Causes of Sediment Toxicity

OVERVIEW

The Five Year Plan developed by the EEWG for evaluating risks to benthic biota includes a primary focus on determining the causes of toxicity in sediment toxicity tests. Determining the causes of impacts in sediment has been identified as a high priority for the RMP. Sediment toxicity has been observed at a high proportion of RMP sampling locations since the Program began in 1993. Reducing this toxicity depends on determining which pollutants or other factors are responsible. The annual SQO assessments will provide information about sediment condition in the Estuary, but will not identify causes of the observed toxicity or benthic community impacts. This component of the Sediment Plan will investigate causes of observed sediment toxicity and benthic impacts. "Stressor identification" is a key element of the Water Quality Plan for implementation of the SQOs.

One means of stressor identification will be to conduct Toxicity Identification Evaluations (TIEs) on any Status and Trends sediment samples that are sufficiently toxic. Funding for TIEs will come from the RMP contingency fund.

Work on this study in 2009 will continue the development of TIE methods for the estuarine amphipod *Eohaustorius estuarius* begun in 2007.

The EEWG recommended that this work be continued over the next several years, with $150,000 allocated for this work in 2009. The results of this study will be evaluated and, if warranted, another round of the work will be performed in 2011.

CONTINUING INVESTIGATION OF THE CAUSES OF SEDIMENT TOXICITY IN MISSION CREEK

Background

Understanding the cause(s) of sediment toxicity is one of the primary goals of the RMP and to accomplish this, the RMP has employed Toxicity Identification Evaluations. A recent TIE study in Mission Creek (MC) used a combination of procedures to investigate sediment toxicity using the estuarine amphipod *Eohaustorius estuarius*. A combination of whole-sediment and interstitial water TIE procedures provided lines of evidence to suggest that toxicity to amphipods was caused by a mixture of organic chemicals. While the results were promising, they did not provide confirmation of specific chemicals responsible for amphipod mortality. This project is designed to build on the Mission Creek TIE results to determine the specific chemicals causing toxicity at this site. Mission Creek is an appropriate site for exploring causes of sediment toxicity because historical evidence demonstrates this site has been highly toxic for a number of years. In addition, Bay Protection and Toxic Cleanup Program (BPTCP) gradient studies at this site linked laboratory toxicity test results to field surveys showing degraded benthic communities. The intention of the proposed project is to provide evidence of specific chemicals posing ecological risk to benthic organisms (RMP Management Questions 4.1 and 4.2).

Project Approach

The project is designed to build on the recent TIE results in Mission Creek. While a number of whole sediment and interstitial water TIE procedures provided useful lines of evidence, the results suggested these procedures could be improved upon. The proposed new procedures fall into three categories: whole-sediment procedures, interstitial water procedures, and dose-response experiments using key chemicals of concern.

The previous MC whole-sediment TIE results suggested that after a 10d exposure to sediment, the Amberlite resin treatment likely over-estimated the bioavailable fraction of chemicals in MC sediment. Recent studies using Tenax have suggested that a 24 hour equilibration using this resin gives a better approximation of the bioavailable fraction of chemicals in sediment interstitial water. The proposed project will evaluate the relationships between a 24h equilibration of Tenax in MC sediment, toxicity of the Tenax eluate, and chemistry of the eluate and Mission Creek interstitial water. These results will be combined with the other lines of evidence to provide additional information on the bioavailability of contaminants in MC sediment.

Results of the MC interstitial water TIEs were inconclusive because of variability in the effectiveness of the HLB solid-phase extraction columns to remove toxicity, and lack of detection of chemicals in the column eluates. Conversations with USGS chemists familiar with HLB extraction of sediment interstitial water have suggested that column effectiveness may be compromised when chemicals are sorbed to dissolved organic carbon (DOC) in sediment interstitial water, because this interferes with their sorption to the column substrate. As an alternative, we propose using liquid/liquid extraction of MC interstitial water as a Phase I and Phase II TIE approach and to combine this information with more complete analysis of MC interstitial water chemistry.

Evaluation of the MC whole-sediment and interstitial water chemistry was constrained by a lack of information on the toxicity of key constituents to amphipods. We propose conducting whole sediment and water-only dose-response experiments with selected chemicals identified in MC sediment and interstitial water (e.g., chlordane, PBDEs, PAHs) to determine their toxicity to *E. estuarius*.

Proposed project budget: $75,000 for 2009.