Do TIE Laboratory Based Methods Really Reflect Field Conditions? K. T. Ho1, M. L. Gielazyn2 R. M. Burgess1, M.C. Pelletier1, J.R. Serbst1, S.A. Ryba1, M. M. Perron3, M. Cantwell1, Roxanne L. Johnson1, Kenneth Perez1 Deena Wassenberg4, Richard Di Giulio4. 1 US EPA Atlantic Ecology Division, Narragansett, RI 02882. 2 NOAAc/o USEPA, Region IV, Waste Management Division, Atlanta, GA 30303. 3 University of Rhode Island Kingston, RI 02881. 4Duke University, Durham, NC 90328

Abstract

Sediment Toxicity Identification and Evaluation (TIE) methods have been developed for both interstitial waters and whole sediments. These relatively simple laboratory methods are designed to identify specific toxicants or classes of toxicants in sediments; however, the question of whether the same toxicant identified in the laboratory is causing effects in the field remains unanswered. In this study we used a number of different methods in a weight-of evidence approach to determine if laboratory TIE methods accurately predict field effects. Previously reported data from a TIE performed on sediments collected from the Elizabeth River (VA) identified PAHs as the major toxicant. Several lines of evidence indicated PAHs were the major toxic agents in the field as well. Concentrations of PAHs in Elizabeth River sediment were elevated relative to a nearby reference site. Chemical analyses of exposed bivalves indicate PAHs occurred in high concentrations in the bivalve tissue; concentrations of PCBs, another potential toxicant, were below detection levels in the same tissue. The Comet assay, which measures DNA damage and is sensitive to PAHs, indicated adverse effects in caged bivalves in the Elizabeth River relative to those from a reference site. In addition, Fundulus heteroclitus exposed to extracts of Elizabeth River sediment responded similarly to fish exposed to PAH model compounds and differently from fish exposed to PCB model compounds. Our final line of evidence was the response of benthic organisms exposed to Elizabeth River sediments and then exposed to ultraviolet (UV) radiation. UV radiation causes a toxic diagnostic response unique to PAHs. The aggregation of these various lines of evidence supports the conclusion that PAHs are active in both laboratory and field exposed organisms and that laboratory based TIE methods reflect field conditions.

TIE, sediment, Elizabeth River, field validation, identification