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Appendix A: Detailed Survey Responses

Table A-1. Responses from state risk assessors (October 2015)

State	Response	Additional Information
Alaska	No currently we assume 100 %. However, we are in the process of updating our risk assessment and will allow the default of 60% for arsenic in soil and the associated default for lead used in the IEUBK model.	
Alaska	For human health with soil ingestion, the site-specific application of quantitative bioavailability adjustments in risk assessments is not recommended. A default value of 100% is recommended for all chemicals except arsenic and lead in soil for the baseline risk assessment. A default of 60% for arsenic (USEPA 2010) and the default value used in the Integrated Exposure Uptake Biokinetic (IEUBK) model (EPA, 2009a) for lead in soil is recommended. For lead if alternate bioavailability values are proposed (based either on in vivo studies, blood lead studies, or other studies) for use in the IEUBK model or the Adult model, the proposed values must be submitted to ADEC and the Technical Review Workgroup (TRW) for review. For ecological screening-level risk assessment bioavailability = 100% as a default. Alteration of default exposure assumptions may be appropriate in a baseline risk assessment with ADEC approval. References associated with the above. USEPA (2012) Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil. OSWER #9200.1-113. Washington, D.C.: United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. https://semspub.epa.gov/work/HQ/175338.pdf. USEPA. (2009a June). Integrated Exposure Uptake Biokinetic Model for Lead in Children Version 1.1, build 264. Retrieved from https://www.epa.gov/system/files/other-files/2023-07/IEUBKwin%202%20Build1.72.msi.	The information is in our Risk Assessment Procedural Manual which is adopted in regulation.
California	Yes, California does allow the use of bioavailability of contaminants in soil to be applied to risk assessments in certain cases. For lead there is a bioavailability factor included in our LeadSpread model that is used to model blood lead levels based off source specific contributions of lead. For Arsenic, we do allow the use of USEPAs default bioavailability of 60% to be applied to risk assessments. I know of at least one other site in California where the bioavailability of other metal alloys is being evaluated. The same protocol that was used in our Brownfield grant has been employed on that site.	DTSC received a $900,000, 5-year grant from USEPA Brownfield to evaluate the bioavailability of arsenic in mining soils. Two one-year no cost extensions were granted and we are just wrapping up the grant now. This grant was used to help develop affordable bench top methods for evaluating arsenic in mining soils. As a result of this work I am currently working on a guidance document for DTSC to be used in the State of California on measuring and applying bioavailability of arsenic in soils to risk assessments. Historically we have not allowed the application of in vitro methods to make risk based decisions and have required in vivo (swine) data before making adjustments to risk based on bioavailability. It is my goal that with the completion of this grant and the development of the guidance document, we will have an approved in vitro method that we will allow to be used in the place of in vivo data for arsenic.
California Department of Toxic Substances Control	I am a risk assessor in California. We do not have any bioavailability guidance. We have been working on state specific arsenic oral bioavailability testing to come up with our own arsenic oral bioavailability values. I am working on a site where site specific oral bioavailability testing is being planned for cobalt and nickel in dust from metal alloy grinding operations. I don't think we have a policy. I think its site specific but we don't do it without a lot of support. ITRC has a team working on it, I thought.	

State	Response	Additional Information
Georgia	Yes, but only for human health risk evaluations and on a site-specific basis contingent upon the amount of well-supported and credible data provided. The default RBA of 0.6 has been considered acceptable for arsenic since its adoption in the EPA's RSL table even though not prescribed in our current RCRA guidance. This is based on arsenic absorbed from ingested soil compared to the fraction absorbed from the water-borne arsenic in the human epidemiological studies used to develop the toxicity studies. Our guidance is in the process of being updated to reflect this. We also acknowledge the default RBA of 0.6 used in the IEUBK model and the latest version of EPA's ALM (2009) uses an absorption fraction for soil of 0.12, which is based on the lead default RBA multiplied by the absorption of lead of 0.2. For ecological risk assessments, we currently only recommend assuming 100% bioavailability. However, we have noted that Region 4 EPA allows the use of default RBAs for lead and arsenic in the BERA for incidental ingestion of arsenic and lead from soil, but not for lead and arsenic that is ingested as part of the diet. Georgia has not yet issued guidance on bioavailability, but is in the process of updating its risk assessment guidance to clarify our current stance on bioavailability.	
Kentucky	Have you used bioavailability or relative bioavailability (RBA) of contaminants in your soil risk assessment? No, with the possible exception of lead. The adult lead model uses an absorption factor of 0.1. No on the 2nd question.	
Massachusetts	We have allowed a relative bioavailability (RBA) approach at one site in Massachusetts for human health risks related to arsenic soil exposures. We do not have a formal policy for RBA. For this one site we applied USEPA methods and adapted them for this site. As a conservative measure we used the maximum value of the bioavailability distribution for data collected at the site as the exposure point concentration.	
Michigan	Briefly, two pilot studies were conducted with soils from Midland and the Tittabawassee River floodplain. Bioavailability was measured by analyzing liver and adipose tissue from rats and juvenile swine fed soil, corn oil gavage, and feed (rats only) after daily dosing for 30 days. Since there is not a preferred animal model, the values used were averaged between rats and swine. Relative bioavailability from soil fed animals to corn oil gavage animals was used for the noncancer criterion (RfD PBPK model uses human corn oil uptake values). For cancer risk, we used relative bioavailability based on soil to feed, since the cancer slope factor was from a rodent feed dosing bioassay.	There are several other complicating factors that can be discussed, if the team wants more details.
Michigan	Michigan DEQ used the IEUBK model which include a default value for bioavailability of lead in soil, in developing the direct contact criteria for lead. MDEQ has allowed the use of site-specific RBA for arsenic or in vivo BA for dioxin.	No state guidance or policy; however, MDEQ uses EPA guidance on bioavailability or RBA.
Missouri	Yes, bioavailability has been used in soil risk assessments prepared by EPA on Superfund sites in Missouri (and reviewed by Missouri DNR and DHSS).	No state guidance or policy.
Montana	Montana uses RBA for lead and arsenic and we use EPA guidance. If it were proposed for other contaminants, we would consider it.	

State	Response	Additional Information
NY State	Depending upon the purpose of the evaluation and the amount and quality of information available to us, we would either implement a generic approach, or tailor the evaluation as warranted and supportable. An example of a more generic approach is that taken in the setting of the soil cleanup objectives for New York State (which are used to help guide remedial decisions for contaminated sites on a statewide basis), where we have assumed that soil contaminants are 100% bioavailable. We judged that in light of limited data on how many factors could change bioavailability, we could not assign a single value that could be applicable statewide. As stated in our technical support document (found at http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf): "A metal's solubility or its potential to become soluble if conditions change depends on many factors associated with the metal form, particle size, weathering, and soil chemistry (NRC, 2003; Ruby et al. 1999). Another important factor is the likelihood of disturbances that would alter the soil conditions that determine solubility and bioavailability (Ruby et al. 1999). There are limited data on how these factors vary with metals and soils and how these changes affect solubility and bioavailability. The missing data preclude accurate estimates of bioavailability of metals ingested with soils. Consequently, it is typically assumed that the bioavailability of a metal ingested in a soil matrix is the same as the bioavailability of the metal ingested in the studies used to determine the toxicity value." References: 1) NRC (National Research Council). 2003. Bioavailability of Contaminants in Soils and Sediments: Processes, Tools and Applications. Washington, DC: National Academy Press. 2) Ruby MV, Schoof R, Brattin W, et al. 1999. Advances in Evaluating the Oral Bioavailability of Inorganics in Soil for Use in Human Health Risk Assessment. Environ. Sci. Tech. 33(21):3697-3705).	That being said, there are instances in which we would consider site-specific evaluations of bioavailability of specific contaminants in soil as a part of the overall evaluation of risk and remedial alternatives at specific sites. We would look at the nature and quality of the studies supporting lower values, as well as their relevance to the specific nature of any hypothesized potential exposure scenarios, the presence or absence of institutional controls and their relevance to ensuring the assumed chemical form tied to the lower bioavailability factor will persist indefinitely, etc. In addition, our effort might be less involved in instances where bioavailability adjustments are made moot by other considerations. For example, private sector assessors have often advocated using values around 20% for evaluating exposures and risks associated with arsenic at their clients' sites, and the EPA has a default relative bioavailability value of 60%. However, bioavailability arguments for arsenic are often not a major factor in our risk management decisions at arsenic sites. This is because of the magnitude of the EPA cancer potency factor for arsenic, and because our legislative mandate that requires us to set our soil cleanup objectives at a cancer risk of one in one million. Consequently, any reasonable risk assessment (whether it uses bioavailability adjustments or not), will arrive at a health based soil level below typical arsenic background levels. So in cases such as these, the final SCO is based on background.
Oklahoma	Ref your question on bioavailability, although it is not common for us to run into this issue, we can look at bioavailability on a site specific basis, but it needs to be well supported. On metals we would normally want more information on the form of a metal. (arsenic trioxide vs lead arsenate, or some other form etc.) We do not have specific guidance on this issue. We could consider relevant studies. For example, in the past, some decisions were made on smelter waste based on relevant or site specific in vivo bioavailability studies on pigs.	
Oregon	On a couple of projects in the Oregon Department of Environmental Quality's Cleanup Program, we used the results of laboratory relative bioavailability studies. In both cases, arsenic was the chemical of interest. We do not have state guidance on RBA, so these studies were done on a site-specific basis.	
Pennsylvania	We don't have specific guidance yet for how to handle bioavailability of contaminants in soil. Generally, what we tell remediators is that they should assume 100% bioavailability unless they can demonstrate a site specific value is more accurate. Remediators can use EPA's default value of 60% but a site specific number using an approved EPA method is preferred.	
Tennessee	I would be very interested in reading about any responses you receive concerning bioavailability of lead in soil.	

State	Response	Additional Information
Utah	We have used site specific lead and arsenic bioavailability estimates in the soil risk assessments for the CERCLA activities. Depending on the RBA the cleanup goals have been selected. Some sites have such high RBA that cleanup levels are lower than the default values.	The State of Utah has not developed guidance and rely on EPA guidance.
Virginia	Bioavailability is not used- except for EPA value for arsenic.	There is no guidance or similar on bioavailability.
Washington State Dep of Ecology	As a matter of general policy, Washington State Department of Ecology assumes 100% bioavailability of contaminants in soil for Ecological Risk Assessments. However, there are some isolated instances where our screening levels for specific contaminants are based off of values where less than 100% is noted (ex: USEPA Ecological Soil Screening Levels). Even so – the values in Ecology screening levels represent soil concentrations that are expected to be protective at any [cleanup] site.	
Washington State Dep of Ecology	For mixtures of dioxins and furans, we allow the use of 60% bioavailability from soil. For lead, where we have set remediation levels using the IEUBK model, the model default of 60% was used. For arsenic, we use 100 % bioavailability for several policy and scientific reasons. Here are some of the technical concerns regarding the accuracy and reproducibility of in vivo test results (some of which also apply to lead bioavailability studies): 1) Uncertainty that the results in animals accurately reflect bioavailability in humans; 2) Compared to humans, there were significant differences in uptake of arsenic in the Roberts' monkey studies; 3) Anatomical differences between the digestive systems of mice and humans; 4) Lack of demonstrated reproducibility. Specifically, each soil was tested in only one pig study; 5) For the same soil, there was often different measured bioavailability among the different animal models; 6) Arsenic dosing. In pigs, bioavailability tended to be inversely related to the arsenic dose (i.e., higher arsenic doses had (mostly) lower bioavailability). The doses per kilogram body weight given to the pigs tended to be higher (70 – 200 times) than those we'd expect children to get at most sites, suggesting that the pig studies may underestimate human bioavailability; 7) Soil dosing. The amount of soil per kilogram body weight in the pig studies tended to be higher than the 12.5 milligrams soil per kilogram body weight (200 mg/day) we assume for children; and 8) For a given soil, there was often substantial variation in arsenic excretion between animals, as well as within a given animal over time. It is unclear whether or how this variability was addressed in the final reported bioavailability values.	