



Standard Guide for Determination of the Bioaccumulation of Sediment- Associated Contaminants by Benthic Invertebrates¹

This standard is issued under the fixed designation E 1688; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope *

1.1 This guide covers procedures for measuring the bioaccumulation of sediment-associated contaminants by infaunal invertebrates. Marine, estuarine, and freshwater sediments are a major sink for chemicals that sorb preferentially to particles, such as organic compounds with high octanol-water-partitioning coefficients (K_{ow}) (for example, polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethane (DDT)) and many heavy metals. The accumulation of chemicals into whole or bedded sediments (that is, consolidated rather than suspended sediments) reduces their direct bioavailability to pelagic organisms but increases the exposure of benthic organisms. Feeding of pelagic organisms on benthic prey can reintroduce sediment-associated contaminants into pelagic food webs. The bioaccumulation of sediment-associated contaminants by sediment-dwelling organisms can therefore result in ecological impacts on benthic and pelagic communities and human health from the consumption of contaminated shellfish or pelagic fish.

1.2 Methods of measuring bioaccumulation by infaunal organisms from marine, estuarine, and freshwater sediments will be discussed. The procedures are designed to generate quantitative estimates of steady-state tissue residues because data from bioaccumulation tests are often used in ecological or human health risk assessments. Eighty percent of steady-state is used as the general criterion. Because the results from a single or few species are often extrapolated to other species, the procedures are designed to maximize exposure to sediment-associated contaminants so that residues in untested species are not underestimated systematically. A 28-day exposure with sediment-ingesting invertebrates and no supplemental food is recommended as the standard single sampling procedure. Procedures for long-term and kinetic tests are provided for use when 80 % of steady-state will not be obtained within 28 days or when more precise estimates of steady-state tissue residues are required. The procedures are adaptable to shorter exposures and different feeding types. Exposures shorter than 28 days may be used to identify which compounds are bioavailable

(that is, bioaccumulation potential) or for testing species that do not live for 28 days in the sediment (for example, certain *Chironomus*). Non-sediment-ingestors or species requiring supplementary food may be used if the goal is to determine uptake in these particular species because of their importance in ecological or human health risk assessments. However, the results from such species should not be extrapolated to other species.

1.3 Standard test methods are still under development, and much of this guide is based on techniques used in successful studies and expert opinion rather than experimental comparisons of different techniques. Also, relatively few marine/estuarine (for example, *Nereis* and *Macoma*), freshwater (for example, *Diporeia* and *Lumbriculus variegatus*) species, and primarily neutral organic compounds provide a substantial portion of the basis for the guide. Nonetheless, sufficient progress has been made in conducting experiments and understanding the factors regulating sediment bioavailability to establish general guidelines for sediment bioaccumulation tests.

1.4 This guide is arranged as follows:

Scope	1
Referenced Documents	2
Terminology	3
Summary of Guide	4
Significance and Use	5
Interferences	6
Apparatus	7
Safety Precautions	8
Overlying Water	9
Sediment	10
Test Organisms	11
Experimental Design	12
Procedure	13
Analytical Methodology	14
Interpretation of Data	15
Keywords	
Annexes	
Annex A1. Additional Methods for Predicting Bioaccumulation	
Annex A2. Determining the Number of Replicates	
Annex A3. Adequacy of 10-Day and 28-Day Exposures	
Annex A4. Alternative Test Designs	
Annex A5. Calculation of Time to Steady-State	
Annex A6. Special Purpose Exposure Chambers	
Annex A7. Additional Techniques to Correct for Gut Sediment	
Annex A8. Bioaccumulation Testing with <i>Lumbriculus variegatus</i>	
References	

1.5 Field-collected sediments may contain toxic materials,

¹ This guide is under the jurisdiction of ASTM Committee E-47 on Biological Effects and Environmental Fate and is the direct responsibility of Subcommittee E47.03 on Sediment Toxicology.

Current edition approved April 10, 2000. Published July 2000. Originally published as E 1688 – 95. Last previous edition E 1688 – 00.