Appendix C-T8. Fish uptake calculation methods and models

Method: Sediment, receptor tissue equilibrium partitioning (EqP) or biota-sediment accumulation factor (BSAF)		
See Appendix C-T5.		
Method: Sediment, diet, water, receptor tissue bioaccumulation factor (BAF)		
Description: Ratio of the concentration in aquatic organism to its concentration in specific media (water, sediment, prey). Bioaccumulation is net uptake and retention of a chemical in an organism from all routes of exposure (diet, dermal, and respiratory) and any source (water, sediment, food) as typically occurs in the natural environment. Measured endpoints include concentration in organism and concentration in water (all sources). It can be conducted in laboratory or field. **Test organisms** include all aquatic and aquatic-dependent wildlife. **References:** USEPA n.d. "ECOTOX," Weisbrod et al. 2007	**Advantages:** Simple estimation tool that can use default USEPA values or develop site-specific factors based on measured tissue and other site media concentrations. Simple and easily performed using spreadsheet functions. **Disadvantages:** BSAFs derived from literature sources do not reflect site-specific conditions. Site-derived BSAFs implicitly assume that all exposures occur within the area under investigation.	**Analyte capability:** All classes of chemicals but especially applicable to divalent cation uptake
Method: Water, receptor tissue bioconcentration factor (BCF)		
Description: Bioconcentration is the process by which a chemical is retained in an aquatic organism following its absorption through respiratory and dermal surfaces from the surrounding water (does not include dietary exposure). Bioconcentration is measured under controlled laboratory conditions. **Measured endpoints** include concentration in organism, concentration (total and dissolved) in water. **Laboratory exposure test organisms** are typically fish, amphibians, and reptiles. **References:** USEPA n.d. "ECOTOX"	**Advantages:** Simple estimation tool that can use default USEPA values or develop site-specific factors based on measured tissue and other site media concentrations. Simple and easily performed using spreadsheet functions. **Disadvantages:** BCFs derived from literature sources may not reflect site specific conditions. Site-derived BCFs implicitly assume that all exposures occur within the area under investigation.	**Analyte capability:** All classes of chemicals
Method: Predator tissue, prey tissue biomagnification factor (BMF)		
See Appendix C-T5.		
Method: Estimation Program Interface (EPI) Suite™		
Description: The EPI Suite is a Windows-based suite of physical/chemical property and environmental fate estimation programs developed by the USEPA Office of Pollution Prevention Toxics and Syracuse Research Corporation. **Website:** www.epa.gov/opptintr/exposure/pubs/episuite.htm	**Advantages:** Facilitated by a database of >40,000 chemicals. **Disadvantages:** A screening-level tool not to be used if acceptable measured values are available.	**Analyte capability:** Screening-level estimates of physical/ chemical and environ-mental fate properties, the building blocks of exposure assessment

Method: Gobas kinetic food web model		
See Appendix C-T5.		
Method: Food web Bioaccumulation and Aquatic System Simulator (BASS)		
See appendix C-T5.		
Method: Food web Spreadsheet For Environmental Risk Assessment For Mercury (SERAFM)		
See Appendix C-T5.		
Method: Tissue/direct tissue residue assessments		
See Appendix C-T5.		
Method: Plasma/direct plasma residue assessments		
See Appendix C-T5.		
Method: Tissue/in situ bioaccumulation studies		
Description: Surrogate receptor organisms are placed at the target site in cages either in contact with or directly above the sediment. After a specified period of time, the organisms are harvested and the tissues analyzed for COCs. **Measured endpoints** include survival, tissue residue, COCs, and lipids. **Test organisms** are benthic organisms, small fish, and clams. **References:** USEPA 2000a	**Advantages:** Site-specific exposures that integrate contaminant uptake over all media. Relatively easy and inexpensive to implement. **Disadvantages:** Surrogate organisms are most often those used in bioassays and may not reflect uptake by site-specific organisms.	**Analyte capability:** All classes of chemicals
Method: Tissue/dietary assimilation efficiencies		
Description: Absorption efficiency represents the net result of absorption and elimination. Feeding studies are designed to estimate absorption efficiency based on accumulated chemical residues. The fraction of the chemical retained in the organisms relative to that ingested is the assimilation efficiency. **Measured endpoints** are COC levels in food and residual in feces. Also may involve measuring chemical levels in target organism tissue, organelles, and developing fetus. **Test organisms** include all, but most typically fish, birds, and mammals. **References:** Erickson et al. 2008	**Advantages:** Most direct measure of how much of a contaminant in food is retained by the target organism. **Disadvantages:** Difficult to adequately capture fish fecal matter. Useful for birds and mammals but can be time- and resource-intensive. Expensive and requires special laboratory procedures and animal husbandry.	**Analyte capability:** All classes of chemicals
Method: Direct tissue residue analysis		
See Appendix C-T5.		