

Capturing Bioavailable Organic Contaminants for Phase II Whole Sediment Toxicity Identification Evaluations

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In Phase I of whole sediment TIEs, causes of toxicity to freshwater and marine organisms are characterized into broad toxicant classes including ammonia, metals and organic chemicals. In the whole sediment Phase I TIEs performed so far, organic chemicals have been shown to be the dominant cause of toxicity while other toxicants are much less important. In Phase II of the TIE, the specific toxicants causing observed toxicity are identified. For ammonia and metals, this process is often not complicated because of the limited number of metals likely to cause toxic effects and because ammonia toxicity is well understood. In contrast, identifying the specific organic chemicals causing toxicity is very complex because of the thousands of compounds that may be present and eliciting adverse effects. Further, adding to the complexity, not all of these organic chemicals are necessarily bioavailable and contributing to observed toxicity. Unlike the effects-directed assay (EDA) process, the TIE approach emphasizes exposing whole organisms in systems emulating environmental conditions including contaminant bioavailability. Currently, a major challenge in whole sediment TIE is the development of exposure techniques for whole organisms that reduce the complex mixtures of organic chemicals potentially causing toxicity into simpler bioavailable components that can be analyzed for identification. In this presentation, the development of an artificial exposure system that captures only the bioavailable organic chemicals will be described. The artificial exposure system uses a combination of whole sediment extraction, passive sampler-based dosing, and whole organism toxicity testing to identify the causes of sediment toxicity. A key to successfully capturing the bioavailable contaminants is to insure the sediment extraction step is sufficiently mild and does not result in over-dosing the toxicity testing organisms. Use of TENAX[®] resin and accelerated solvent extraction (ASE) shows promise for these types of extractions. The approach under-development is intended for use with both targeted legacy and non-target emerging contaminants. This presentation will provide information useful for the development of identification processes for organic chemicals causing toxicity to whole organisms in aquatic environments.