

# **Submissions of Significant Scientific Information**

## **Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria**

Lakes and Reservoirs in Nutrient Ecoregions: III, IV, V, and XIV.

Rivers and Streams in Nutrient Ecoregions I, IV, V, VIII, and X

This summary represents comments from:

**1.** Wendell Kido, Sacramento Regional County Sanitation District, **2.** David Williams, Tri Tac, California Association of Sanitation Agencies (CASA), and the Southern California Alliance of TW;s (SCAP); **3.** David Hamilton, Michigan DEQ; **4.** Conrad Lamon, Louisiana State University; **5.** Eugenia Marks, Audubon Society of Rhode Island; **6.** Douglas Karafa, Western Coalition of Arid States; **7.** Maryilyn Parsons, National Association of Home Builders.

Many of the concerns raised by the public about EPA's approach for developing nutrient criteria were previously raised during the development of EPA's Technical Guidance Manuals. At that time, some questions were raised about EPA's use of a statistical derivation of a reference condition. EPA continues to believe these approaches are reasonable for the purpose of making today's criteria recommendations. The reference condition approach used by EPA was endorsed by the Science Advisory Board (SAB), which stated in its review of "Biological Criteria: Technical Guidance for Streams and Small Rivers" (EPA, 1993) that "the definition of reference condition using reference sites is appropriate when used in conjunction with historical data, empirical models, and expert opinion/consensus." EPA's Nutrient Criteria Program later adopted the reference condition approach, and continues to recommend it in all of its nutrient criteria guidance manuals. Additionally, the statistical derivation approach to developing nutrient criteria was favorably reviewed by peer reviewers as well. Consequently, EPA did not change its fundamental approach to nutrient criteria development, or change the documents significantly beyond responding to comments of peer reviewers. Following is a summary of the most significant scientific information submitted by the public. The issues are grouped by topic, and then followed by EPA's response:

### **Percentile Approach:**

- 1) The criteria are based on a statistical analysis of current nutrient levels in the Nation's waters rather than on the latest scientific knowledge and therefore are inconsistent with Section 304(a) of the Clean Water Act;
- 2) The use of the 25<sup>th</sup> percentile of all data or the 75<sup>th</sup> percentile of all reference data as criteria by States is undocumented, not scientifically valid, and results in meaningless numerical criteria values;

3) Many data gaps exist in the nutrient database, for example a lake with only one reading for a parameter in a given year. Some screening techniques should have been done so that only those waterbodies were included for which there are sufficient representative data;

4) The statistical approach used to develop the nutrient criteria is statistically flawed because it ignores the relationship between nutrient levels and in-stream/in-lake effects. As a result, there is no way of knowing the environmental benefit, or the level of protection of designated uses, gained by attaining the nutrient criteria levels set forth in the documents. As a result, EPA's statistical derivation of numerical nutrient criteria are meaningless to real world situations and are not helpful in making watershed management decisions, TMDL allocations, or in developing Water Quality Standards for nutrients at the State level, and should be withdrawn.

**EPA Response:** The mean, median and mode are measures of central tendency commonly used in science to represent the distribution of a population of observations. The frequency distribution approach is not used to establish criteria; rather it is used to determine one of the components of a criterion, the reference condition. This reference condition is one element of a criterion which should be considered along with historical background information, possible model extrapolations of data, and consideration of possible downstream impacts on those waters by a regional panel of experts (Regional Technical Assistance Group - RTAG).

Further, the scientific community uses frequency distributions as a common basic interpreter of data with the upper and lower quartiles as an admittedly subjective, but traditional, approach to viewing the extent of a distribution about a central tendency. It is not mandatory or expected that the reference condition so derived be translated directly into a criterion. The selection of an upper quartile (or lower quartile with mixed water quality samples) is also consistent with the EPA policy to set levels protective of the majority of waters, and has been peer reviewed both by EPA's SAB and external peer reviewers of our water body type technical guidance.

Finally, EPA's technical guidance manuals provide examples of alternate approaches to use in lieu of frequency distributions to assess reference conditions and determine relationships among causal response variables.

### **Model Based Approach**

5) The percentile based nutrient criteria proposed by EPA are acceptable only as a way to initiate a model-based, decision-theoretic approach to standard setting (as described in submission) to be undertaken by the effected States and Tribes with the assistance of EPA.

**EPA Response:** The presumption underlying EPA's use of a reference condition approach is that reference conditions reflect conditions conducive to the protection of most aquatic life in the given water body type and geographic region. The upper quartile of the reference data distribution is an accommodation to variability of the reference condition, and the lower quartile of a mixed sample is an effort to approach this reference condition when insufficient *a priori* sites exist. Therefore the percentiles serve as recommended starting points to be further refined by in the absence of refinements that may be employed by the States, authorized Tribes and

RTAGs.

### **Need for Site Specific Criteria:**

- 6) Establishing a single nutrient criterion for all waters of a geographically diverse region, based on inadequate data is not an appropriate approach. Numeric criteria should be developed at a site specific level;
- 7) Regarding the chlorophyll standard: annual cycle of circadian photo-periods vary significantly from southern Georgia to southern Maine. Hours of daylight affect the growth of the chlorophyll in a water body not only in photons activating chlorophyll but in water temperature. It is difficult to understand how a single standard for chlorophyll or Secchi depth could be set over this geographic distance.
- 8) Numeric criteria, if they are to be developed at all, should be developed at a more site-specific level.
- 9) Establishing a single nutrient criteria for total phosphorus of 10 micrograms per liter (ug/L) for rivers and streams in Nutrient Ecoregion VIII, with 49,000 total river miles, will result in areas of over-protection and under-protection of the designated uses.
- 10) The aggregation of diverse photo, temperature, and geologic conditions across a geographic region that spans almost 14 degrees of latitude into one coastal plain region will not adequately protect the region's waters. Such a scheme does not seem to account for the biological, chemical or physical diversity of this range of different areas, and the goal of the Clean Water Act to protect the biological as well as the physical and chemical integrity of the nation's waters would not seem to be met.

**EPA Response:** EPA is employing an ecoregion approach as an initial attempt to assess nutrient conditions on a broad geographic context. The RTAGs, including member States and authorized Tribes, are encouraged to refine and further subdivide the initial ecoregions; if time and resources permit, States and authorized Tribes should also consider adopting nutrient criteria that are tailored to specific sites. EPA believes that recommending nutrient criteria on an ecoregion basis with the use of ecoregional reference conditions is a reasonable alternative approach to recommending a single nation-wide criterion that may fail to account for regional variability or to recommending criteria on an individual water body basis, which would be very resource intensive. This regionalization and water body-type specificity has been endorsed by the EPA Science Advisory Board for biological criteria, and nutrient criteria share a similar ecological orientation.

### **Total Nitrogen Criteria**

11) Total Nitrogen criteria are not necessary, and should not be required unless USEPA can show site-specific reasoning for applying nitrogen criteria to all water bodies;

**EPA Response:** As a threshold matter, it should be noted that EPA's choice of parameters and criteria values are recommendations. EPA's recommended criteria documents impose no requirements. States and authorized Tribes have considerable flexibility in adopting nutrient criteria, provided that the criteria meet the requirements of the CWA and EPA's regulations, e.g., they are based on sound scientific rationale and contain sufficient parameters to protect the designated uses.

With respect to EPA's recommendation that States and authorized Tribes adopt nutrient criteria for nitrogen, EPA notes that while phosphorus is often considered the limiting nutrient determining the extent of vegetative growth in fresh waters, nitrogen is often considered to be the limiting nutrient in the lower reaches of estuaries and in coastal marine waters. However, there are cases where phosphorus limits algal growth in estuaries and nitrogen performs a similar role in some freshwater systems. Nitrogen itself will not usually cause water quality impairments in the near-field in phosphorus-limited systems. If, however, phosphorus supplies are reduced to attenuate symptoms of eutrophication within freshwater segments of a given river system, corresponding reductions in freshwater algal blooms will allow the highly soluble dissolved forms of nitrogen to be transported downstream. This downstream nitrogen transportation to estuaries or coastal waters may support larger algal blooms resulting in water quality impairments. The practice of setting criteria for only nitrogen or phosphorus in a given region has the potential to displace the responsibility for nutrient abatement from the area of the source to a downstream jurisdiction. This places an undue burden on the recipient of this imported material, and increases the abatement costs because source control is lost as a management option. EPA suggests therefore, that where downstream effects take place, that States and Tribes describe technologies or best management practices in their plans to begin nitrogen control.

#### **Grouping of Reservoirs and Lakes:**

12) The final document should clarify whether Reservoir means impounded stream or river. If impoundments were sampled with natural lakes, the 75<sup>th</sup> percentile number may be too high as a standard for historic conditions in natural lakes.

**EPA Response:** EPA agrees that reservoirs should not be grouped with lakes if possible, and recommends in the Technical Guidance Manual that, wherever feasible, criteria for reservoirs and lakes should be developed separately. Using the National Nutrient Database, one can separate out data by lake or reservoir and determine reference conditions for each.

#### **Relation to Beneficial Uses**

13) EPA has not linked the criteria to beneficial uses, nor has it clearly defined what goal it is

trying to accomplish by issuing these criteria.

**EPA Response:** By setting criteria at reference conditions, all beneficial or designated uses are protected. EPA states in the Executive Summary of each criteria document that the numeric criteria recommendations are intended to represent starting points for states and tribes to develop (with assistance from EPA) more refined nutrient criteria.

### **Clean Water Act Requirements**

14) Nutrient Criteria do not meet the requirements of Section 304 of the Clean Water Act, which requires EPA to develop water quality criteria that accurately reflect the latest scientific knowledge on: 1) the kind and extent of all identifiable effects on health and welfare; 2) the concentration and dispersal of pollutants, or their byproducts, and 3) the effects of pollutants on biological diversity, productivity and stability. EPA has not met these conditions.

**EPA Response:** EPA has suggested a process which meets each of the three criteria stated above. EPA recommends a Regional Technical Assistance Group (RTAG) to be used in the development of each state and tribal nutrient criteria development process. The RTAG is composed of many stakeholders, including academicians and research scientists with specializations in nutrient ecology relevant to the ecoregions in question. One of the primary functions of the RTAG is to use the latest scientific knowledge available for the development of ecoregion-specific nutrient criteria. In the development of this eco-region specific criteria, the RTAG is also likely to consider ecoregion specific concentrations and dispersal of causal variables (e.g. nitrogen and phosphorus), and their effects on the biological diversity, productivity and stability of the ecoregions waters.

### **Additional Work for States**

15) The process for developing nutrient criteria that USEPA has established will create additional work for the states. States may be forced to spend additional time and effort defending criteria developed at the state level that are different from the USEPA ecoregion values. In many cases, data on existing conditions for streams are lacking for the parameters that EPA has identified for criteria development. It will be the states' responsibility to collect the additional data necessary to refine the published ecoregional criteria or develop an alternative scientifically defensible approach.

**EPA Response:** EPA intends that the recommended nutrient criteria values be starting points, to be refined by states and tribes as they develop water quality standards. The comment is correct that if the state or tribe wishes to develop a scientifically defensible approach for alternative criteria, it will be the state or tribes responsibility. EPA has, however, offered to assist in this process. States and tribes may also adopt nutrient criteria recommendations as they are, as part of their water quality standards.

## **Adverse Effects of Criteria**

16) EPA's nutrient criteria are certain to harm the very uses they are supposed to protect.

17) The recommended criteria are lower than concentrations that may be needed to support fisheries, and may result in a reduction of fish biomass;

**EPA Response:** One of the concerns expressed to EPA was that if the recommended nutrient criteria were met, there would not be sufficient nutrients to support fisheries. Generally, however, cultural eutrophication has been identified by state Section 303(d) reports as one of the top national water quality problems. Where enrichment is documented as beneficial by regional specialists, EPA recommends that nutrient criteria be developed to promote the removal of that amount of ambient total nitrogen and phosphorus in excess of optimal fish production as determined by consultation of the RTAG with state and federal fisheries biologists and water resource managers.

## **Effluent Dominated Streams**

18) With respect to the Central Valley criteria document, the ecoregion approach is especially inappropriate because many waterbodies in the Central Valley are effluent dominated. The ecoregion approach is based on the assumption that waterbodies can achieve a natural, or "reference-reach" state, but EDWs cannot achieve such condition due to their hydrological and structural modifications, usually for drainage and flood control purposes. In addition, the "natural" state for many of these EDW's would often be an absence of water. Therefore, we do not believe asking the question of whether or not an EDW is impaired based on a comparison to "natural" waterways is an appropriate question to ask.

**EPA Response:** The designated use of an effluent dominated stream should guide its criteria development. If an effluent dominated stream is designated strictly for water transport, then local and state officials should set criteria appropriate for that use. If the stream contains a valued community of aquatic organisms, then a reference condition for the intermittent or effluent dominated nature of the water body can be determined

## **Criteria are Not Scientifically Valid**

19) Because the 304(a) nutrient criteria are not scientifically valid, using them as a starting point to develop refined scientifically defensible 303(c) criteria at the state level is not feasible. The RTAGs charge to develop a scientifically defensible approach for nutrient criteria is extremely difficult due to the lack of knowledge on nutrient ecology. Because there is so much to learn about nutrients and eutrophication, state efforts would be better directed toward monitoring and data collection, including an assessment of eutrophic conditions. Nutrient criteria should be pursued at a later date when the link between nutrients and eutrophication is better understood.

**EPA Response:** EPA acknowledges that the science of nutrient ecology is still developing. Sufficient documentation exists, however, to establish the causal link between nitrogen and phosphorus, with algal responses measured by chlorophyll *a* and water clarity. EPA acknowledges that there are site specific factors, such as flow, light, temperature, and others which impact the magnitude, and timing of these cause and effect relationships. These spatial and temporal variations, however, are intended to be addressed by the RTAG in the ecoregional nutrient criteria development process.

### **Criteria Have Adverse Impact with No Benefit**

20) If these criteria are promulgated and implemented, the adverse consequences will be far reaching with little or no environmental benefit. Because the 304(a) nutrient criteria are not feasible, the foundation for evaluating attainment of water quality standards, setting targets for TMDLs, and establishing permit limits will be fundamentally flawed. The likely outcome will be very stringent permit limits and waste load allocations (WLAs) for nutrients being imposed on POTWs. It will also impose very low load allocations on agriculture through the TMDL process. It will require the application of expensive advanced treatment facilities, even though EPA lacks sufficient data and understanding of nutrient ecology. We are not aware of a treatment system that is capable of achieving a 0.31 mg/L total nitrogen standard. Membrane systems coupled with tertiary treatment technologies are very costly ( $\$2.7 \times 10^3$  per million gallons of wastewater treated) and generate treatment residuals brine streams) requiring waste disposal.

The high cost of wastewater treatment necessary to approach very low levels of the nutrient criteria is of great concern to us because we are not convinced there will be a commensurate environmental benefit if nutrients are reduced to these levels. The required nutrient reduction may not even affect algae levels, since algae is common in waters without POTW and even agricultural discharge. Reducing nutrient levels in waterbodies to the 304(a) nutrient criteria levels will not ensure that ecosystems are receiving appropriate nutrient loadings, and there is a likely chance that such a reduction in nutrients will harm ecosystems.

EPA should:

- rescind the 304(a) ecoregion criteria documents
- redirect the national nutrient program from numeric criteria development to developing an approach that focuses on beneficial uses at a localized level.
- focus the federal nutrient program on nutrient monitoring and data collection.

**EPA Response:** EPA disagrees with the assertion that the 304(a) criteria are not feasible, and that the foundation for evaluating attainment of water quality standards, setting targets for TMDLs, and establishing permit limits will be fundamentally flawed. EPA is using a peer

reviewed approach, based on a fundamental methodology that was supported by the Science Advisory Board when reviewed for the Biocriteria Program.

EPA allows flexibility in developing criteria which will protect the particular designated use within a geographical context. The development of criteria is focused solely on the protection and propagation of aquatic life. Economic and feasibility issues are more appropriately dealt with in the process of adopting state water quality standards.