Technical Review Workgroup for Metals and Asbestos Bioavailability Committee Annual Report: Accomplishments and Activities for Calendar Year 2016

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TRW Bioavailability Committee Accomplishments of 2016

Reports and Guidance on the Bioavailability of Metals in Soil

1. **Continued Development of a Report to Validate the Arsenic IVBA (*In Vitro* Bioaccessibility Assay)**
   Developed the Draft Arsenic IVBA Validation Report. This report will provide the basis for validation and regulatory acceptance of the arsenic IVBA assay. Once approved for regulatory use, the arsenic IVBA assay can be used to replace animal bioavailability assays.

2. **Developed Draft Standard Operating Procedure (SOP) for the Lead and Arsenic IVBA assay.**
   The existing Lead IVBA assay SOP was modified to include arsenic and to refine method descriptions and reporting requirements.

3. **Initiated Development of a Manuscript Reviewing Available Bioavailability and Bioaccessibility Methods for Arsenic.**
   Developed the first draft of a manuscript reviewing available *in vivo* and *in vitro* methods to assess bioavailability and bioaccessibility of arsenic.

4. **Continued Development of a Round Robin Study to Support the Arsenic IVBA Assay**
   Continued development of a multi-laboratory round-robin study to establish consensus values for the arsenic IVBA assay using several soil reference materials.

5. **Continued Development of a New Flat Creek Reference Soil Material for Lead and Arsenic**
   In collaboration with U.S. Geological Survey (USGS), the TRW Bioavailability Committee continued development of a new soil Reference Material (Flat Creek Soil Reference Material) for lead and arsenic, using material collected from the Flat Creek Iron Mountain Mill and Mine Superfund site in Region 8. The new Reference Material is intended to replace the depleted National Institute of Standards and Technology (NIST) Soil Reference Materials (SRMs), and to be used as Quality Control standards in analyses of arsenic and lead levels in soil IVBA assays.

6. **Continued Development of the Report for the Round Robin Study of New Flat Creek Soil Reference Material for Lead and Arsenic**
   Continued development of the draft report on a multi-laboratory round robin analysis of the new Flat Creek Soil Reference Material to establish consensus values for lead IVBA and for lead and arsenic concentrations analyzed using EPA Method 3051A (microwave extraction). To be posted on the TRW Bioavailability Committee website.

7. **Continued Manuscript Development: "Development and Analysis of a New Soil Reference Material for Lead and Arsenic"**
   Continued progress of a manuscript on the development and analysis of the new Flat Creek 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) Superfund site in Region 8.

8. **Developed Mouse Assay for Lead Bioavailability**
   Developed mouse assay to estimate the relative bioavailability of soil lead in the mouse model assay. Estimates of relative bioavailabilities derived from mouse compared favorably with those obtained in juvenile swine. The mouse model is an efficient and inexpensive method to obtain estimates of relative bioavailability of soil Pb.

9. **Completed Evaluation of Bioavailability/Bioaccessibility of Other Metals**
   Conducted a survey of EPA regions to determine the need to evaluate bioavailability/ bioaccessibility methods of other metals (e.g., other than lead and arsenic). Based on responses, method development for bioavailability and/or bioaccessibility of other metals will not be undertaken at this time.

Communication, Training, and Outreach

1. ***Hotline.*** The TRW Bioavailability Committee responds to questions from inquiries made either by telephone to the TRW Bioavailability Committee hotline (toll-free 1-866-282-8622) or via bahelp@epa.gov. The TRW Bioavailability Committee responded to four requests for assistance in 2016. Of these calls, two were from a federal agency, one was from a state agency, and one was from outside the U.S. (Canada).

2. ***Community Outreach.*** Collaborated with the University of North Carolina and the University of Arizona to develop community outreach materials and presentations on bioavailability.

3. ***TRW Bioavailability Committee Annual Meeting.*** Held October 17-19, 2015, at EPA Potomac Yard, Arlington, VA. Members of the TRW Bioavailability Committee met to work on projects and plan activities for 2017.

4. ***Presentations/Reports/Publications/Training:***
   a. Assessment of Arsenic Speciation and Bioaccessibility in Mine-impacted Materials. C.J. Ollson, E. Smith, K.G. Scheckel, A.R. Betts, and A.L. Juhasz. 2016. J. Haz. Mater. 313: 130-137.
   b. Predicting Oral Relative Bioavailability of Arsenic in Soil from In Vitro Bioaccessibility. G.L. Diamond, K.D. Bradham, W.J. Brattin, M. Burgess, S. Griffin, C.A. Hawkins, A.L. Juhasz, J.M. Klotzbach, C. Nelson, Y.W. Lowney, K.G. Scheckel, and D.J. Thomas. 2016. J. Toxic. Environ. Health Part A. 79(4): 165-173.

c. Bioaccessibility Tests Accurately Estimate Bioavailability of Lead to Quail. W.N. Beyer, NT. Basta, RL Chaney, P.F.P. Henry, D. Mosby, B.A. Rattner, K.G. Scheckel, D. Sprague, and J. Weber. 2016. Environ. Toxicol. Chem. Available Online.
d. Phosphorus Amendment Efficacy for In Situ Remediation of Soil Lead Depends on the Bioaccessible Method. J.F. Obrycki, N.T. Basta, K. G. Scheckel, B.N. Stevens, and K.K. Minca. 2016. J. Environ. Qual. 45: 37-44.
e. Temporal and Seasonal Variations of As, Cd and Pb Atmospheric Deposition Flux in the Vicinity of Lead Smelters in Jiyuan, China. 2016. K. Qiu, W. Xing, K.G. Scheckel, Y. Cheng, Z. Zhao, X. Ruan, L. Li. 2016. Atmos. Pollut. Res. 7: 170-179.
f. In-situ Fixation of Metal(loid) Contaminated Soils: A Comparison of Conventional, By-product and Engineered Soil Amendments. E. Mele, E. Donner, A.L. Juhasz, G. Brunetti, E. Smith, P. Castaldi, S. Deiana, K.G. Scheckel, and E. Lombi. 2015. Environ. Sci. Technol. 49 (22): 13501-13509.
g. Influence of Amendments on *Sedum plumbizincicola* Phytoextraction of Metals from a Lead-smelting Polluted Calcareous Soil. L. Li, H. Tian, Y. Lu, H. Zhang, L. Wu, K.G. Scheckel, and W. Xing. 2015. Acta Sci. Circum. 6: 1858-1865.
h. Bioavailability-Based In Situ Remediation To Meet Future Lead (Pb) Standards in Urban Soils and Gardens. H. Henry, M.F. Naujokas, C. Attanayake, N.T. Basta, Z. Cheng, G.M. Hettiarachchi, M. Maddaloni, C. Schadt, and K.G. Scheckel. 2015. Environ. Sci. Technol. 49: 8948-8958.
i. Use of Bioavailability Data for Soil-Borne Arsenic to Refine Site-Specific Risk Assessments: USEPA Perspective. K.G. Scheckel and M. Maddaloni. Toxicology and Risk Assessment Conference, West Chester, OH, 2016.
j. Human Health Impacts of Metal Contaminated Soils. K.G. Scheckel. Australian Society of Soil Science, Adelaide, Australia, 2015.
k. Correlating Arsenic (As) and Iron (Fe) Speciation to As Bioavailability from a Collection of Contaminated Soils with Varying Contamination Sources and Soil Properties. A.R. Betts, B. Stevens, N.T. Basta, and K.G. Scheckel. Annual Meeting of the Soil Science Society of America, Minneapolis, MN, 2015.
l. Point of Zero Charge: Role in Pyromorphite Formation and Stability in Lead Contaminated Soils. R.R. Karna and K.G. Scheckel. Scheckel. Annual Meeting of the Soil Science Society of America, Minneapolis, MN, 2015.
m. Lead Stabilization and Arsenic Mobilization by Phosphate and Alternative Amendments: Implications on Urban Soil Remediation and Urban Agriculture. Z. Cheng, A. Paltseva, M. Maddaloni, and K.G. Scheckel. Geological Society of America, Baltimore, MD, 2015.
n. Lead stabilization and arsenic mobilization by P-bearing amendments: laboratory and field observations. Z. Cheng, M. Maddaloni, K.G. Scheckel, Z. Garcia, and A. Paltseva. AEHS 31st Annual International Conference on Soils, Sediments, Water, and Energy, Amherst, MA, 2015.
o. Role of complex organic arsenicals in food in aggregate exposure to arsenic. Thomas, D.J., Bradham, K. J. Environ. Sci. (2016), http://dx.doi.org/10.1016/j.jes.2016.06.005

p. Estimating relative bioavailability of soil lead in the mouse. Karen D. Bradham, William Green, Hunter Hayes, Clay Nelson, Pradeep Alava, John Misenheimer, Gary L. Diamond, William C. Thayer, David J. Thomas. Journal of Toxicology and Environmental Health, Part A, 2016. DOI: 10.1080/15287394.2016.1221789.
q. In vitro bioaccessibility method for prediction of relative bioavailability of arsenic in contaminated soils. Karen Bradham, Clay Nelson, Albert Juhasz, Euan Smith, Kirk Scheckel, David Thomas. 2016 International Symposium on Environment and Health, August, Galway.
r. Evaluating the All-Ages Lead Model using Site-Specific Data: Approaches and Challenges. ED McLanahan, L Wilder, D Jackson, K Scruton, D Mellard, K Bradham, RR Worley. Presentation at Society of Toxicology, New Orleans, March 2016.
s. Estimating Lead Bioavailability in a Mouse Model. Thomas, David; Green, William; Hayes, Hunter; Alava, Pradeep; Bradham, Karen; Nelson, Clay; Misenheimer, John. Presented at Society of Toxicology, New Orleans, March 2016.

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

1. **USGS:** Continued collaboration for the development and analysis of a new lead and arsenic soil Reference Material.

2. **EPA Region 9:** Collaboration with ORD-RTP and ORD NHEERL-RTP to provide support on Reviewed Arsenic Bioavailability IR Site 22 – Former Naval Weapons Station Seal Beach Detachment Concord (Concord, CA).

3. **California Department of Toxic Substances Control:** Reviewed and commented on the report, "Arsenic Characterization/Bioavailability on Mine-Scarred Lands (Study)". This report escribes methods and results of a study that was initiated to *determine the range of arsenic bioavailability that may exist in contaminated soil at former mine sites, and to develop better methods for determining the human health effects caused by exposure to arsenic at mine sites, calculating health risk, and developing health based cleanup goals for arsenic.*

4. **Texas Commission on Environmental Quality (TCEQ):** Reviewed and commented on (1) Draft Final Polycyclic Aromatic Hydrocarbon (PAH) Bioavailability Pilot Study Report, Former Foster Air Force Base, Skeet Range", and (2) "Final PAH Bioavailability Pilot Study Report".

5. **Interstate Technology & Regulatory Council (ITRC):** Bioavailability in Contaminated Soil Team – Several members of the TRW are participating on an ITRC workgroup that is developing guidance documents and internet-based training on bioavailability of lead, arsenic and PAHs in soil.