

August 8, 1997

EPA-SAB-EPEC-LTR-97-009

Honorable Carol M. Browner  
Administrator  
U.S. Environmental Protection Agency  
401 M Street, SW  
Washington, D.C. 20460

Subject: Evaluation of Superfund Ecotox Threshold Benchmark Values for  
Water and Sediment

Dear Ms. Browner:

On May 13, 1997, the Sediment Quality Subcommittee (Subcommittee) of the Ecological Processes and Effects Committee of the Science Advisory Board (SAB) reviewed the Office of Solid Waste and Emergency Response's Ecotox Threshold (ET) benchmark values to be used within the Superfund program to determine the need for site-specific ecological risk assessment involving water and sediments. Ecotox Threshold (ET) benchmark values are defined as media-specific contaminant concentrations above which there is sufficient concern regarding the potential for adverse ecological effects to warrant further site investigation. The Subcommittee's review and comments are based on information contained in an Agency bulletin, ECO Update (January 1996, volume 3, number 2), on the development and use of ET benchmark values for water and sediment in the Superfund Ecological Risk Assessment process. (Agency guidance on ET benchmark values for soils is not yet available and was not included in this SAB review.) The ECO Update bulletin, hereafter referred to as the ET document, states that the ET values: 1) are intended to provide a screening-level process that determines the need for additional ecological risk assessment for a given site for specific contaminants of concern at that site; and 2) are **not** proposed or intended to be used as regulatory criteria, site-specific cleanup standards, or remediation goals.

In short, the Subcommittee treated the current ET document as limited in scope (addressing only ecological toxicity--not fate and transport--and sediment and water levels, not terrestrial levels) and intent (for screening purposes only).

The Charge to the Subcommittee included four questions, which are presented and discussed below:

**1) Recognizing the continued scientific debate over the accuracy of the equilibrium partitioning theory, are the sediment thresholds derived using this model accurate enough to use as screening levels?**

Yes. The Subcommittee continues to support the conclusions of previous SAB reviews of the equilibrium partitioning (EqP) approach, which is based on a theory describing the partitioning of chemical contaminants between sediment and interstitial (or pore) water; these reviews found the EqP to be a scientifically sound approach for assessing sediment quality if the uncertainties associated with assumptions of equilibrium, bioavailability, routes of exposure, and so forth, are considered and described (SAB, 1992; SAB, 1990). While we recognize that the equilibrium approach to establishing sediment quality values has both strengths and weaknesses, the Subcommittee agrees that it is satisfactory for use in a screening-level risk assessment that recognizes these uncertainties. As discussed in our response to Charge Question 3, however, the choice to use values derived using the EqP, rather than values derived from other methods, should be based on a scientific rationale. Additionally, the ET document indicates that "Superfund has elected to use the lower limit of the 95 percent confidence interval presented in the criteria documents as the ET, rather than the central tendency value." This decision adds an additional level of conservatism for screening purposes.

**2) Should the dissolved water column concentration of heavy metals be used to compare to the thresholds or should the total concentrations be used to add more conservatism?**

The Subcommittee recommends that dissolved concentrations of metals in surface water samples collected at Superfund sites be used to compare to threshold concentrations for screening-level risk assessments; this is the accepted approach for assessing exposure for organisms that dwell in the water column. It has been shown, as the state-of-the-science has evolved over the past decade, that the dissolved fraction more appropriately reflects the bioavailable portion of the total metal present in a sample. Considerable study in this area shows that free metal ions are most often responsible for the toxic effects observed from metals. The dissolved fraction appears to provide a much better measure of the free metal ion concentration than total metal, which includes metals that are sorbed or bound to various other particles, bound to dissolved organic matter, or incorporated in various matrices (Bergman and Dorward-King, 1997). Using this rationale, the Agency's Office of Water established the same position for the National Pollutant Discharge Elimination System (NPDES) (Prothro, 1993).

The Subcommittee recognizes, however, that the state-of-the-science is evolving regarding the assessment of suspended particles and associated sorbed metals. We recommend, therefore, that the Agency revisit this issue at an appropriate time in the future. Consistent with the state-of-the-science, the ET document evaluates potential exposure to metals from sediment ingestion by comparison of sediment concentration against ET values for sediment.

We recommend, however, that guidance be provided or referenced in the ET document on how to obtain reliable data on dissolved metal concentrations. For example, considerable care must be taken in both the sample collection and analysis to avoid contamination or loss of the analyte.

- 3) The document currently presents a tiered approach to the use of preferred methods. For sediments, for example, a draft Sediment Quality Criterion is the first choice, then Sediment Quality Benchmarks using the equilibrium approach, and then the NOAA Effects Range Low values. Should the document continue with this approach, should different priorities be recommended, or should it present all available screening levels, including other values developed by states (e.g., New York), other Agencies (e.g., Ontario) and let the regional risk assessors decide which one is most appropriate for their site?**

The current ET document does not provide a scientific rationale supporting the sequence (tiers) for the selection of the preferred values. While the Subcommittee has supported the Agency's use of the EqP approach for deriving threshold values, we also recognize that other approaches can provide useful numbers and might be preferred in certain circumstances. We note, however, that there are only a few chemicals for which the ET document provides more than one value. We recommend that the Agency update the existing document to reflect the Agency's current thinking on the calculation and use of EqP-based sediment quality criteria (e.g., for polycyclic aromatic hydrocarbons), and to provide a scientific rationale for the choice of methods used to derive a threshold when values are available from more than one approach. The published literature provides some insight on the strengths and weaknesses of the various methods, which vary depending on the class of chemical and sometimes the individual constituent in question. These studies should guide the rationale for selecting among the threshold values. For example, the EqP is applicable to non-ionic organics, but not to polar organics or metals. For these chemicals, the threshold values (ERL - effects range low) developed by Long et al. (1995) may be the best choice for marine sediments. These authors have indicated chemicals for which this approach also has limitations. As noted in the ET document, a scientific rationale for selecting ET values should allow consideration of site-specific characteristics that affect the extent to which critical assumptions would be met, and would provide a basis

for selecting among validated and peer-reviewed ET values. In general, the Subcommittee believes that less weight should be given to methods that require the use of safety factors to derive threshold values (e.g., the method used to calculate Sediment Quality Benchmarks, or SQB).

The Subcommittee views the question of who should decide which ET value is most appropriate for the limited purpose of screening at a specific site to be a matter of policy, rather than science.

- 4) We recognize that there could be some situations where all chemicals at a site could "pass" the screen, but due to unpredicted cumulative effects or the presence of very sensitive species or ecological processes, adverse ecological effects could occur, but we feel the likelihood of this happening is relatively low (i.e., <5%) and is acceptable. Do these thresholds and the use of the maximum environmental concentrations provide sufficient conservatism to make it unlikely that sites posing a "real" risk would pass the screening test?**

The Subcommittee believes that the threshold concept is valid and useful and supports the use of the ET values in a decision-making pass/fail screening system. Insufficient information was available to the Subcommittee at the review meeting to make a quantitative determination of the degree of protection provided by individual ET benchmarks. Based on past briefings to the Subcommittee and upon its expert opinion, however, the Subcommittee believes that ET values used in conjunction with maximum environmental concentrations are sufficiently conservative for screening to identify sites that require further study.

### **Additional Comments**

The Subcommittee recommends that the ET document be revised to contain more explicit information as to where in the Superfund process the ET benchmarks are most appropriately used. Although the document discusses the limited scope and intent of ETs as benchmark screening values for baseline (preliminary) risk assessment, this guidance does not explicitly relate the comparatively crude ET procedure to the fuller Risk Assessment Guidance for Superfund (RAGS)(EPA, 1990) or to the overall ecological risk assessment process. Indeed, the RAGS is mentioned only in a footnote on the first page of the ET document. While we recognize that the level of detail in the RAGS cannot be duplicated in the ET document, additional information should be included in the ET document regarding the connection between ET benchmarks and the overall ecological risk assessment process. An explicit discussion of the relationship between ET and RAGS will make the document more informative and useful to the reader. At a minimum, the various ecorisk guidance

documents should be cross-referenced. As part of an integration into the ecological risk assessment process, we recommend that the Agency's recently proposed Guidelines for Ecological Risk Assessment (EPA, 1996) be utilized as the principal guidance for performing ecological risk assessments and that the Agency reexamine the RAGS to ensure consistency with these proposed guidelines.

We hope these comments will be useful to the Superfund program in implementing preliminary ecological risk screening for water column and sediments. The Subcommittee has been very supportive of the Agency's efforts to develop uniform guidance for the performance of ecological risk assessment across the Agency and we appreciate the opportunity to review program-specific guidance that brings the ecorisk process to the operational level of Agency activities.

Sincerely,

*/signed/*

Dr. Genevieve M. Matanoski, Chair  
Executive Committee

*/signed/*

Dr. Mark A. Harwell, Chair  
Ecological Processes and  
Effects Committee

*/signed/*

Dr. William J. Adams, Chair  
Sediment Quality Subcommittee

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**MAY 13, 1997**

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