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| **Supporting Information** Gary L. Diamond1, Karen D. Bradham2, William J. Brattin1, Michele Burgess3, Susan Griffin4, Cheryl A. Hawkins3, Albert L. Juhasz5, Julie M. Klotzbach1, Clay Nelson2, Yvette W. Lowney6, Kirk Scheckel7, David J. Thomas81SRC, Inc., North Syracuse, New York, USA2U.S. Environmental Protection Agency, Office of Research and Development, National Exposure Research Laboratory, Research Triangle Park, North Carolina, USA3U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, Science Policy Branch, Washington DC, USA4U.S. Environmental Protection Agency, Denver, Colorado, USA5Centre for Environmental Risk Assessment and Remediation, University of South Australia, Adelaide, South Australia, Australia6Exponent, Inc., Boulder, Colorado, USA7U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Cincinnati, Ohio, USA8U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Research Triangle Park, North Carolina, USABrief descriptions of *in vivo* RBA assay methods, IVBA and RBA estimates and soil arsenic concentrations for all soil samples considered in this analysis (Table S-1), regression models for data from each laboratory (Figures S-1–S-3). This material is available free of charge via Internet at http://pubs.acs.org.*In vivo RBA Assay Methods*. *In vivo* RBA assays in mice were performed as reported in Bradham et al. (2011, referred to in this report as the *mouse UEF assay*). In brief, female C57BL/6 mice, 4 to 6 weeks of age, were housed in metabolic cages (three mice per cage) allowing collection of urine and feces. The Institutional Animal Care and Use Committee of the U.S. EPA National Health and Environmental Effects Research Laboratory approved the protocol for mouse use, which assured humane treatment and alleviation of suffering. Mice were maintained on a low-arsenic basal diet (AIN-93G) that had an arsenic concentration of <1 ppm, which contributed negligible levels of arsenic in urine. Groups of 12 mice were fed a diet amended with either sodium arsenate or the test soil, for a period of ten days, during which urine and feces were collected daily and food consumption was measured daily. Each group of mice was fed a single arsenic dose level. RBA of arsenic in soil was calculated as the ratio of urinary excretion fractions (UEF) in animals that ingested arsenic in soil or sodium arsenate, where UEF was the ratio of the cumulative urinary arsenic excretion (µg per 10 days) and the cumulative dietary arsenic intake (µg per 10 days, Equations S1 and S2).$UEF=\frac{Cum Urinary As}{Cum As Dose}$ Eq. (S1) $RBA=100 ∙\frac{UEF\_{Soil}}{UEF\_{NaAsO\_{4}}}$ Eq. (S2)*In vivo* RBA assays reported in Brattin et al. (2013) were performed as described in Brattin and Casteel (2013, referred to in this report as the *swine UEF assay*). In brief, male juvenile swine were housed in individual stainless steel cages that enabled collection of urine. Swine had free access to water and were fed a diet having an arsenic concentration of <1 ppm. Groups of swine (5–7 weeks of age, 7–12 kg) received repeated daily doses of arsenic in soil or sodium arsenate for a period of 14 days. The doses were delivered in a dough ball (approximately 5 g of moist feed), twice daily, 2 hours before each feeding. Three dose levels of arsenic as sodium arsenate and 2 or 3 dose levels of soil arsenic were administered (4–5 animals per dose group), with doses selected to achieve similar ranges for soil arsenic and sodium arsenate. Periodic 48‑hour urine collections were made during the dosing period. RBA of arsenic in soil was calculated as the ratio of UEF in animals that ingested arsenic in soil or sodium arsenate (Equation S2). UEF was estimated by regression analysis using simultaneous weighted regression of arsenic mass excreted vs arsenic mass administered. This automatically incorporates all the data and adjusts for a non-zero value in control animals.*In vivo* RBA assays reported in Juhasz et al. (2009, 2014a) were performed as described in Rees et al. (2009, referred to in this report as the *swine AUC assay*). In brief, juvenile female swine were surgically prepared with indwelling jugular vein catheters. Each of three pigs were administered a single oral gavage dose of sodium arsenate solution or an aqueous suspension of soil at different times (i.e., each pig served as its own reference). Blood samples were collected over a 26-hour period following dosing. RBA of arsenic in soil was calculated as the ratio of dose (µg)-adjusted area under the curve (AUC) of the arsenic concentration in plasma (µg hr/L) in animals that ingested arsenic in soil or sodium arsenate (Equation S3):$RBA (\%)=100∙\frac{AUC\_{Soil}}{AUC\_{NaAsO\_{4}}}∙\frac{Dose\_{NaAsO\_{4}}}{Dose\_{Soil}}$ Eq. (S3)(1) Bradham, K. D.; Scheckel, K. G.; Nelson, C. M.; Seales, P. E.; Lee, G. E.; Hughes, M. F.; Miller, B. W.; Yeow, A.; Gilmore, T.; Serda, S. M.; Harper, S.; Thomas, D. J. Relative bioavailability and bioaccessibility and speciation of arsenic in contaminated soils. *Environ. Health Persp*. **2011**, *119*, 1629–1634(3) Brattin, W.; Casteel, S. Measurement of arsenic relative bioavailability in swine. *J. Toxicol. Environ. Health A*. **2013**, *76* , 449–457.(2) Brattin, W.; Drexler, J.; Lowney, Y.; Griffin, S.; Diamond, G.; Woodbury, L. An *in vitro* method for estimation of arsenic relative bioavailability in Soil. *J. Toxicol. Environ. Health A*. **2013**, *76* : 458–478.(4) Juhasz, A. L.; Weber, J.; Smith, E.; Naidu, R.; Rees, M.; Rofe, A.; Kuchel, T.; Sansom, L. Assessment of four commonly employed *in vitro* arsenic bioaccessibility assays for predicting in vivo relative arsenic bioavailability in contaminated soils. *Environ. Sci. Technol.* **2009**, *43*, 9487–9494.(5) Juhasz, A. L.; Herde, P.; Herde, C.; Boland, J.; Smith, E. Validation of the predictive capabilities of the Sbrc-G in vitro assay for estimating arsenic relative bioavailability in contaminated soils. *Environ. Sci. Technol*. **2014a**, *48*, 12962–12969.(6) Juhasz, A.L.; Smith, E.; Nelson, C.; Thomas, D. J.; Bradham, K. Variability associated with As in vivo-in vitro correlations when using different bioaccessibility methodologies. *Environ. Sci. Technol*. **2014b**, *48*, 11646–11653.(7) Rees, M.; Sansom, L.; Rofe, A.; Juhasz, A. L.; Smith, E.; Weber, J.; Naidu, R.; Kuchel, T. Principles and application of an in vivo swine assay for the determination of arsenic bioavailability in contaminated matrices. *Environ. Geochem. Health*. **2009**, *31*, 167–177.**Table S-1. Data Used for Meta-analysis of IVBA Assay for Predicting oral RBA of Arsenic** |
| ID | As Source | Soil As | IVBA | IVBA SD | RBA  | RBA SE | RBA Assay |
|   |   | (ppm) | (%) | (%) | (%) | (%) |   |
| 1 | Mining/smelting | 676 | 13.0 | 0.7 | 38.1 | 1.6 | Swine UEF |
| 2 | Mining/smelting | 313 | 32.5 | 1.6 | 52.4 | 2.0 | Swine UEF |
| 3 | Pesticide (orchard) | 290 | 21.0 | 1.1 | 31.0 | 4.0 | Swine UEF |
| 4 | Pesticide (orchard) | 388 | 18.6 | 0.9 | 40.8 | 1.8 | Swine UEF |
| 5 | Pesticide (orchard) | 382 | 19.4 | 0.4 | 48.7 | 4.7 | Swine UEF |
| 6 | Pesticide (orchard) | 364 | 30.6 | 1.5 | 52.8 | 2.3 | Swine UEF |
| 7 | Mining/smelting | 234 | 8.8 | 0.3 | 17.8 | 3.2 | Swine UEF |
| 8 | Mining/smelting | 367 | 6.0 | 0.3 | 23.6 | 2.4 | Swine UEF |
| 9 | Mining/smelting | 181 | 50.4 | 2.5 | 50.7 | 5.9 | Swine UEF |
| 10 | Mining | 200 | 78.0 | 3.9 | 60.2 | 2.7 | Swine UEF |
| 11 | Mining | 3957 | 11.0 | 0.6 | 18.6 | 0.9 | Swine UEF |
| 12 | Mining/smelting | 590 | 55.1 | 2.8 | 44.1 | 2.3 | Swine UEF |
| 13 | Mining/smelting | 1400 | 42.2 | 0.6 | 41.8 | 1.4 | Swine UEF |
| 14 | Mining/smelting | 312 | 41.8 | 2.1 | 40.3 | 3.6 | Swine UEF |
| 15 | Mining/smelting | 983 | 33.2 | 1.7 | 42.2 | 3.8 | Swine UEF |
| 16 | Mining/smelting | 390 | 40.3 | 0.7 | 36.7 | 3.3 | Swine UEF |
| 17 | Mining/smelting | 813 | 22.0 | 1.1 | 23.8 | 2.4 | Swine UEF |
| 18 | Mining/smelting | 368 | 18.7 | 0.9 | 21.2 | 2.1 | Swine UEF |
| 19 | Mining/smelting | 516 | 18.6 | 0.9 | 23.5 | 2.6 | Swine UEF |
| 20 | Herbicide (railway corridor) | 267 | 57.3 | 2.2 | 72.2 | 19.9 | Swine AUC |
| 21 | Herbicide (railway corridor) | 42 | 42.7 | 0.8 | 41.6 | 6.6 | Swine AUC |
| 22 | Herbicide (railway corridor) | 1114 | 17.2 | 0.4 | 20.0 | 9.5 | Swine AUC |
| 23 | Herbicide (railway corridor) | 257 | 10.5 | 0.1 | 10.1 | 2.5 | Swine AUC |
| 24 | Herbicide (railway corridor) | 751 | 22.2 | 0.0 | 22.5 | 2.2 | Swine AUC |
| 25 | Herbicide (railway corridor) | 91 | 80.0 | 0.3 | 80.5 | 6.9 | Swine AUC |
| 26 | Pesticide (dip site) | 713 | 17.8 | 0.1 | 29.3 | 8.7 | Swine AUC |
| 27 | Pesticide (dip site) | 228 | 55.4 | 0.6 | 43.8 | 5.6 | Swine AUC |
| 28 | Mining | 807 | 40.0 | 0.1 | 41.7 | 4.4 | Swine AUC |
| 29 | Mining | 577 | 3.8 | 0.0 | 7.0 | 2.9 | Swine AUC |
| 30 | Gossan | 190 | 19.0 | 0.2 | 16.4 | 5.2 | Swine AUC |
| 31 | Gossan | 88 | 14.0 | 0.2 | 12.1 | 4.9 | Swine AUC |
| 32 | Pesticide | 275 | 5.7 | 0.2 | 10.8 | 0.7 | Swine AUC |
| 33 | Pesticide | 210 | 7.7 | 0.4 | 12.9 | 1.2 | Swine AUC |
| 34 | Pesticide | 81 | 41.7 | 1.1 | 6.8 | 1.2 | Swine AUC |
| 35 | Pesticide | 358 | 6.5 | 0.1 | 10.1 | 3.5 | Swine AUC |
| 36 | Pesticide | 200 | 13.1 | 0.3 | 10.9 | 3.9 | Swine AUC |
| 37 | Pesticide | 215 | 7.2 | 0.2 | 18.2 | 3.8 | Swine AUC |
| 38 | Pesticide | 981 | 9.7 | 0.2 | 16.4 | 3.6 | Swine AUC |
| 39 | Pesticide | 1221 | 15.1 | 0.6 | 15.7 | 1.9 | Swine AUC |
| 40 | Mining | 949 | 52.9 | 0.1 | 45.8 | 2.6 | Swine AUC |
| 41 | Mining | 1126 | 36.9 | 1.1 | 30.7 | 4.1 | Swine AUC |
| 42 | Mining | 1695 | 38.1 | 1.3 | 27.5 | 0.7 | Swine AUC |
| 43 | Mining | 1306 | 78.4 | 0.4 | 70.5 | 6.8 | Swine AUC |
| 44 | Mining | 2270 | 43.5 | 3.4 | 36.2 | 1.5 | Swine AUC |
| 45 | Mining | 244 | 18.1 | 0.40 | 15.5 | 1.3 | Mouse UEF |
| 46 | Mining | 173 | 6.8 | 0.80 | 14.1 | 1.2 | Mouse UEF |
| 47 | Mining | 6899 | 17.5 | 0.60 | 14.7 | 1.0 | Mouse UEF |
| 48 | Mining | 280 | 53.6 | 0.20 | 39.9 | 1.7 | Mouse UEF |
| 49 | Mining | 4495 | 8.8 | 0.10 | 14.5 | 1.6 | Mouse UEF |
| 50 | Mining | 448 | 22.8 | 0.6 | 17.2 | 0.5 | Mouse UEF |
| 51 | Mining | 195 | 25.7 | 3.4 | 18.8 | 2.7 | Mouse UEF |
| 52 | Mining/smelting | 837 | 18.2 | 2.70 | 11.2 | 0.3 | Mouse UEF |
| 53 | Mining/smelting | 182 | 32.9 | 0.20 | 26.7 | 1.8 | Mouse UEF |
| 54 | Mining/smelting | 990 | 73.1 | 0.60 | 48.7 | 2.4 | Mouse UEF |
| 55 | Mining/smelting | 829 | 74.3 | 1.30 | 49.7 | 2.1 | Mouse UEF |
| 56 | Mining/smelting | 379 | 53.2 | 0.50 | 51.6 | 2.1 | Mouse UEF |
| 57 | Pesticide (orchard) | 322 | 18.8 | 0.30 | 26.3 | 1.4 | Mouse UEF |
| 58 | Pesticide (orchard) | 462 | 16.1 | 0.40 | 35.2 | 2.0 | Mouse UEF |
| 59 | Pesticide (orchard) | 401 | 18.0 | 0.20 | 20.9 | 2.2 | Mouse UEF |
| 60 | Pesticide (orchard) | 422 | 27.9 | 0.80 | 35.0 | 1.8 | Mouse UEF |
| 61 | Pesticide (orchard) | 340 | 35.4 | 1.90 | 33.2 | 2.4 | Mouse UEF |
| 62 | Pesticide (orchard) | 396 | 48.1 | 0.80 | 46.4 | 1.4 | Mouse UEF |
| 63 | Pesticide (dip site) | 965 | 9.0 | 0.40 | 21.7 | 1.5 | Mouse UEF |
| 64 | Pesticide (dip site) | 313 | 36.4 | 1.30 | 29.1 | 1.7 | Mouse UEF |
| 65 | Herbicide (railway corridor) | 246 | 47.0 | 2.10 | 45.1 | 2.7 | Mouse UEF |
| 66 | Herbicide (railway corridor) | 108 | 27.0 | 0.80 | 23.8 | 1.9 | Mouse UEF |
| 67 | Herbicide (railway corridor) | 184 | 11.9 | 0.20 | 23.0 | 1.8 | Mouse UEF |
| 68 | Herbicide (railway corridor) | 981 | 54.3 | 2.50 | 36.3 | 1.3 | Mouse UEF |
| 69 | Mining | 573 | 3.5 | 0.30 | 6.4 | 0.3 | Mouse UEF |
| 70 | Mining | 583 | 21.2 | 0.20 | 14.2 | 0.3 | Mouse UEF |
| 71 | Gossan | 239 | 12.3 | 0.70 | 20.4 | 1.9 | Mouse UEF |
| 72 | Mining | 197 | 21.9 | 0.20 | 29.0 | 2.7 | Mouse UEF |
| 73 | Mining | 884 | 16.9 | 0.40 | 23.2 | 3.3 | Mouse UEF |
| 74 | Mining | 293 | 12.3 | 0.30 | 17.9 | 0.7 | Mouse UEF |
| 75 | Mining | 223 | 17.3 | 0.10 | 19.8 | 1.9 | Mouse UEF |
| 76 | Mining | 494 | 15.5 | 0.10 | 18.0 | 1.8 | Mouse UEF |
| 77 | Mining | 738 | 13.4 | 3.50 | 11.2 | 0.9 | Mouse UEF |
| 78 | Mining | 777 | 0.0 | 0.00 | 4.3 | 0.7 | Mouse UEF |
| 79 | Mining | 943 | 0.1 | 0.00 | 3.0 | 0.2 | Mouse UEF |
| 80 | Mining | 898 | 0.1 | 0.00 | 1.9 | 0.2 | Mouse UEF |
| 81 | Mining | 668 | 0.0 | 0.00 | 3.6 | 0.3 | Mouse UEF |
| 82 | Mining/smelting (SRM) | 601 | 54.0 | 4.10 | 42.9 | 1.2 | Mouse UEF |
| 83 | Mining/smelting (SRM) | 1513 | 41.8 | 1.70 | 42.1 | 1.1 | Mouse UEF |
| 84 | Mining/smelting (SRM) | 879 | 14.5 | 0.20 | 14.6 | 0.8 | Mouse UEF |
| As, arsenic; AUC, area under the curve; ID, sample identification number; IVBA, *in vitro* bioaccessibility; RBA, relative bioavailability; SD, standard deviation; SE, standard error; SRM, standard reference material; UEF, urinary excretion fraction |



Figure S-1. Ordinary least squares linear regression model for data from Laboratory A (n=40; RBA estimated with mouse UEF assay; Bradham et al 2011).



Figure S-2. Ordinary least squares linear regression model for data from Laboratory B (n-19; RBA estimated with swine UEF assay; Brattin and Casteel, 2013).



Figure S-3. Ordinary least squares linear regression model for data from Laboratory C (n=24; RBA estimated with swine AUC assay; Rees et al. 2009). The data point labeled *outlier* was not used in fitting the regression model.