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October 7, 2009

Via Email

Dr. Thomas Armitage
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Ave, NW
Mail Code 1400F
Washington, DC 20460

RE: **Supplemental Comments on EPA Guidance for
Developing Nutrient Water Quality Criteria for Nutrients**

Dear Dr. Armitage:

As you know, the Science Advisory Board ("SAB") Ecological Processes and Effects Committee completed a thorough review of EPA's draft guidance document on empirical approaches for the derivation of nutrient criteria on September 11, 2009. While the Committee's official recommendations are not due for 90 days, it has already provided EPA and the public with summary responses to each of the charge questions formulated by EPA. Based on these responses, it is apparent the Committee believes the empirical methods contained in the guidance do not provide a sufficient basis to establish nutrient criteria in free-flowing rivers and streams. Specifically, the Committee noted that:

1. the approaches identified in the guidance lack a demonstrated "cause and effect" relationship that is required for developing scientifically defensible water quality criteria;
2. the approaches failed to consider numerous confounding factors and essential mechanisms that impact whether or how nutrients affect aquatic life, particularly with regard to macroinvertebrates; and,
3. the conditional probability empirical method was specifically singled out on several occasions as being particularly inappropriate for criteria derivation.

The Committee commented that response variables must be coupled to designated uses in a clear and rational manner before those responses can be used to derive criteria.

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Before criteria can be developed, a more mechanistic understanding is required of how nutrients affect the response variable. This mechanistic understanding requires a solid conceptual model, including all the major stressors governing the dynamics of the response variable, before impairments associated with nutrients can be assessed and criteria developed.

These responses echo the requirements set forth in EPA's "*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*" (USEPA, 1985)¹. The National Guidelines note that water quality criteria must ensure use protection "with a small probability of considerable overprotection or under-protection" (Guidelines at 5). This requirement can only be achieved through a mechanistic understanding of how nutrients and other stressors interact to affect designated uses. Attached are other criteria development principles that have been part of the regulatory framework since 1985. The draft report should reference these principles as support for the suggested improvements to EPA's proposed approach on nutrient criteria development.

It is clear that the draft guidance proposed by EPA as a basis for deriving nutrient criteria does not meet these minimum requirements set forth in the National Guidelines. Moreover, other methods currently being employed by EPA to derive nutrient criteria (e.g., distributional statistics, literature values) do not meet these minimum requirements either. These other methods lack a demonstrated "cause and effect" relationship that is required to develop scientifically defensible water quality criteria that ensure use protection. While these other methods were not the specific subject of this SAB review, we believe the Committee should preclude the application of other inappropriate nutrient criteria derivation procedures by specifying the type of analysis necessary to derive scientifically-defensible nutrient criteria.

In your response to Charge #1 on suggestions that will improve the utility of the document to derive numeric nutrient criteria based on stressor-response relationships, the Committee should unequivocally state that such criteria must be based on a solid conceptual model, including all the major stressors governing the dynamics of the response variable, and the response variable must be linked to designated use impairment.

¹ Authored by Charles E. Stephan, Donald I. Mount, David J. Hansen, John H. Gentile, Gary A. Chapman, and William A. Brungs. USEPA Office of Research and Development. Environmental Research Laboratories Duluth, MN, Narragansett, RI, and Corvallis, OR. PB85-227049. NTIS, Springfield, VA.

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Moreover, nutrient criteria derived without such a conceptual model and linkage to designated use impairment are not scientifically defensible.

Sincerely,



William T. Hall
Hall & Associates

Enclosure

cc: John C. Hall

Relevant Excerpts from The Guidelines for Deriving National Water Quality Criteria

- By statute, criteria must be based on the “latest scientific knowledge” and set at the level “necessary to restore and maintain” aquatic life and human health uses. Clean Water Act § 304(a).
- Water quality criteria must ensure use protection “with a small possibility of considerable overprotection or under-protection.” *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, USEPA 1985 at 5.
- Criteria should be derived “only if adequate appropriate data are available to provide reasonable confidence that it is a good estimate;” based on “all available laboratory and field information” it must be determined that the criteria are “consistent with sound scientific evidence...” *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, USEPA 1985 at 5, 57.
- All decisions should be based on a “thorough knowledge of aquatic toxicology” and criteria decisions must be altered when the decisions are “substantially overprotective or underprotective of the aquatic organisms and their uses” *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, USEPA 1985 at 18.
- Criteria should be based on studies showing a dose/response relationship and water quality characteristics that significantly influence the impact of a pollutant should be accounted for in criteria derivation. *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, USEPA 1985 at 15, 16, 21, 29, and 40.

Relevant Excerpts from Nutrient Criteria Technical Guidance Manual - Rivers and Streams

- “Nutrient criteria development should relate nutrient concentrations in streams, algal biomass and changes in ecological condition (e.g., nuisance algae accrual rate and deoxygenation). ... Initial criteria should be verified and calibrated by comparing criteria in the system of study to nutrients, chl *a* and turbidity values in water bodies of known condition to ensure that the system of interest operates as expected.” *Nutrient Criteria Technical Guidance Manual – Rivers and Streams*, USEPA July 2000, at 13.

- “Predictive relationships between nutrients and periphyton (or phytoplankton) biomass are required to identify the critical or threshold concentrations that produce nuisance algal biomass.” *Nutrient Criteria Technical Guidance Manual – Rivers and Streams*, USEPA July 2000, at 76.
- “However, fish and macroinvertebrates do not directly respond to nutrients, and therefore may not be as sensitive to changes in nutrient concentrations as algal assemblages. It is recommended that relations between biotic integrity of algal assemblages and nutrients be defined and then related to biotic integrity of macroinvertebrate and fish assemblages in a stepwise, mechanistic fashion.” *Nutrient Criteria Technical Guidance Manual – Rivers and Streams*, USEPA July 2000, at 85.

Information Lacking From EPA Guidance Document

- The technical guidance document released by EPA lacks several critical demonstrations although it is intended to provide the basis for deriving nutrient criteria a national scale.
- Cause and effect relationships have not been established for any waters as noted below:

Water Body	Nutrients : Plant Growth	Nutrients : Invertebrate Impacts
<i>Streams</i>	None	Yes – but weakly correlated
<i>Lakes</i>	Yes	None
<i>Estuaries</i>	None	None
<i>Bays</i>	None	None

- The statistical relationships that are contained in the document provide no basis for addressing well-established plant growth kinetics influencing how/whether nutrients will affect a water body.
- Nowhere does the guidance document a relationship between the degree of plant growth occurring and changes in invertebrate metrics for any waters.
- The guidance document fails to consider or identify other plausible mechanisms of impairment that influence invertebrate metrics used to develop the regressions. Such relevant ecological factors include available light, sedimentation, and habitat availability/alteration.
- Nowhere does the document assesses the range of uncertainty associated with the recommended approaches or indicate how site-specific information is addressed in this process. Consequently, the approach will result in broad scale overprotective/under protective criteria.