability to site assessments.
15. **Archive of Site-Specific Bioavailability Assessments for Metals.** Develop an information archive of site-specific bioavailability assessments for metals that have been conducted in support of remedial investigations and human health risk assessments.
16. **Bioavailability Committee Literature Archive.** Update archive of literature on bioavailability of lead and arsenic. Committee will review lists of new literature available in the archive.

17. **2013 BAC Annual Meeting.** Plan annual meeting for November 2013.