SETAC Europe 26th Annual Meeting - May 22-26, 2016

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Advancing the use of passive sampling in risk assessment and management of contaminated sediments: Results of an international passive sampling ring test

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Abstract

It is widely-accepted that not the total (solvent-extractable), but only the bioavailable concentration of hydrophobic organic contaminants in sediments is available for uptake in organisms and responsible for any subsequent effects. In view of proper risk assessment and management of contaminated sediments, several methods for assessing bioavailable concentrations have therefore been developed and are being used, mostly however within the scientific community. Among these methods, passive sampling methods (determining freely dissolved concentrations; Cfree) represent the most widely-used and well-characterized approach. In the regulatory community, there is some aversion to implementing these methods in actual risk assessment, as there is no consensus among scientists on which bioavailability method or passive sampling approach to use best and the variability associated with these methods is yet unknown. Therefore, the objectives of the international ring test study presented here were (1) to map the state of the art in determining Cfree with passive sampling (what is the intra/inter-method/lab variability); (2) to identify the sources of variability by means of dedicated, tiered experiments (including standardizing methods); (3) to provide recommendations and practical guidance (standard protocols); (4) to increase confidence in the use of passive sampling and to advance its use outside the scientific domain. The ring test was performed by a consortium of 11 labs and included experiments with 14 passive sampling formats on 3 sediments and 25 chemicals (PAHs and PCBs). The results demonstrated that standardizing

methods significantly decreased the overall inter-lab variability. The resulting variability however still largely exceeded the intra-lab/inter-method variability, because of the substantial variability introduced by analytical chemistry (identification, integration, calibration of target chemicals). Excluding the latter variability (all analyses performed in one lab) demonstrated that Cfree can be determined sufficiently accurately. Overall, passive sampling appears fit for implementation in risk assessment and management of contaminated sediments, when following standard protocols.